

**NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR  
(AN AUTONOMOUS INSTITUTE)**



**Affiliated to**

**DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY UTTAR PRADESH, LUCKNOW**



**Evaluation Scheme & Syllabus**

**For**

**Bachelor of Technology**

**Computer Science and Business System**

**Third Year**

**(Effective from the Session: 2026-27)**

**NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR**  
(AN AUTONOMOUS INSTITUTE)

**Computer Science and Business System**  
**EVALUATION SCHEME**  
**SEMESTER-V**

| S. No | Subject Codes | Subject                                                 | Types of Subjects     | Periods   |          |           | Evaluation Schemes |            |            |            | End Semester |            | Total      | Credit    |
|-------|---------------|---------------------------------------------------------|-----------------------|-----------|----------|-----------|--------------------|------------|------------|------------|--------------|------------|------------|-----------|
|       |               |                                                         |                       | L         | T        | P         | CT                 | TA         | TOTAL      | PS         | TE           | PE         |            |           |
| 1     | BCSBS0501     | Design And Analysis of Algorithms                       | Mandatory             | 3         | 0        | 0         | 30                 | 20         | 50         |            | 100          |            | 150        | 3         |
| 2     | BCSBS0507     | Machine Learning                                        | Mandatory             | 3         | 0        | 0         | 30                 | 20         | 50         |            | 100          |            | 150        | 3         |
| 3     | BCSBS0505     | Fundamentals Of Management                              | Mandatory             | 2         | 0        | 0         | 30                 | 20         | 50         |            | 50           |            | 100        | 2         |
| 4     | BCSBS0506     | Cloud Computing                                         | Mandatory             | 2         | 0        | 0         | 30                 | 20         | 50         |            | 50           |            | 100        | 2         |
| 5     |               | Departmental Elective -I                                | Departmental Elective | 2         | 1        | 0         | 30                 | 20         | 50         |            | 100          |            | 150        | 3         |
| 6     | BCSBS0551     | Design And Analysis of Algorithms Lab                   | Mandatory             | 0         | 0        | 2         |                    |            |            | 25         |              | 25         | 50         | 1         |
| 7     | BCSBS0557     | Machine Learning Lab                                    | Mandatory             | 0         | 0        | 3         |                    |            |            | 25         |              | 25         | 50         | 1.5       |
| 8     | BCSBS0566     | Cloud Computing Lab                                     | Mandatory             | 0         | 0        | 3         |                    |            |            | 25         |              | 25         | 50         | 1.5       |
| 9     |               | Departmental Elective -I Lab                            | Departmental Elective | 0         | 0        | 2         |                    |            |            | 25         |              | 25         | 50         | 1         |
| 10    | BCSBS0553     | Business Communication & Value Science-III Lab          | Mandatory             | 0         | 0        | 2         |                    |            |            | 25         |              | 25         | 50         | 1         |
| 11    | BCSBS0558     | Mini Project                                            | Mandatory             | 0         | 0        | 2         |                    |            |            | 50         |              |            | 50         | 1         |
| 12    |               | *Massive Open Online Courses (For B.Tech. Hons. Degree) | *MOOCs                |           |          |           |                    |            |            |            |              |            |            |           |
|       |               | <b>TOTAL</b>                                            |                       | <b>12</b> | <b>1</b> | <b>14</b> | <b>150</b>         | <b>100</b> | <b>250</b> | <b>175</b> | <b>400</b>   | <b>125</b> | <b>950</b> | <b>20</b> |

**\* List of MOOCs Based Recommended Courses for Third year B. Tech Students**

| <b>S. No.</b> | <b>Subject Code</b> | <b>Course Name</b>                                                           | <b>University / Industry Partner Name</b> | <b>No of Hours</b> | <b>Credits</b> |
|---------------|---------------------|------------------------------------------------------------------------------|-------------------------------------------|--------------------|----------------|
| 1             | BMC0040             | Data Structures and Algorithms using Python - Part 2                         | Infosys Wingspan (Infosys Springboard)    | 37h 41m            | 3              |
| 2             | BMC0115             | Introduction of Cloud Computing                                              | NASSCOM                                   | 12hrs              | 1              |
| 3             | BMC0116             | Introduction to Generative AI – Artificial intelligence and Machine Learning | NASSCOM                                   | 15h                | 1              |

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CE: Core Elective, OE: Open Elective, DE: Departmental Elective, PE: Practical End Semester Exam, CA: Compulsory Audit,

MOOCs: Massive Open Online Courses.

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**Computer Science and Business System**  
**EVALUATION SCHEME**  
**SEMESTER-VI**

| Sl. No. | Subject Codes | Subject Name                                               | Types of Subjects     | Periods   |          |           | Evaluation Schemes |            |            |            | End Semester |            | Total       | Credit    |
|---------|---------------|------------------------------------------------------------|-----------------------|-----------|----------|-----------|--------------------|------------|------------|------------|--------------|------------|-------------|-----------|
|         |               |                                                            |                       | L         | T        | P         | CT                 | TA         | TOTAL      | PS         | TE           | PE         |             |           |
| 1       | BCSBS0601     | Artificial Intelligence                                    | Mandatory             | 3         | 0        | 0         | 30                 | 20         | 50         |            | 100          |            | 150         | 3         |
| 2       | BCSBS0602     | Computer Networks                                          | Mandatory             | 3         | 0        | 0         | 30                 | 20         | 50         |            | 100          |            | 150         | 3         |
| 3       | BCSBS0603     | Information Security                                       | Mandatory             | 3         | 0        | 0         | 30                 | 20         | 50         |            | 100          |            | 150         | 3         |
| 4       | BCSBS0604Z    | Business Communication & Value Science-IV                  | Mandatory             | 2         | 0        | 0         | 30                 | 20         | 50         |            | 50           |            | 100         | 2         |
| 5       | BCSBS0605     | Financial & Cost Accounting                                | Mandatory             | 2         | 0        | 0         | 30                 | 20         | 50         |            | 50           |            | 100         | 2         |
| 6       |               | Departmental Elective –II                                  | Departmental Elective | 2         | 0        | 0         | 30                 | 20         | 50         |            | 50           |            | 100         | 2         |
| 8       | BCSBS0651     | Artificial Intelligence Lab                                | Mandatory             | 0         | 0        | 2         |                    |            |            | 25         |              | 25         | 50          | 1         |
| 9       | BCSBS0662     | Computer Networks Lab                                      | Mandatory             | 0         | 0        | 4         |                    |            |            | 50         |              | 50         | 100         | 2         |
| 11      | BCSBS0663     | Information Security Lab                                   | Mandatory             | 0         | 0        | 2         |                    |            |            | 25         |              | 25         | 50          | 1         |
| 12      | BCSBS0654     | Business Communication & Value Science-Iv Lab              | Mandatory             | 0         | 0        | 2         |                    |            |            | 25         |              | 25         | 50          | 1         |
| 13      |               | Departmental Elective -II Lab                              | Departmental Elective | 0         | 0        | 2         |                    |            |            | 25         |              | 25         | 50          | 1         |
|         |               | *Massive Open Online Courses<br>(For B.Tech. Hons. Degree) | *MOOCs                |           |          |           |                    |            |            |            |              |            |             |           |
|         |               | <b>TOTAL</b>                                               |                       | <b>15</b> | <b>0</b> | <b>12</b> | <b>180</b>         | <b>120</b> | <b>300</b> | <b>150</b> | <b>450</b>   | <b>150</b> | <b>1050</b> | <b>21</b> |

**\* List of MOOCs Based Recommended Courses for Third year B. Tech Students**

| <b>S. No.</b> | <b>Subject Code</b> | <b>Course Name</b>                                    | <b>University / Industry Partner Name</b> | <b>No of Hours</b> | <b>Credits</b> |
|---------------|---------------------|-------------------------------------------------------|-------------------------------------------|--------------------|----------------|
| 1             | BMC0111             | Deep Learning for Developers                          | Infosys Wingspan (Infosys Springboard)    | 34h 51m            | 2.5            |
| 2             | BMC0128             | Microsoft Power BI Data Analyst (PL-300) by Microsoft | NASSCOM                                   | 13h 16m            | 1              |
| 3             | BMC0027             | Network Fundamentals                                  | Infosys Wingspan (Infosys Springboard)    | 37h 57m            | 3              |

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MOOCs: Massive Open Online Courses.

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**List of Department Elective (if any): -**

| S. No. | Subject code | Subject Name                      | Types of Subjects            | Bucket Name | Branch | Sem. |
|--------|--------------|-----------------------------------|------------------------------|-------------|--------|------|
| 1      | BCSBS0517    | Business Strategy                 | Departmental Elective -I     |             | CSBS   | V    |
| 2      | BCSBS0518    | Compiler Design                   | Departmental Elective -I     |             | CSBS   | V    |
| 3      | BCSBS0518P   | Compiler Design Lab               | Departmental Elective -I Lab |             | CSBS   | V    |
| 4      | BCSBS0511N   | Conversational Systems            | Departmental Elective -I     |             | CSBS   | V    |
| 5      | BCSBS0511P   | Conversational Systems Lab        | Departmental Elective -I Lab |             | CSBS   | V    |
| 6      | BCSBS0517P   | Business Strategy Lab             | Departmental Elective -I Lab |             | CSBS   | V    |
| 7      | BCSBS0613Z   | Data Mining and Analytics         | Departmental Elective-II     |             | CSBS   | VI   |
| 8      | BCSBS0613P   | Data Mining and Analytics Lab     | Departmental Elective-II Lab |             | CSBS   | VI   |
| 9      | BCSBS0612Z   | Modern Web Applications           | Departmental Elective-II     |             | CSBS   | VI   |
| 10     | BCSBS0612P   | Modern Web Applications Lab       | Departmental Elective-II Lab |             | CSBS   | VI   |
| 11     | BCSBS0617    | Natural Language Processing       | Departmental Elective-II     |             | CSBS   | VI   |
| 12     | BCSBS0617P   | Natural Language Processing       | Departmental Elective-II Lab |             | CSBS   | VI   |
| 13     | BCSBS0611Z   | Robotics And Embedded Systems     | Departmental Elective-II     |             | CSBS   | VI   |
| 14     | BCSBS0611P   | Robotics And Embedded Systems Lab | Departmental Elective-II Lab |             | CSBS   | VI   |

**NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR  
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**AICTE Guidelines in Model Curriculum:**

A student will be eligible to get Undergraduate degree with Honours only, if he/she completes the additional MOOCs courses such as Infosys Springboard/NASSCOM/CISCO (as applicable) certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B.Tech. Program Guidelines for credit calculations are as follows.

1. For 6 to 12 Hours =0.5 Credit
2. For 13 to 18 =1 Credit
3. For 19 to 24 =1.5 Credit
4. For 25 to 30 =2 Credit
5. For 31 to 35 =2.5 Credit
6. For 36 to 41 =3 Credit
7. For 42 to 47 =3.5 Credit
8. For 48 and above =4 Credit

For registration to MOOCs Courses, the students shall follow Infosys Springboard/NASSCOM/CISCO (as applicable) registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.

The students shall be awarded Honours Degree as per following criterion.

- i. If he / she secures 7.50 as above CGPA.
- ii. Passed each subject of that degree program in the single attempt without any grace.
- iii. Successful completion of MOOCs based 20 credits

\* Subject code column to be left blank- It will be issued by Exam Section

|                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-----|-----|-----|-----|--------------------------------------------------|-----------------------------------------------|-----|-----|------|------|------|------------------------------|------|----------|---|
| Course Code: BCSBS0501                                                                                                                                                                                                                                                                                                                                                                    |                                                                         |     |     |     |     |                                                  | Course Name: Design and Analysis of Algorithm |     |     |      |      |      | L                            | T    | P        | C |
| Course Offered in: B.Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                          |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      | 3                            | 0    | 0        | 3 |
| Pre-requisite: Basic Knowledge of Design and Analysis of Algorithms                                                                                                                                                                                                                                                                                                                       |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
| Course Objectives: The objective of this course is to understand the fundamental concepts of the basics of computational complexity analysis and various algorithm design paradigms. The goal is to provide students with solid foundations to deal with a wide variety of computational problems, and to provide a thorough knowledge of the most common algorithms and data structures. |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                               |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      | Bloom's Knowledge Level (KL) |      |          |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                       | Understand the fundamental concepts of Design and Analysis of Algorithm |     |     |     |     |                                                  |                                               |     |     |      |      |      | K2                           |      |          |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                       | Explain and exemplify the most common algorithms and their strategies   |     |     |     |     |                                                  |                                               |     |     |      |      |      | K2                           |      |          |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                       | Study different type of Graph and Tree                                  |     |     |     |     |                                                  |                                               |     |     |      |      |      | K3                           |      |          |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                       | Analyze how to trace and intractable problem                            |     |     |     |     |                                                  |                                               |     |     |      |      |      | K4                           |      |          |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                       | Illustrate advance algorithms                                           |     |     |     |     |                                                  |                                               |     |     |      |      |      | K3                           |      |          |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                          |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                             | PO1                                                                     | PO2 | PO3 | PO4 | PO5 | PO6                                              | PO7                                           | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2                         | PSO3 |          |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                       | 3                                                                       | 2   | –   | –   | 2   | –                                                | –                                             | –   | –   | –    | 1    | 2    | 1                            | 1    |          |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                       | 3                                                                       | 3   | 2   | 1   | 2   | –                                                | –                                             | –   | –   | –    | 1    | 3    | 2                            | 1    |          |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                       | 3                                                                       | 2   | 2   | 1   | 2   | –                                                | –                                             | –   | –   | –    | 1    | 3    | 2                            | 1    |          |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                       | 3                                                                       | 3   | 2   | 2   | 2   | 1                                                | –                                             | –   | –   | –    | 2    | 3    | 2                            | 2    |          |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                       | 3                                                                       | 3   | 3   | 2   | 3   | 1                                                | –                                             | –   | –   | –    | 2    | 3    | 3                            | 2    |          |   |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
| UNIT 1                                                                                                                                                                                                                                                                                                                                                                                    |                                                                         |     |     |     |     | INTRODUCTION TO DESIGN AND ANALYSIS OF ALGORITHM |                                               |     |     |      |      |      |                              |      | 09 hours |   |
| Introduction: Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.                                    |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
| UNIT 2                                                                                                                                                                                                                                                                                                                                                                                    |                                                                         |     |     |     |     | FUNDAMENTAL ALGORITHMIC STRATEGIES               |                                               |     |     |      |      |      |                              |      | 09 hours |   |
| Fundamental Algorithmic Strategies: Brute-Force, Heuristics, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, Travelling Salesman Problem.                                                                                                                                     |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
| UNIT 3                                                                                                                                                                                                                                                                                                                                                                                    |                                                                         |     |     |     |     | GRAPH AND TREE ALGORITHMS                        |                                               |     |     |      |      |      |                              |      | 09 hours |   |
| Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.                                                                                                                                                               |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
| UNIT 4                                                                                                                                                                                                                                                                                                                                                                                    |                                                                         |     |     |     |     | TRACTABLE AND INTRACTABLE PROBLEM                |                                               |     |     |      |      |      |                              |      | 09 hours |   |
| Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.                                                                                                                                                                                          |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
| UNIT 5                                                                                                                                                                                                                                                                                                                                                                                    |                                                                         |     |     |     |     | ADVANCE ALGORITHMS                               |                                               |     |     |      |      |      |                              |      | 09 hours |   |
| Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithms.                                                                                                                                                                                                                                                               |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |
|                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      | Total Lecture Hours          |      | 45 hours |   |
| Textbook:                                                                                                                                                                                                                                                                                                                                                                                 |                                                                         |     |     |     |     |                                                  |                                               |     |     |      |      |      |                              |      |          |   |

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| 1.                      | Fundamental of Computer Algorithms<br><a href="https://kailash392.files.wordpress.com/2019/02/fundamentals-of-computer-algorithms-by-ellis-horowitz.pdf">https://kailash392.files.wordpress.com/2019/02/fundamentals-of-computer-algorithms-by-ellis-horowitz.pdf</a>                                                                                                                                                                          | E. Horowitz and S. Sahni.          |
| 2.                      | The Design and Analysis of Computer Algorithms,<br><a href="https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/The%20Design%20and%20Analysis%20of%20Computer%20Algorithms%20-%20Aho,%20Hopcroft%20&amp;%20Ullman%201974-01-11%5D.pdf">https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/The%20Design%20and%20Analysis%20of%20Computer%20Algorithms%20-%20Aho,%20Hopcroft%20&amp;%20Ullman%201974-01-11%5D.pdf</a> | A. Aho, J. Hopcroft and J. Ullman. |
| <b>Reference Books:</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |
| 1.                      | Introduction to Algorithms, T. H. Cormen.                                                                                                                                                                                                                                                                                                                                                                                                      | C. E. Leiserson and R. L. Rivest.  |
| 2.                      | Computer Algorithms: Introduction to Design and Analysis.                                                                                                                                                                                                                                                                                                                                                                                      | S. Baase                           |



| Self-Study Content Links: | Duration (in Hrs)                                                                                                                                                                                                           |           |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| MOOCs                     | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127667384693882883448_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127667384693882883448_shared/overview</a>   | 37 hr 41m |
| Video Lectures            | <a href="https://www.youtube.com/watch?v=DKCbsiDBN6c">https://www.youtube.com/watch?v=DKCbsiDBN6c</a>                                                                                                                       | 8m        |
|                           | <a href="https://www.youtube.com/watch?v=Pu_hqOXSV38">https://www.youtube.com/watch?v=Pu_hqOXSV38</a>                                                                                                                       | 10m       |
|                           | <a href="https://www.youtube.com/watch?v=pcKY4hjDrxk">https://www.youtube.com/watch?v=pcKY4hjDrxk</a>                                                                                                                       |           |
|                           | <a href="https://www.youtube.com/watch?v=I_JuQ5ayPmc&amp;t=520s">https://www.youtube.com/watch?v=I_JuQ5ayPmc&amp;t=520s</a>                                                                                                 | 5h 6m     |
|                           | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330154401547878426609_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330154401547878426609_shared/overview</a> |           |
|                           | <a href="https://www.youtube.com/watch?v=iug_d-PxLio">https://www.youtube.com/watch?v=iug_d-PxLio</a>                                                                                                                       | 1h        |
|                           | <a href="https://www.youtube.com/watch?v=e2cF8a5aAhE">https://www.youtube.com/watch?v=e2cF8a5aAhE</a>                                                                                                                       |           |
| Web References            | MIT OpenCourseWare – Introduction to Algorithms                                                                                                                                                                             |           |
|                           | <a href="#">Coursera – Algorithms Specialization (Stanford University)</a>                                                                                                                                                  |           |

### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 100 | 150   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                             |     |     |     |     |                                                       |     |     |     |      |      |                              |             |      |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-------------------------------------------------------|-----|-----|-----|------|------|------------------------------|-------------|------|---|
| LAB Course Code: BCSBS0551                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                             |     |     |     |     | LAB Course Name: Design and Analysis of Algorithm Lab |     |     |     |      |      | L                            | T           | P    | C |
| Course Offered in: B. Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                             |     |     |     |     |                                                       |     |     |     |      |      | 0                            | 0           | 2    | 1 |
| Pre-requisite: Students should have basic knowledge of programming languages such as C/C++ or Java, along with a clear understanding of fundamental data structures like arrays, stacks, queues, linked lists, trees, and graphs.                                                                                                                                                                                                                                                            |                                                                                                                             |     |     |     |     |                                                       |     |     |     |      |      |                              |             |      |   |
| Course Objectives: This lab aims to develop students’ ability to design and implement algorithms using iterative, recursive, divide and conquer, greedy, dynamic programming, and backtracking approaches. It focuses on enhancing problem-solving and coding skills through practical implementation of searching, sorting, and graph algorithms, while also enabling students to analyze algorithm efficiency and apply appropriate techniques to solve real-world computational problems. |                                                                                                                             |     |     |     |     |                                                       |     |     |     |      |      |                              |             |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                             |     |     |     |     |                                                       |     |     |     |      |      | Bloom’s Knowledge Level (KL) |             |      |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Implement algorithm to solve problems by iterative approach.                                                                |     |     |     |     |                                                       |     |     |     |      |      | K3                           |             |      |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Implement algorithm to solve problems by divide and conquer approach.                                                       |     |     |     |     |                                                       |     |     |     |      |      | K3                           |             |      |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Implement algorithm to solve problems by Dynamic programming, backtracking, branch and bound and Greedy algorithm approach. |     |     |     |     |                                                       |     |     |     |      |      | K3                           |             |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                             |     |     |     |     |                                                       |     |     |     |      |      |                              |             |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | PO1                                                                                                                         | PO2 | PO3 | PO4 | PO5 | PO6                                                   | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2        | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                                                                                                                           | 2   | 1   | 1   | 3   | –                                                     | –   | 1   | 1   | –    | 1    | 2                            | 2           | 1    |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                                                                                                                           | 3   | 2   | 2   | 3   | –                                                     | –   | 1   | 1   | –    | 1    | 3                            | 2           | 1    |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                                                                                                                           | 3   | 2   | 2   | 3   | 1                                                     | –   | 1   | 1   | –    | 1    | 3                            | 3           | 2    |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                                                                                                                           | 3   | 3   | 3   | 3   | 1                                                     | –   | 1   | 1   | –    | 2    | 3                            | 3           | 2    |   |
| List Of Practical’s (Indicative & Not Limited To)                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                             |     |     |     |     |                                                       |     |     |     |      |      |                              |             |      |   |
| Sr. No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Program                                                                                                                     |     |     |     |     |                                                       |     |     |     |      |      |                              | CO, K level |      |   |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Program for Recursive Binary & Linear Search.                                                                               |     |     |     |     |                                                       |     |     |     |      |      |                              | CO1, K3     |      |   |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Program for Heap Sort.                                                                                                      |     |     |     |     |                                                       |     |     |     |      |      |                              | CO1, K3     |      |   |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Program for Merge Sort.                                                                                                     |     |     |     |     |                                                       |     |     |     |      |      |                              | CO2, K3     |      |   |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Program for Insertion Sort.                                                                                                 |     |     |     |     |                                                       |     |     |     |      |      |                              | CO1, K3     |      |   |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Program for Quick Sort.                                                                                                     |     |     |     |     |                                                       |     |     |     |      |      |                              | CO2, K3     |      |   |
| 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Program to implement Knapsack Problem using Greedy Solution.                                                                |     |     |     |     |                                                       |     |     |     |      |      |                              | CO3, K3     |      |   |
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Program for 0/1 knapsack.                                                                                                   |     |     |     |     |                                                       |     |     |     |      |      |                              | CO3, K3     |      |   |
| 8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Program for LCS.                                                                                                            |     |     |     |     |                                                       |     |     |     |      |      |                              | CO3, K3     |      |   |
| 9.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Program for BFS and DFS.                                                                                                    |     |     |     |     |                                                       |     |     |     |      |      |                              | CO1, K3     |      |   |
| 10.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Program to implement Dijkstra’s Algorithm.                                                                                  |     |     |     |     |                                                       |     |     |     |      |      |                              | CO3, K3     |      |   |
| 11.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Program to find Minimum Spanning Tree using Kruskal’s Algorithm.                                                            |     |     |     |     |                                                       |     |     |     |      |      |                              | CO3, K3     |      |   |
| 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Program to implement N Queen Problem using Backtracking.                                                                    |     |     |     |     |                                                       |     |     |     |      |      |                              | CO3, K3     |      |   |
| Total Hours: 30 hrs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                             |     |     |     |     |                                                       |     |     |     |      |      |                              |             |      |   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |                               |     |     |     |      |      |      |                              |          |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-------------------------------|-----|-----|-----|------|------|------|------------------------------|----------|---|
| Course Code: BCSBS0507                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     | Course Name: Machine Learning |     |     |     |      |      | L    | T                            | P        | C |
| Course Offered in: B. Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |                               |     |     |     |      |      | 3    | 0                            | 0        | 3 |
| Pre-requisite: Basic programming skills, fundamental knowledge of mathematics data structures, algorithms, and basic database concepts.                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |                               |     |     |     |      |      |      |                              |          |   |
| Course Objectives: This course covers fundamental concepts and methods of computational data analysis, including pattern classification, prediction, visualization, and recent topics in deep learning. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work. The underlying theme in the course is statistical inference as it provides the foundation for most of the methods covered. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |                               |     |     |     |      |      |      |                              |          |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |                               |     |     |     |      |      |      | Bloom’s Knowledge Level (KL) |          |   |
| C O1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Understand the fundamental concepts, learning paradigms, validation techniques, and dimensionality reduction methods in Machine Learning.                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |     |     |     |                               |     |     |     |      |      |      | K2                           |          |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Apply supervised learning algorithms for classification and regression problems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |     |     |     |                               |     |     |     |      |      |      | K3                           |          |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Apply unsupervised learning techniques to discover patterns and clusters in datasets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     |     |                               |     |     |     |      |      |      | K3                           |          |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Analyze probabilistic learning models and ensemble methods for predictive analytics.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |     |     |     |                               |     |     |     |      |      |      | K4                           |          |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Analyze association rule mining and reinforcement learning techniques to solve real-world problems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |     |     |     |                               |     |     |     |      |      |      | K4                           |          |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |                               |     |     |     |      |      |      |                              |          |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | PO2 | PO3 | PO4 | PO5 | PO6                           | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2                         | PSO3     |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2   | 1   | 3   | 3   | -                             | -   | -   | -   | 2    | 2    | 2    | 2                            | 2        |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3   | 2   | 2   | 2   | -                             | -   | -   | -   | 1    | 2    | 2    | 2                            | 2        |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3   | 2   | 2   | 2   | -                             | -   | -   | -   | 1    | 2    | 2    | 2                            | 2        |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3   | 2   | 3   | 2   | -                             | -   | -   | -   | 1    | 2    | 2    | 2                            | 2        |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3   | 2   | 2   | 2   | -                             | -   | -   | -   | 1    | 3    | 2    | 2                            | 2        |   |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |                               |     |     |     |      |      |      |                              |          |   |
| Unit 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | FOUNDATION FOR MACHINE LEARNING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |     |                               |     |     |     |      |      |      |                              | 10 hours |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Introduction, Examples of Various Learning Paradigms, Perspectives and Issues, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning, VC Dimension, ML Techniques overview, Validation Techniques (Cross-Validations), Feature Reduction/Dimensionality reduction, Principal components analysis (Eigen values, Eigen vectors, Orthogonality).                                                                                                                                                                                                                                           |     |     |     |     |                               |     |     |     |      |      |      |                              |          |   |
| Unit 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SUPERVISED LEARNING                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |     |     |     |                               |     |     |     |      |      |      |                              | 08 hours |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Decision Trees: ID3, C4.5, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and Non-Linear, Kernel Functions, Making Kernels and working in feature space, SVM for classification and regression problems. K-Nearest Neighbors<br><br>Computational geometry; Voronoi Diagrams; Delaunay Triangulations, K-Nearest Neighbor algorithm; Wilson editing and triangulations, Aspects to consider while designing K-Nearest Neighbor |     |     |     |     |                               |     |     |     |      |      |      |                              |          |   |

|                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------|
| Unit 3                                                                                                                                                                                                                                                                                                                                                                   | UNSUPERVISED LEARNING                                                                                                                                                                                                                                                                                                    |                                                                              | 09 hours |
| Introduction to clustering, Distance measures, Different clustering methods (Distance, Density, Hierarchical), Iterative distance-based clustering, dealing with continuous, categorical values in K-Means, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, density-based clustering, Expectation Maximization, Gaussian Mixture Models. |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| Unit 4                                                                                                                                                                                                                                                                                                                                                                   | PROBABILISTIC LEARNING                                                                                                                                                                                                                                                                                                   |                                                                              | 09 hours |
| Bayesian Learning, Bayes Optimal Classifier, Naive Bayes Classifier, Model Assumptions, Probability estimation, Bayesian Belief Networks.                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| Ensembles methods                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| Bagging & boosting and its impact on bias and variance, C5.0 boosting, Random Forest, Gradient Boosting Machines and XGBoost.                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| Unit 5                                                                                                                                                                                                                                                                                                                                                                   | ASSOCIATION RULE MINING                                                                                                                                                                                                                                                                                                  |                                                                              | 09 hours |
| The applications of Association Rule Mining: Market Basket, Recommendation Engines, etc, A mathematical model for association analysis; Large item sets; Association Rules, Apriori: Constructs large item sets with mini sup by iterations; Interestingness of discovered association rules, Application examples; Association analysis vs. classification, FP-trees.   |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| Reinforcement Learning                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| Introduction to Reinforcement Learning, Learning Task, Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process, Q Learning – Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning, Introduction to Deep Learning.                                                                       |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| Case Study: Health Care, E-Commerce, Smart Cities.                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| Total Lecture Hours                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                          |                                                                              | 45 hours |
| Textbook:                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| 1.<br>2.<br>3.<br>4.                                                                                                                                                                                                                                                                                                                                                     | Marco Gori , Machine Learning: A Constraint-Based Approach, Morgan Kaufmann. 2017<br>Ethem Alpaydin, Machine Learning: The New AI, MIT Press-2016<br>Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995<br>Tom M. Mitchell, “Machine Learning”, McGraw-Hill, 2010 | Marco Gori,<br>Ethem Alpaydin,<br>Christopher M. Bishop,<br>Tom M. Mitchell, |          |
| Reference Books:                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                          |                                                                              |          |
| 1.                                                                                                                                                                                                                                                                                                                                                                       | Machine Learning: An Artificial Intelligence Approach, Volume 1, Elsevier. 2014                                                                                                                                                                                                                                          | Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell (Eds.)         |          |
| 2                                                                                                                                                                                                                                                                                                                                                                        | Taylor & Francis 2009. Machine Learning: An Algorithmic Perspective.                                                                                                                                                                                                                                                     | Stephen Marsland,                                                            |          |
| 3                                                                                                                                                                                                                                                                                                                                                                        | (2004) “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press.                                                                                                                                                                                                                    | Ethem Alpaydin                                                               |          |
| 4                                                                                                                                                                                                                                                                                                                                                                        | Fundamentals of Machine Learning for Predictive Data Anayltics: Algorithms, Worked Examples, and Case Studies 1st Edition                                                                                                                                                                                                | John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy,                         |          |
|                                                                                                                                                                                                                                                                                                                                                                          | Self-Study Content Links:                                                                                                                                                                                                                                                                                                | Duration (in Hrs)                                                            |          |
| MOOCs                                                                                                                                                                                                                                                                                                                                                                    | Introduction to Generative AI – Artificial intelligence and Machine Learning<br><a href="http://www.futureskillsprime.in/course/fundamentals-in-generative-ai-and-machine-learning/">www.futureskillsprime.in/course/fundamentals-in-generative-ai-and-machine-learning/</a>                                             | 16hrs 31min                                                                  |          |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Video Lectures | <a href="https://www.youtube.com/watch?v=fC7V8QsPBec&amp;list=PL1xHD4vteKYVpaliy295pg6_SY5qznc77&amp;index=2">https://www.youtube.com/watch?v=fC7V8QsPBec&amp;list=PL1xHD4vteKYVpaliy295pg6_SY5qznc77&amp;index=2</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
|                | <a href="https://www.youtube.com/watch?v=OTAR0kT1swg&amp;list=PL1xHD4vteKYVpaliy295pg6_SY5qznc77&amp;index=3">https://www.youtube.com/watch?v=OTAR0kT1swg&amp;list=PL1xHD4vteKYVpaliy295pg6_SY5qznc77&amp;index=3</a><br><a href="https://www.youtube.com/watch?v=OCwZyYH14uw">https://www.youtube.com/watch?v=OCwZyYH14uw</a><br><a href="https://www.youtube.com/watch?v=9_LY0LiFqRQ">https://www.youtube.com/watch?v=9_LY0LiFqRQ</a><br><a href="https://www.youtube.com/watch?v=EYef2e2IKEo">https://www.youtube.com/watch?v=EYef2e2IKEo</a><br><a href="https://www.youtube.com/watch?v=_PwhiWxHK8o">https://www.youtube.com/watch?v=_PwhiWxHK8o</a><br><a href="https://www.youtube.com/watch?v=wTF6vzS9fy4">https://www.youtube.com/watch?v=wTF6vzS9fy4</a><br><a href="https://www.youtube.com/watch?v=lt65K-REdHw">https://www.youtube.com/watch?v=lt65K-REdHw</a> |  |
|                | <a href="https://www.youtube.com/watch?v=HTSCbxSxsg&amp;list=PL1xHD4vteKYVpaliy295pg6_SY5qznc77&amp;index=4">https://www.youtube.com/watch?v=HTSCbxSxsg&amp;list=PL1xHD4vteKYVpaliy295pg6_SY5qznc77&amp;index=4</a><br><a href="https://www.youtube.com/watch?v=NnlS2BzXvyM">https://www.youtube.com/watch?v=NnlS2BzXvyM</a><br><a href="https://www.youtube.com/watch?v=7enWesSofhg">https://www.youtube.com/watch?v=7enWesSofhg</a>                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
|                | <a href="https://youtu.be/rthuFS5LSOo">https://youtu.be/rthuFS5LSOo</a><br><a href="https://youtu.be/kho6oANGu_A">https://youtu.be/kho6oANGu_A</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
|                | <a href="https://www.youtube.com/watch?v=9vMpHk44XXo&amp;list=PL1xHD4vteKYVpaliy295pg6_SY5qznc77&amp;index=5">https://www.youtube.com/watch?v=9vMpHk44XXo&amp;list=PL1xHD4vteKYVpaliy295pg6_SY5qznc77&amp;index=5</a><br>Reinforcement Learning Tutorial   Reinforcement Learning Example Using Python   Edureka - YouTube<br>Association Rule Mining – Solved Numerical Question on Apriori Algorithm(Hindi) - YouTube<br>Q Learning Explained   Reinforcement Learning Using Python   Q Learning in AI   Edureka - YouTube                                                                                                                                                                                                                                                                                                                                                |  |
|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
| Web References | NA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |

#### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 100 | 150   |

|                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                   |     |     |     |                                       |     |     |     |     |      |      |                              |      |                     |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|---------------------------------------|-----|-----|-----|-----|------|------|------------------------------|------|---------------------|-----|
| LAB Course Code: BCSBS0557                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                   |     |     |     | LAB Course Name: Machine Learning Lab |     |     |     |     |      |      | L                            | T    | P                   | C   |
| Course Offered in: B. Tech (CSBS)                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                   |     |     |     |                                       |     |     |     |     |      |      | 0                            | 0    | 3                   | 1.5 |
| Pre-requisite: Basic knowledge of programming using Python, mathematics fundamentals such as linear algebra, probability, and statistics                                                                                                                                                                                                              |                                                                                                                                                                                                   |     |     |     |                                       |     |     |     |     |      |      |                              |      |                     |     |
| Course Objectives: The Machine Learning Lab aims to provide practical knowledge of implementing and analysing supervised and unsupervised learning algorithms using Python, enabling students to pre-process datasets, build predictive models, evaluate performance, and apply Machine Learning techniques to solve real-world problems effectively. |                                                                                                                                                                                                   |     |     |     |                                       |     |     |     |     |      |      |                              |      |                     |     |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                   |     |     |     |                                       |     |     |     |     |      |      | Bloom's Knowledge Level (KL) |      |                     |     |
| CO1                                                                                                                                                                                                                                                                                                                                                   | Understand the implementation procedures for the machine learning algorithms.                                                                                                                     |     |     |     |                                       |     |     |     |     |      |      | K2                           |      |                     |     |
| CO2                                                                                                                                                                                                                                                                                                                                                   | Design Java/Python programs for various Learning algorithms.                                                                                                                                      |     |     |     |                                       |     |     |     |     |      |      | K3                           |      |                     |     |
| CO3                                                                                                                                                                                                                                                                                                                                                   | Apply appropriate data sets to the Machine Learning algorithms.                                                                                                                                   |     |     |     |                                       |     |     |     |     |      |      | K3                           |      |                     |     |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                   |     |     |     |                                       |     |     |     |     |      |      |                              |      |                     |     |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                         | PO1                                                                                                                                                                                               | PO2 | PO3 | PO4 | PO5                                   | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3                |     |
| CO1                                                                                                                                                                                                                                                                                                                                                   | 3                                                                                                                                                                                                 | 2   | 1   | 2   | 2                                     | -   | -   | -   | -   | -    | 1    | 2                            | 2    | 2                   |     |
| CO2                                                                                                                                                                                                                                                                                                                                                   | 3                                                                                                                                                                                                 | 2   | 3   | 2   | 3                                     | -   | -   | -   | 1   | 1    | 2    | 2                            | 2    | 2                   |     |
| CO3                                                                                                                                                                                                                                                                                                                                                   | 2                                                                                                                                                                                                 | 3   | 2   | 3   | 2                                     | -   | -   | -   | -   | 1    | 2    | 2                            | 2    | 2                   |     |
| List Of Practical's (Indicative & Not Limited To)                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                   |     |     |     |                                       |     |     |     |     |      |      |                              |      |                     |     |
| Sr. No.                                                                                                                                                                                                                                                                                                                                               | Program                                                                                                                                                                                           |     |     |     |                                       |     |     |     |     |      |      | CO, K level                  |      |                     |     |
| 1.                                                                                                                                                                                                                                                                                                                                                    | Write a program to perform various types of regression (Linear & Logistic).                                                                                                                       |     |     |     |                                       |     |     |     |     |      |      | CO1, K3                      |      |                     |     |
| 2.                                                                                                                                                                                                                                                                                                                                                    | Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a CSV file.                    |     |     |     |                                       |     |     |     |     |      |      | CO1, K3                      |      |                     |     |
| 3.                                                                                                                                                                                                                                                                                                                                                    | Write a program to demonstrate the working of the decision tree based ID3algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. |     |     |     |                                       |     |     |     |     |      |      | CO1, K3                      |      |                     |     |
| 4.                                                                                                                                                                                                                                                                                                                                                    | Write a program to implement k-Nearest Neighbour algorithm to classify the iris dataset. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.   |     |     |     |                                       |     |     |     |     |      |      | CO2, K3                      |      |                     |     |
| 5.                                                                                                                                                                                                                                                                                                                                                    | Apply EM algorithm to cluster a set of data. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.  |     |     |     |                                       |     |     |     |     |      |      | CO2, K3                      |      |                     |     |
| 6.                                                                                                                                                                                                                                                                                                                                                    | Implement Support Vector Machine using Scikit-learn.                                                                                                                                              |     |     |     |                                       |     |     |     |     |      |      | CO2, K3                      |      |                     |     |
| 7.                                                                                                                                                                                                                                                                                                                                                    | Implement the non-parametric Locally Weighted Regression algorithm to fit data points. Select appropriate data set for your experiment and draw graphs.                                           |     |     |     |                                       |     |     |     |     |      |      | CO3, K3                      |      |                     |     |
| 8.                                                                                                                                                                                                                                                                                                                                                    | Implement Gradient Boosting Machine Ensemble in Python.                                                                                                                                           |     |     |     |                                       |     |     |     |     |      |      | CO3, K3                      |      |                     |     |
| 9.                                                                                                                                                                                                                                                                                                                                                    | Implement Apriori algorithm using sample data in Python.                                                                                                                                          |     |     |     |                                       |     |     |     |     |      |      | CO3, K3                      |      |                     |     |
| 10.                                                                                                                                                                                                                                                                                                                                                   | Implement naïve Bayesian Classifier model. Write the program to calculate the accuracy, precision, and recall for your data set.                                                                  |     |     |     |                                       |     |     |     |     |      |      | CO2, K3                      |      |                     |     |
|                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                   |     |     |     |                                       |     |     |     |     |      |      |                              |      | Total Hours: 45 hrs |     |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-----|-----|----------------------------------------|-----|-----|-----|-----|------|------|------|-------------------|------|---|
| Course Code: BCSBS0505                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                     |                                                         |     |     | Course Name: Fundamental of Management |     |     |     |     |      |      | L    | T                 | P    | C |
| Course Offered in: CSBS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      | 2    | 0                 | 0    | 2 |
| Pre-requisite: Basic knowledge of business operations and organizational environment.                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| Course Objectives: This course introduces students to key management theories, the evolution of management over time, and fundamental concepts without going into extensive detail. It helps students understand how organizations function and builds a foundation for learning advanced management areas. After completing the course, students will find it easier to understand subjects like finance, marketing, and strategy in future studies.                                                         |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Understand the principles, functions, and evolution of management along with major management theories and thinkers |                                                         |     |     |                                        |     |     |     |     |      |      |      | (K2)              |      |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Apply planning, organizing, staffing, directing, and controlling functions in organizational settings.              |                                                         |     |     |                                        |     |     |     |     |      |      |      | (K3)              |      |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Analyze individual and group behavior to improve motivation, teamwork, and organizational effectiveness             |                                                         |     |     |                                        |     |     |     |     |      |      |      | (K4)              |      |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Develop managerial, leadership, communication, and decision-making skills for business environments                 |                                                         |     |     |                                        |     |     |     |     |      |      |      | (K6)              |      |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Evaluate ethical practices, corporate governance, and corporate social responsibility in modern organizations.      |                                                         |     |     |                                        |     |     |     |     |      |      |      | (K5)              |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | PO1                                                                                                                 | PO2                                                     | PO3 | PO4 | PO5                                    | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1              | PSO2 |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1                                                                                                                   | 1                                                       | –   | –   | –                                      | –   | –   | 1   | –   | 1    | 2    | 2    | 1                 | 1    |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | –                                                                                                                   | 2                                                       | 2   | –   | 1                                      | 1   | –   | 1   | 2   | 2    | 3    | 1    | –                 | 2    |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | –                                                                                                                   | 2                                                       | –   | 1   | –                                      | 1   | –   | 1   | 3   | 2    | 2    | 1    | –                 | 2    |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | –                                                                                                                   | 2                                                       | 2   | 1   | 1                                      | 1   | –   | 2   | 3   | 3    | 3    | 2    | –                 | 2    |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | –                                                                                                                   | 1                                                       | 1   | –   | –                                      | 2   | 2   | 3   | 1   | 2    | 2    | 2    | –                 | 1    |   |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| Unit 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                     | Management Theories                                     |     |     |                                        |     |     |     |     |      |      |      | 09 hours          |      |   |
| Definition of Management, Nature and Scope, Functions, Mintzberg Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management, [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word). Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc. Classical & scientific Approach, Max Weber Theory.                                     |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| Unit 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                     | Functions of Management & Organization Design           |     |     |                                        |     |     |     |     |      |      |      | 10 hours          |      |   |
| Planning- Definition, Types of planning, planning process and techniques, Organizing-principles of organising, Authority, Responsibility and delegation, Staffing- Process of selection and Recruitment, Directing- Effective Directing and Challenges, Controlling- Process of controlling, Performance Measurement and Management, Organisational Structure- Types of Organisational Structure, Matrix, Functional, Divisional, Classical, Neoclassical and Contingency approaches to organizational design |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| Unit 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                     | Organization Behavior                                   |     |     |                                        |     |     |     |     |      |      |      | 06 hours          |      |   |
| Introduction of Motivation- Types, Process, Maslow Theory of Motivation, Personality-definition, types of personality, Perception- Definition and Error, Attitudes: Meaning, Components, Attitude Formation Group: Meaning, types, group dynamics, Stress Management, Team Building, Tuckman Model of Team Development                                                                                                                                                                                        |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| Unit 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                     | Managerial Ethics                                       |     |     |                                        |     |     |     |     |      |      |      | 05 hours          |      |   |
| Ethics- definition, importance in Business, Ethics in various functions of business- Marketing & advertising, Finance & Accounting, Corporate Social Responsibility- CSR, Global relevance of ethics and consumer impact. Corporate Governance and Citizenship.                                                                                                                                                                                                                                               |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| Total Lecture Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      | 30 hours          |      |   |
| Textbook:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| 1. “Fundamentals of Management” — Ricky W. Griffin, Cengage Learning; 11th Edition (to be published in 2026).<br>2. . “Management: Principles, Practices, and Guidelines” – Ricky W. Griffin, Cengage Learning, 2020                                                                                                                                                                                                                                                                                          |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| Reference Books:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| 1. “Management: Fundamentals and Practices” – K. Ashwathappa, Tata McGraw-Hill, 2016<br>2. “Principles of Management” — Virat V. Giri & Dr. Yogeshwari L. Giri, TechKnowledge Publications; 2024.                                                                                                                                                                                                                                                                                                             |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      |                   |      |   |
| Self-Study Content Links:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                     |                                                         |     |     |                                        |     |     |     |     |      |      |      | Duration (in Hrs) |      |   |
| MOOCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                     | Fundamentals of Management and Organizations   Coursera |     |     |                                        |     |     |     |     |      |      |      | 30 Hrs            |      |   |

|                |                                                                                                                                             |  |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|--|
| Video Lectures | <a href="#">Fundamentals of Management: Management Practices From Past to Present</a>                                                       |  |
|                | <a href="#">Fundamental of Management One shot by Du Survivors   All units Covered   Delhi University</a>                                   |  |
|                | <a href="#">Fundamental of Management studies SEM 1 PYQ (2023-24) + Syllabus Full Guide   BBA(FIA)   DU</a>                                 |  |
| Web References | <a href="#">MCQ on Fundamental of Management</a>   <a href="#">CMA Foundation Management</a>   <a href="#">Top MCQ Series on Management</a> |  |

### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 50  | 100   |



|                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----|-----|-------------------------------------|------------------------------|-----|----------------------------------------------|-----|-----|------|------------------------------|------|------|------|
| Course Code: BCSBS0506                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                 |     |     |                                     | Course Name: CLOUD COMPUTING |     |                                              |     |     | L    | T                            | P    | C    |      |
| Course Offered in: B. Tech. CSBS                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     | 2    | 0                            | 0    | 2    |      |
| Pre-requisite: Basic Knowledge of Cloud Computing Fundamentals.                                                                                                                                                                                                                                                                                                                       |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| Course Objectives: The course intends to introduce students to the fundamentals of developing an application the on Cloud, specifically public clouds such as AWS, AZURE and Google. Students would be able to appreciate<br>✓ How to design applications for Cloud<br>✓ Develop applications using various services<br>✓ Deploy applications on Cloud by using cloud-native services |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| Course Outcome:                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      | Bloom’s Knowledge Level (KL) |      |      |      |
| CO1                                                                                                                                                                                                                                                                                                                                                                                   | Understand the fundamental concepts of cloud computing, service models, deployment models, and cloud platforms. |     |     |                                     |                              |     |                                              |     |     |      | K2                           |      |      |      |
| CO2                                                                                                                                                                                                                                                                                                                                                                                   | Apply cloud service models, APIs, and microservice concepts in cloud application development.                   |     |     |                                     |                              |     |                                              |     |     |      | K3                           |      |      |      |
| CO3                                                                                                                                                                                                                                                                                                                                                                                   | Analyze DevOps tools, containerization, and Kubernetes for cloud application deployment.                        |     |     |                                     |                              |     |                                              |     |     |      | K4                           |      |      |      |
| CO4                                                                                                                                                                                                                                                                                                                                                                                   | Apply Python, cloud platforms, and deployment techniques for cloud-based applications.                          |     |     |                                     |                              |     |                                              |     |     |      | K3                           |      |      |      |
| CO5                                                                                                                                                                                                                                                                                                                                                                                   | Analyze cloud security, resource management, and monitoring tools for cloud applications.                       |     |     |                                     |                              |     |                                              |     |     |      | K4                           |      |      |      |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                      |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| CO \ PO/PSO                                                                                                                                                                                                                                                                                                                                                                           | PO1                                                                                                             | PO2 | PO3 | PO4                                 | PO5                          | PO6 | PO7                                          | PO8 | PO9 | PO10 | PO11                         | PSO1 | PSO2 | PSO3 |
| CO1                                                                                                                                                                                                                                                                                                                                                                                   | 3                                                                                                               | 2   | –   | –                                   | 1                            | –   | –                                            | –   | –   | –    | 1                            | 2    | 2    | 1    |
| CO2                                                                                                                                                                                                                                                                                                                                                                                   | 3                                                                                                               | 2   | 2   | 1                                   | 3                            | –   | –                                            | –   | 1   | 1    | 1                            | 3    | 3    | 2    |
| CO3                                                                                                                                                                                                                                                                                                                                                                                   | 2                                                                                                               | 3   | 2   | 2                                   | 3                            | 1   | –                                            | 1   | 1   | 2    | 1                            | 2    | 3    | 2    |
| CO4                                                                                                                                                                                                                                                                                                                                                                                   | 2                                                                                                               | 2   | 2   | 1                                   | 3                            | –   | –                                            | 1   | 1   | 2    | 1                            | 3    | 3    | 2    |
| CO5                                                                                                                                                                                                                                                                                                                                                                                   | 2                                                                                                               | 3   | 2   | 2                                   | 3                            | 2   | 1                                            | –   | 1   | 1    | 2                            | 2    | 3    | 2    |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| UNIT1                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 |     |     | Cloud Fundamentals                  |                              |     |                                              |     |     |      | 8 hours                      |      |      |      |
| Cloud Fundamentals; Cloud Service Components, Cloud service/Deployment Models. Cloud components Guiding Principle with respect to utilization/Security/Pricing and the applications of Cloud. Public Cloud Platforms overview and their usage: AWS, Azure, Google                                                                                                                     |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| UNIT2                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 |     |     | Application architectures           |                              |     |                                              |     |     |      | 8 hours                      |      |      |      |
| Monolithic & Distributed, Microservice fundamental and design approach, Cloud Native applications-12 Factors App. Application integration process/Apification Process, API Fundamental. Microservice /API management, Spring boot Fundamental and design of microservice, API tools. Developer Portal. Applications of Microservice and APIFICATION.                                  |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| UNIT 3                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                 |     |     | Devops fundamentals                 |                              |     |                                              |     |     |      | 6 hours                      |      |      |      |
| Tools and Applications Containerization Process and application.                                                                                                                                                                                                                                                                                                                      |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| UNIT 4                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                 |     |     | Cloud Security, Resource Management |                              |     |                                              |     |     |      | 8 hours                      |      |      |      |
| Python- Refresher, Use cases for cloud application development. Design and developing solution steps using containers, containerization of application and deployment using Kubernetes Team Presentation of Project work/Thesis- Preliminary Round) and Review.                                                                                                                       |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| Cloud Security and Monitoring Tools. Team Presentation of Project work/Thesis- Final Round) and Review.                                                                                                                                                                                                                                                                               |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| Total Lecture Hours                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      | 30 hours                     |      |      |      |
| Textbook:                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                 |     |     |                                     |                              |     |                                              |     |     |      |                              |      |      |      |
| 1                                                                                                                                                                                                                                                                                                                                                                                     | Cloud Computing – A Practical Approach<br>McGraw Hill Book Page                                                 |     |     |                                     |                              |     | Toby Velte, Anthony Velte, Robert Elsenpeter |     |     |      |                              |      |      |      |

|   |                                                                                                                                                                             |              |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 2 | Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)<br>O'Reilly Book Page | George Reese |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|

#### Reference Books:

|   |                                                                                                                                                                                               |            |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1 | Python API Development Fundamentals<br><a href="https://www.packtpub.com/">https://www.packtpub.com/</a>                                                                                      | Jack Chan  |
| 2 | Building Microservices<br><a href="https://www.oreilly.com/library/view/building-microservices/9781491950340/">https://www.oreilly.com/library/view/building-microservices/9781491950340/</a> | Sam Newman |

| Self-Study Content Links: |                                                                                                                                                                                               | Duration (in Hrs) |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| MOOCs                     | CCSO - Certified Cloud Security Officer - TOC   Infosys Springboard                                                                                                                           | 24 hr             |
| Video Lectures            | <a href="https://www.youtube.com/watch?v=IT1X42D1KeA">https://www.youtube.com/watch?v=IT1X42D1KeA</a>                                                                                         | 2 hr              |
|                           | <a href="https://www.youtube.com/watch?v=NyA9PB6j8bg&amp;list=PLBGx66SQNZ8ZoTCIRIGKvvtbKMj0rqCL-">https://www.youtube.com/watch?v=NyA9PB6j8bg&amp;list=PLBGx66SQNZ8ZoTCIRIGKvvtbKMj0rqCL-</a> | 1hr 1 min         |
|                           | <a href="https://www.youtube.com/watch?v=XMskE8AjEjs&amp;t=41s">https://www.youtube.com/watch?v=XMskE8AjEjs&amp;t=41s</a>                                                                     | 22min             |
|                           | <a href="https://www.youtube.com/watch?v=b1b6JTYnbjU">https://www.youtube.com/watch?v=b1b6JTYnbjU</a>                                                                                         | 54 min            |
| Web References            | Oracle University – Oracle Cloud Learning <a href="https://education.oracle.com/">https://education.oracle.com/</a>                                                                           |                   |
|                           | Red Hat – OpenShift and Kubernetes Learning <a href="https://developers.redhat.com/learn">https://developers.redhat.com/learn</a>                                                             |                   |

#### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 50  | 100   |

|                                                                                                                                                                                                                                                                                                                          |                                                                               |                                          |     |     |                                      |     |     |     |     |      |      |               |             |      |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------|-----|-----|--------------------------------------|-----|-----|-----|-----|------|------|---------------|-------------|------|-----|
| LAB Course Code: BCSBS0566                                                                                                                                                                                                                                                                                               |                                                                               |                                          |     |     | LAB Course Name: CLOUD COMPUTING LAB |     |     |     |     |      |      | L             | T           | P    | C   |
| Course Offered in: B.Tech CSBS                                                                                                                                                                                                                                                                                           |                                                                               |                                          |     |     |                                      |     |     |     |     |      |      | 0             | 0           | 3    | 1.5 |
| Pre-requisite: Basic knowledge of cloud platforms and familiarity with internet technologies and web services.                                                                                                                                                                                                           |                                                                               |                                          |     |     |                                      |     |     |     |     |      |      |               |             |      |     |
| Course Objectives: The objective of this lab is to provide hands-on experience in designing, deploying, and managing cloud-based applications using modern cloud platforms. It focuses on implementing APIs, microservices, DevOps tools, and security practices in real cloud environments to develop practical skills. |                                                                               |                                          |     |     |                                      |     |     |     |     |      |      |               |             |      |     |
| CO                                                                                                                                                                                                                                                                                                                       |                                                                               | Course Outcome                           |     |     |                                      |     |     |     |     |      |      | Bloom's Level |             |      |     |
| CO1                                                                                                                                                                                                                                                                                                                      |                                                                               | Apply cloud concepts and service models. |     |     |                                      |     |     |     |     |      |      | K3            |             |      |     |
| CO2                                                                                                                                                                                                                                                                                                                      |                                                                               | Apply cloud deployment and DevOps tools. |     |     |                                      |     |     |     |     |      |      | K3            |             |      |     |
| CO3                                                                                                                                                                                                                                                                                                                      |                                                                               | Analyze cloud security and monitoring.   |     |     |                                      |     |     |     |     |      |      | K4            |             |      |     |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                         |                                                                               |                                          |     |     |                                      |     |     |     |     |      |      |               |             |      |     |
| CO \ PO/PSO                                                                                                                                                                                                                                                                                                              | PO1                                                                           | PO2                                      | PO3 | PO4 | PO5                                  | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1          | PSO2        | PSO3 |     |
| CO1                                                                                                                                                                                                                                                                                                                      | 3                                                                             | 2                                        | 1   | –   | 2                                    | –   | –   | –   | –   | –    | 1    | 3             | 2           | 1    |     |
| CO2                                                                                                                                                                                                                                                                                                                      | 2                                                                             | 2                                        | 2   | 1   | 3                                    | –   | –   | 1   | 1   | 2    | 1    | 3             | 3           | 2    |     |
| CO3                                                                                                                                                                                                                                                                                                                      | 2                                                                             | 3                                        | 2   | 2   | 3                                    | 2   | 1   | –   | 1   | 1    | 2    | 2             | 3           | 2    |     |
| List Of Practical's (Indicative & Not Limited To)                                                                                                                                                                                                                                                                        |                                                                               |                                          |     |     |                                      |     |     |     |     |      |      |               |             |      |     |
| Sr. No.                                                                                                                                                                                                                                                                                                                  | Program                                                                       |                                          |     |     |                                      |     |     |     |     |      |      |               | CO, K level |      |     |
| 1.                                                                                                                                                                                                                                                                                                                       | Configure cloud architectural design for business applications                |                                          |     |     |                                      |     |     |     |     |      |      |               | CO1,K3      |      |     |
| 2.                                                                                                                                                                                                                                                                                                                       | Create and analyze public and private cloud services                          |                                          |     |     |                                      |     |     |     |     |      |      |               | CO1,K4      |      |     |
| 3.                                                                                                                                                                                                                                                                                                                       | Apply scaling to cloud services according to business need                    |                                          |     |     |                                      |     |     |     |     |      |      |               | CO1,K3      |      |     |
| 4.                                                                                                                                                                                                                                                                                                                       | Configure design and deployment steps for API/Microservice on cloud platforms |                                          |     |     |                                      |     |     |     |     |      |      |               | CO2,K3      |      |     |
| 5.                                                                                                                                                                                                                                                                                                                       | Create AWS Lambda services and analyze its usage in API integration           |                                          |     |     |                                      |     |     |     |     |      |      |               | CO2,K4      |      |     |
| 6.                                                                                                                                                                                                                                                                                                                       | Prepare and formulate DevOps tool usage for automation in cloud applications  |                                          |     |     |                                      |     |     |     |     |      |      |               | CO3,K4      |      |     |
| 7.                                                                                                                                                                                                                                                                                                                       | Design and deploy web/RESTful services on cloud environment                   |                                          |     |     |                                      |     |     |     |     |      |      |               | CO3,K3      |      |     |
| 8.                                                                                                                                                                                                                                                                                                                       | Configure security steps in deployment of cloud application/microservices     |                                          |     |     |                                      |     |     |     |     |      |      |               | CO3,K3      |      |     |
| 9.                                                                                                                                                                                                                                                                                                                       | Implement monitoring tools for analysis of cloud-based applications           |                                          |     |     |                                      |     |     |     |     |      |      |               | CO5,K3      |      |     |
| Total Hours:45h                                                                                                                                                                                                                                                                                                          |                                                                               |                                          |     |     |                                      |     |     |     |     |      |      |               |             |      |     |

|                                                                                                                                                                                                                                                      |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------|---------------------------------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------------|-------------|----------|
| <b>Course Code: BCSBS0517</b>                                                                                                                                                                                                                        |                                                                                                                                                                                               |                                                                               |            | <b>Course Name: Business Strategy</b> |            |            |            |            |            |             |             | <b>L</b>    | <b>T</b>          | <b>P</b>    | <b>C</b> |
| <b>Course Offered in: CSBS</b>                                                                                                                                                                                                                       |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             | <b>2</b>    | <b>1</b>          | <b>0</b>    | <b>3</b> |
| <b>Pre-requisite: Student must have basic understanding of General Management.</b>                                                                                                                                                                   |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>Course Objectives:</b> To learn the fundamental concepts of strategic management to analyze business situations and apply these concepts to solve business problems.                                                                              |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>Course Outcome:</b> After completion of the course, the student will be able to                                                                                                                                                                   |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>CO1</b>                                                                                                                                                                                                                                           | Understand the fundamental concepts of strategic management and apply them to analyze real business situations.                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             | K2, K3      |                   |             |          |
| <b>CO2</b>                                                                                                                                                                                                                                           | Analyze a firm’s internal environment, including resources, capabilities, and core competence, to identify sources of sustained competitive advantage.                                        |                                                                               |            |                                       |            |            |            |            |            |             |             | K4          |                   |             |          |
| <b>CO3</b>                                                                                                                                                                                                                                           | Evaluate a firm’s external environment to formulate appropriate competitive strategies.                                                                                                       |                                                                               |            |                                       |            |            |            |            |            |             |             | K4, K5      |                   |             |          |
| <b>CO4</b>                                                                                                                                                                                                                                           | Analyze corporate-level growth strategies and evaluate portfolio choices using tools such as the BCG Matrix.                                                                                  |                                                                               |            |                                       |            |            |            |            |            |             |             | K4, K5      |                   |             |          |
| <b>CO5</b>                                                                                                                                                                                                                                           | Evaluate strategy implementation mechanisms and strategic control systems, design a governance framework to support effective strategy execution.                                             |                                                                               |            |                                       |            |            |            |            |            |             |             | K5          |                   |             |          |
| <b>CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)</b>                                                                                                                                                                                              |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>CO-PO Mapping</b>                                                                                                                                                                                                                                 | <b>PO1</b>                                                                                                                                                                                    | <b>PO2</b>                                                                    | <b>PO3</b> | <b>PO4</b>                            | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PSO1</b> | <b>PSO2</b>       | <b>PSO3</b> |          |
| <b>CO1</b>                                                                                                                                                                                                                                           | 2                                                                                                                                                                                             | 2                                                                             | 1          | 1                                     | –          | 1          | –          | 1          | 1          | 2           | 1           | 2           | 1                 | 1           |          |
| <b>CO2</b>                                                                                                                                                                                                                                           | 2                                                                                                                                                                                             | 3                                                                             | 2          | 2                                     | 1          | 1          | –          | 1          | 1          | 2           | 1           | 2           | 1                 | 1           |          |
| <b>CO3</b>                                                                                                                                                                                                                                           | 2                                                                                                                                                                                             | 3                                                                             | 2          | 2                                     | 1          | 2          | 1          | 1          | 1          | 2           | 2           | 3           | 1                 | 2           |          |
| <b>CO4</b>                                                                                                                                                                                                                                           | 2                                                                                                                                                                                             | 3                                                                             | 2          | 2                                     | 1          | 1          | –          | 1          | 2          | 2           | 3           | 3           | 1                 | 2           |          |
| <b>CO5</b>                                                                                                                                                                                                                                           | 2                                                                                                                                                                                             | 3                                                                             | 3          | 2                                     | 1          | 2          | 1          | 2          | 2          | 3           | 3           | 3           | 2                 | 3           |          |
| <b>Course Contents / Syllabus</b>                                                                                                                                                                                                                    |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>Unit 1</b>                                                                                                                                                                                                                                        |                                                                                                                                                                                               | <b>Introduction to Strategic Management</b>                                   |            |                                       |            |            |            |            |            |             |             |             | <b>09 hours</b>   |             |          |
| Strategic Management- Concept & Importance, Vision, Mission & Objectives, Schools of Thought in Strategic Management, Strategy: Content, Process, & Practice, Fit Concept and Configuration Perspective in Strategic Management.                     |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>Unit 2</b>                                                                                                                                                                                                                                        |                                                                                                                                                                                               | <b>Internal Environment of Firm- Recognizing a Firm’s Intellectual Assets</b> |            |                                       |            |            |            |            |            |             |             |             | <b>09 hours</b>   |             |          |
| Business Environment, SWOT Analysis, Core Competence as the Root of Competitive Advantage, Sources of Sustained Competitive Advantage, Business Processes and Capabilities-based Approach to Strategy.                                               |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>Unit 3</b>                                                                                                                                                                                                                                        |                                                                                                                                                                                               | <b>External Environments of Firm- Competitive Strategy</b>                    |            |                                       |            |            |            |            |            |             |             |             | <b>09 hours</b>   |             |          |
| PESTLE Framework, Porter’s Five Forces Model, The Concept of Strategic Groups and Industry Life Cycle. Porter’s Generic Strategies, Value Chain Analysis.                                                                                            |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>Unit 4</b>                                                                                                                                                                                                                                        |                                                                                                                                                                                               | <b>Corporate Strategy and Growth Strategies</b>                               |            |                                       |            |            |            |            |            |             |             |             | <b>10 hours</b>   |             |          |
| Corporate Strategy- Expansion, Integration, and Diversification. The Motives for Diversification, Related and Unrelated Diversification, Business Portfolio Analysis (BCG Matrix), Strategic Alliances - Joint Ventures, and Mergers & Acquisitions. |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>Unit 5</b>                                                                                                                                                                                                                                        |                                                                                                                                                                                               | <b>Strategy Implementation: Structure and Systems</b>                         |            |                                       |            |            |            |            |            |             |             |             | <b>08 hours</b>   |             |          |
| McKinsey 7S Framework, GE 9 Cell Matrix. Strategic Control & Corporate Governance.                                                                                                                                                                   |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>Total Lecture Hours</b>                                                                                                                                                                                                                           |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             | <b>45 hours</b>   |             |          |
| <b>Textbook:</b>                                                                                                                                                                                                                                     |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| 1. Contemporary Strategic Management, Blackwell, 7 <sup>th</sup> Edition. (2012). Robert M. Grant                                                                                                                                                    |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| 2. Strategic Management, McGraw Hill, 5 <sup>th</sup> Edition (2021). Azhar Kazmi                                                                                                                                                                    |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| <b>Reference Books:</b>                                                                                                                                                                                                                              |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| 1. Competitive Strategy, Sweetzy Publication, (2024). M.E. Porter                                                                                                                                                                                    |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| 2. Business Strategy Essentials You Always wanted To Know Vibrant Publishers 2 <sup>nd</sup> Edition (2020), Callie Daum                                                                                                                             |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |
| Self-Study Content Links:                                                                                                                                                                                                                            |                                                                                                                                                                                               |                                                                               |            |                                       |            |            |            |            |            |             |             |             | Duration (in Hrs) |             |          |
| MOO Cs                                                                                                                                                                                                                                               | <a href="https://www.coursera.org/learn/business-strategy-creating-competitive-advantage">https://www.coursera.org/learn/business-strategy-creating-competitive-advantage</a>                 |                                                                               |            |                                       |            |            |            |            |            |             |             |             | 15 Hrs            |             |          |
| Video Lectures                                                                                                                                                                                                                                       | <a href="https://www.youtube.com/watch?v=m9rn-wazIis&amp;list=PLLy_2iUCG87A3bWaN-wjZemniTKmRejeD">https://www.youtube.com/watch?v=m9rn-wazIis&amp;list=PLLy_2iUCG87A3bWaN-wjZemniTKmRejeD</a> |                                                                               |            |                                       |            |            |            |            |            |             |             |             | 15 Hrs            |             |          |
|                                                                                                                                                                                                                                                      | <a href="https://www.youtube.com/watch?v=8swTrGXDm-w&amp;list=PLgMDNELGJlCZGHvxBcvmDQzsNhPHZGSsN">https://www.youtube.com/watch?v=8swTrGXDm-w&amp;list=PLgMDNELGJlCZGHvxBcvmDQzsNhPHZGSsN</a> |                                                                               |            |                                       |            |            |            |            |            |             |             |             | 15 Hrs            |             |          |
| Web References                                                                                                                                                                                                                                       | <a href="https://www.scribd.com/document/346892136/92728063-Strategic-Management-Full-Notes-pdf">https://www.scribd.com/document/346892136/92728063-Strategic-Management-Full-Notes-pdf</a>   |                                                                               |            |                                       |            |            |            |            |            |             |             |             |                   |             |          |

Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.

**Mode of Evaluation**

| CIE |     |     |     |     |     |            | ESE | Total |
|-----|-----|-----|-----|-----|-----|------------|-----|-------|
| ST1 | ST2 | ST3 | TA1 | TA2 | TA3 | Attendance |     |       |
|     |     |     | 5   | 5   | 5   | 5          |     |       |
| 30  |     |     | 20  |     |     |            | 100 | 150   |

|                                                                                                                                                                                                                                        |                                                                                                                                          |     |     |                                        |     |     |     |     |     |      |      |      |                |      |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----------------------------------------|-----|-----|-----|-----|-----|------|------|------|----------------|------|---|
| Lab Course Code: BCSBS0517P                                                                                                                                                                                                            |                                                                                                                                          |     |     | Lab Course Name: Business Strategy Lab |     |     |     |     |     |      |      | L    | T              | P    | C |
| Course Offered In: CSBS                                                                                                                                                                                                                |                                                                                                                                          |     |     |                                        |     |     |     |     |     |      |      | 0    | 0              | 2    | 1 |
| Pre-Requisite: General Understanding Of Strategic Management                                                                                                                                                                           |                                                                                                                                          |     |     |                                        |     |     |     |     |     |      |      |      |                |      |   |
| To Develop The Ability To Apply Strategic Management Concepts, Frameworks, And Analytical Tools For Evaluating Business Situations, Formulating Strategies, And Supporting Decision-Making Through Case-Based And Practical Exercises. |                                                                                                                                          |     |     |                                        |     |     |     |     |     |      |      |      |                |      |   |
| Course Outcome: After Completion Of The Course, The Student Will Be Able To                                                                                                                                                            |                                                                                                                                          |     |     |                                        |     |     |     |     |     |      |      |      |                |      |   |
| CO1                                                                                                                                                                                                                                    | Develop Strategic Vision, Mission, Objectives, And Analyze Organizational Resources And Capabilities To Determine Competitive Advantage. |     |     |                                        |     |     |     |     |     |      |      |      |                | K4   |   |
| CO2                                                                                                                                                                                                                                    | Evaluate Industry Structure And Competitive Forces To Recommend Appropriate Business-Level Strategies.                                   |     |     |                                        |     |     |     |     |     |      |      |      |                | K5   |   |
| CO3                                                                                                                                                                                                                                    | Analyze Corporate Strategies And Design Implementation Approaches Using Strategic Models And Frameworks.                                 |     |     |                                        |     |     |     |     |     |      |      |      |                | K4   |   |
| Co-Po Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                       |                                                                                                                                          |     |     |                                        |     |     |     |     |     |      |      |      |                |      |   |
| Co-Po Mapping                                                                                                                                                                                                                          | Po1                                                                                                                                      | Po2 | Po3 | Po4                                    | Po5 | Po6 | Po7 | Po8 | Po9 | Po10 | Po11 | Pso1 | Pso2           | Pso3 |   |
| Co1                                                                                                                                                                                                                                    | 2                                                                                                                                        | 3   | 1   | –                                      | –   | –   | –   | –   | 1   | 2    | –    | 2    | 2              | 1    |   |
| Co2                                                                                                                                                                                                                                    | 2                                                                                                                                        | 3   | 2   | 1                                      | –   | 1   | 1   | –   | –   | 2    | –    | 2    | 3              | 1    |   |
| Co3                                                                                                                                                                                                                                    | 2                                                                                                                                        | 3   | 3   | 2                                      | 1   | 2   | 1   | 2   | 2   | 2    | 3    | 2    | 3              | 2    |   |
| List Of Practical’s (Indicative & Not Limited To)                                                                                                                                                                                      |                                                                                                                                          |     |     |                                        |     |     |     |     |     |      |      |      |                |      |   |
|                                                                                                                                                                                                                                        |                                                                                                                                          |     |     |                                        |     |     |     |     |     |      |      |      |                |      |   |
| Exp. No.                                                                                                                                                                                                                               | Experiment Title                                                                                                                         |     |     |                                        |     |     |     |     |     |      |      |      | Co             |      |   |
| 1                                                                                                                                                                                                                                      | Vision, Mission & Smart Strategic Objectives Formulation                                                                                 |     |     |                                        |     |     |     |     |     |      |      |      | Co1            |      |   |
| 2                                                                                                                                                                                                                                      | Swot Analysis And Tows Strategy Derivation                                                                                               |     |     |                                        |     |     |     |     |     |      |      |      | Co1            |      |   |
| 3                                                                                                                                                                                                                                      | Core Competence & Vrin Framework Analysis                                                                                                |     |     |                                        |     |     |     |     |     |      |      |      | Co1            |      |   |
| 4                                                                                                                                                                                                                                      | Pestle Analysis And Strategic Group Mapping                                                                                              |     |     |                                        |     |     |     |     |     |      |      |      | Co2            |      |   |
| 5                                                                                                                                                                                                                                      | Porter's Five Forces Model & Generic Strategy Recommendation                                                                             |     |     |                                        |     |     |     |     |     |      |      |      | Co2            |      |   |
| 6                                                                                                                                                                                                                                      | Bcg Matrix: Business Portfolio Analysis                                                                                                  |     |     |                                        |     |     |     |     |     |      |      |      | Co3            |      |   |
| 7                                                                                                                                                                                                                                      | Diversification Strategy & M&A Analysis                                                                                                  |     |     |                                        |     |     |     |     |     |      |      |      | Co3            |      |   |
| 8                                                                                                                                                                                                                                      | Mckinsey 7s Framework For Strategy Implementation                                                                                        |     |     |                                        |     |     |     |     |     |      |      |      | Co3            |      |   |
| 9                                                                                                                                                                                                                                      | Ge–Mckinsey 9-Cell Matrix And Strategic Portfolio Decisions                                                                              |     |     |                                        |     |     |     |     |     |      |      |      | Co3            |      |   |
| 10                                                                                                                                                                                                                                     | Comprehensive Strategic Audit — Integrated Case Study                                                                                    |     |     |                                        |     |     |     |     |     |      |      |      | Co1, Co2 & Co3 |      |   |
| Total Hours: 30 Hrs.                                                                                                                                                                                                                   |                                                                                                                                          |     |     |                                        |     |     |     |     |     |      |      |      |                |      |   |

|                                                                                                                                                                                                                                                                           |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      |                              |      |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------------------------------|------|---|
| Course Code:<br>BCSBS0553                                                                                                                                                                                                                                                 | Course Name: Business Communication & Value Science – III LAB                                                                                      |     |     |     |     |     |     |     |     |      |      | L    | T                            | P    | C |
| Course Offered in: B. Tech. CSBS V Semester                                                                                                                                                                                                                               |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      | 0    | 0                            | 2    | 1 |
| Pre-requisite: Basic understanding of Business Communication and completion of BCVS-I & II                                                                                                                                                                                |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      |                              |      |   |
| Course Objectives: Develop technical writing skills, Introduce students to Self-analysis techniques like SWOT & TOWS, Introduce students to key concepts of, Pluralism & cultural spaces, Cross-cultural communication, C. Science of Nation building.                    |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      |                              |      |   |
| Course Outcome: The lab will focus on practical exercises to develop technical writing skills and apply self-analysis tools like SWOT and TOWS, along with hands-on understanding of pluralism, cross-cultural communication, and the role of science in nation building. |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | Bloom's Knowledge Level (KL) |      |   |
| CO1                                                                                                                                                                                                                                                                       | Apply the principles of SWOT analysis, motivation, and personal development in professional and real-life contexts.                                |     |     |     |     |     |     |     |     |      |      |      | K3                           |      |   |
| CO2                                                                                                                                                                                                                                                                       | Analyze the impact of cultural, gender, scientific, and technological communication, including Artificial Intelligence, in society and daily life. |     |     |     |     |     |     |     |     |      |      |      | K4                           |      |   |
| CO3                                                                                                                                                                                                                                                                       | Identify and apply the best practices of technical writing for effective professional communication.                                               |     |     |     |     |     |     |     |     |      |      |      | K3                           |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                          |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      |                              |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                             | PO1                                                                                                                                                | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2                         | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                       | -                                                                                                                                                  | 1   | 1   | 1   | -   | 1   | -   | 1   | 2   | 3    | -    | 2    | -                            | -    |   |
| CO2                                                                                                                                                                                                                                                                       | 1                                                                                                                                                  | -   | -   | -   | -   | 1   | -   | 1   | 2   | 2    | -    | 1    | -                            | -    |   |
| CO3                                                                                                                                                                                                                                                                       | 1                                                                                                                                                  | -   | 1   | -   | -   | 1   | 1   | 1   | 1   | 2    | -    | 1    | -                            | -    |   |
| List of Practical:                                                                                                                                                                                                                                                        |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | COs                          |      |   |
| 1. Summarize the basic principles of SWOT and life positions.                                                                                                                                                                                                             |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO1                          |      |   |
| 2. Apply SWOT in real life scenarios.                                                                                                                                                                                                                                     |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO1                          |      |   |
| 3. Recognize how motivation helps in real life                                                                                                                                                                                                                            |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO1                          |      |   |
| 4. Leverage motivation in real-life scenarios                                                                                                                                                                                                                             |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO1                          |      |   |
| 5. Culture & Stereotypes                                                                                                                                                                                                                                                  |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO2                          |      |   |
| 6. Identify and respect pluralism in cultural spaces                                                                                                                                                                                                                      |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO2                          |      |   |
| 7. Differentiate between the different cultures of India                                                                                                                                                                                                                  |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO2                          |      |   |
| 8. Define and differentiate between global, glocal and trans locational culture                                                                                                                                                                                           |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO2                          |      |   |
| 9. Recognize the implications of cross-cultural communication                                                                                                                                                                                                             |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO2                          |      |   |
| 10. Apply cross-cultural communication                                                                                                                                                                                                                                    |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO2                          |      |   |
| 11. Identify the common mistakes made in cross-cultural communication                                                                                                                                                                                                     |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO2                          |      |   |
| 12. Summarize the role of science in nation building                                                                                                                                                                                                                      |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO3                          |      |   |
| 13. Science as a Driver of Economic Growth                                                                                                                                                                                                                                |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO3                          |      |   |
| 14. Project Presentations                                                                                                                                                                                                                                                 |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      | CO3                          |      |   |
| Total: 30 Hours                                                                                                                                                                                                                                                           |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      |                              |      |   |
| Reference Books:                                                                                                                                                                                                                                                          |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      |                              |      |   |
| 1. 11 Skills of a Good Technical Writer <a href="https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technicalwriter/">https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technicalwriter/</a>                             |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      |                              |      |   |
| 2. 13 benefits and challenges of cultural diversity in the workplace <a href="https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/">https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/</a>                                |                                                                                                                                                    |     |     |     |     |     |     |     |     |      |      |      |                              |      |   |

| NPTEL/Youtube/Faculty Video Link: |                                                                                                                                                                                       |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                 | <a href="https://www.youtube.com/watch?v=LTDsgd0ytbE">https://www.youtube.com/watch?v=LTDsgd0ytbE</a>                                                                                 |
| 2                                 | <a href="https://www.youtube.com/watch?v=BNqIJCm3sXU">https://www.youtube.com/watch?v=BNqIJCm3sXU</a>                                                                                 |
| 3                                 | <a href="https://www.youtube.com/watch?v=Ms4fl-EsF3o">https://www.youtube.com/watch?v=Ms4fl-EsF3o</a>                                                                                 |
| 4                                 | <a href="https://www.youtube.com/watch?v=90c4cPjwuF4">https://www.youtube.com/watch?v=90c4cPjwuF4</a>                                                                                 |
| 5                                 | <a href="https://www.coursera.org/learn/python-text-mining/lecture/sVe8B/regular-expressions">https://www.coursera.org/learn/python-text-mining/lecture/sVe8B/regular-expressions</a> |



|                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----------------------------------------|------------------------------|-----|-----|------|---------------------------------|------------------------------|----------|------|----------|---|
| Course Code: BCSBS0518                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         | Course Name: Compiler Design |     |     |      |                                 |                              | L        | T    | P        | C |
| Course Offered in: B.Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 | 2                            | 1        | 0    | 3        |   |
| Pre-requisite: Basic Knowledge of formal language and automata theory,Discrete Mathematics                                                                                                                                                                                                                                                                                                   |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| Course Objectives: The objective of this course is to understand the fundamental concepts of Compiler, in this course is to explore the principles, algorithms, and data structures involved in the design and construction of compiler. Topics included context-free grammars, lexical analysis, parsing techniques, symbol tables, error recovery, code generation, and code optimization. |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                  |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 | Bloom's Knowledge Level (KL) |          |      |          |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                          | Understand and apply the fundamental concepts of compiler design, language, machine, and expressions.                                   |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 | K3                           |          |      |          |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                          | Explain in detail the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation. |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 | K2                           |          |      |          |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                          | Describe semantic analyzer without the aid of automatic generators.                                                                     |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 | K3                           |          |      |          |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                          | Describe techniques for intermediate code and machine code optimization.                                                                |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 | K4                           |          |      |          |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                          | Describe the Architecture and machine dependent code improvement and K3 the object- oriented features.                                  |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 | K3                           |          |      |          |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                | PO1                                                                                                                                     | PO2                                                                                                                                                                | PO3 | PO4 | PO5 | PO6                                     | PO7                          | PO8 | PO9 | PO10 | PO11                            | PSO1                         | PSO2     | PSO3 |          |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                          | 3                                                                                                                                       | 2                                                                                                                                                                  | 1   | -   | -   | -                                       | -                            | -   | -   | -    | 2                               | 2                            | 1        | 1    |          |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                          | 3                                                                                                                                       | 3                                                                                                                                                                  | 2   | 1   | 1   | -                                       | -                            | -   | -   | -    | 2                               | 3                            | 2        | 1    |          |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                          | 2                                                                                                                                       | 3                                                                                                                                                                  | 3   | 2   | 1   | -                                       | -                            | 1   | -   | -    | 2                               | 2                            | 2        | 1    |          |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                          | 3                                                                                                                                       | 3                                                                                                                                                                  | 2   | 2   | 2   | -                                       | -                            | -   | -   | -    | 2                               | 3                            | 2        | 1    |          |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                          | 3                                                                                                                                       | 2                                                                                                                                                                  | 3   | 2   | 2   | -                                       | -                            | 1   | 1   | -    | 2                               | 3                            | 3        | 2    |          |   |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| UNIT 1                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |                                                                                                                                                                    |     |     |     | INTRODUCTION. TO COMPILER               |                              |     |     |      |                                 |                              |          |      | 09 hours |   |
| Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).                                                                                                                                                                                    |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| UNIT 2                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |                                                                                                                                                                    |     |     |     | SYNTAX ANALYSIS (PARSER)                |                              |     |     |      |                                 |                              |          |      | 09 hours |   |
| Context-free languages and grammars, push-down automata, LL (1) grammars and top-down parsing, operator grammars, LR(O), SLR (1), LR (1), LALR (1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR (1) parser generator (yacc, bison).                                                                                                                                        |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| UNIT 3                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |                                                                                                                                                                    |     |     |     | SEMANTIC ANALYSIS                       |                              |     |     |      |                                 |                              |          |      | 09 hours |   |
| Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree.<br>Symbol Table: Basic structure, symbol attributes and management.<br>Run-time environment: Procedure activation, parameter passing, value return, memory allocation, scope.                                                                                          |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| UNIT 4                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |                                                                                                                                                                    |     |     |     | CODE GENERATION AND IMPROVEMENT         |                              |     |     |      |                                 |                              |          |      | 09 hours |   |
| Intermediate Code Generation: Translation of different language features, different types of intermediate forms.<br>Code Improvement (optimization): control-flow, data-flow dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.                                                                                                        |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| UNIT 5                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |                                                                                                                                                                    |     |     |     | ARCHITECTURE DEPENDENT CODE IMPROVEMENT |                              |     |     |      |                                 |                              |          |      | 09 hours |   |
| Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation.<br>Advanced topics: Type systems, data abstraction, compilation of Object-Oriented features and non-imperative programming languages.                                                                              |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| Total Lecture Hours                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              | 45 hours |      |          |   |
| Textbook:                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                         |                                                                                                                                                                    |     |     |     |                                         |                              |     |     |      |                                 |                              |          |      |          |   |
| 1.                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                         | Compilers: Principles, Techniques and Tools. 2ND Edition.<br><a href="http://ce.sharif.edu/courses/94-95/1/ce414-">http://ce.sharif.edu/courses/94-95/1/ce414-</a> |     |     |     |                                         |                              |     |     |      | V. Aho, R. Sethi and J. Ullman. |                              |          |      |          |   |

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| 2.                      | <a href="https://resources/root/Text%20Books/Compiler%20Design/Alfred%20V.%20Aho,%20Monica%20S.%20Lam,%20Ravi%20Sethi,%20Jeffrey%20D.%20Ullman-Compilers%20-%20Principles,%20Techniques,%20and%20Tools-Pearson_Addison%20Wesley%20(2006).pdf">2/resources/root/Text%20Books/Compiler%20Design/Alfred%20V.%20Aho,%20Monica%20S.%20Lam,%20Ravi%20Sethi,%20Jeffrey%20D.%20Ullman-Compilers%20-%20Principles,%20Techniques,%20and%20Tools-Pearson_Addison%20Wesley%20(2006).pdf</a><br>Lex & Yacc,<br><a href="https://d1.amobbs.com/bbs_upload782111/files_33/ourdev_584393GCYRF3.pdf">https://d1.amobbs.com/bbs_upload782111/files_33/ourdev_584393GCYRF3.pdf</a> | Levine R. John, Tony Mason and Doug Brown. |
| <b>Reference Books:</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            |
| 1.                      | The Design and Evolution of C++                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Bjarne Stroustrup.                         |

| Self-Study Content Links: |                                                                                                                                                                                                                                                                                                                                                                                                                                  | Duration (in Hrs) |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| MOOCs                     | 1- NPTEL- Compiler Design Course (IIT Kharagpur)<br><a href="https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_cs57">https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_cs57</a>                                                                                                                                                                                                                                | 36-45             |
|                           | 2- NPTEL Advanced Compiler Design<br><a href="https://nptel.ac.in/courses/106108052?utm_source=chatgpt.com">https://nptel.ac.in/courses/106108052?utm_source=chatgpt.com</a>                                                                                                                                                                                                                                                     | 35                |
| Video Lectures            | <a href="https://www.youtube.com/watch?v=Qkwj65l_96I">https://www.youtube.com/watch?v=Qkwj65l_96I</a>                                                                                                                                                                                                                                                                                                                            | 02                |
|                           | <a href="https://www.youtube.com/watch?v=Sveob49iOpA">https://www.youtube.com/watch?v=Sveob49iOpA</a>                                                                                                                                                                                                                                                                                                                            | 02                |
|                           | <a href="https://www.youtube.com/watch?v=cC8YRnDGMwI">https://www.youtube.com/watch?v=cC8YRnDGMwI</a>                                                                                                                                                                                                                                                                                                                            | 02                |
|                           | <a href="https://www.youtube.com/watch?v=O-iMkZ7FhKU">https://www.youtube.com/watch?v=O-iMkZ7FhKU</a>                                                                                                                                                                                                                                                                                                                            | 02                |
|                           | <a href="https://www.youtube.com/watch?v=j-bLeUysUiE">https://www.youtube.com/watch?v=j-bLeUysUiE</a><br><a href="https://www.youtube.com/watch?v=O5YIRUYFDA8">https://www.youtube.com/watch?v=O5YIRUYFDA8</a><br><a href="https://www.youtube.com/watch?v=AKYuP3vpdlg">https://www.youtube.com/watch?v=AKYuP3vpdlg</a><br><a href="https://www.youtube.com/watch?v=clb4tnEm8l4">https://www.youtube.com/watch?v=clb4tnEm8l4</a> |                   |
| Web References            | NA                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |
|                           | <a href="https://www.youtube.com/watch?v=XWT-XEUOVY">https://www.youtube.com/watch?v=XWT-XEUOVY</a><br><a href="https://onlinecourses.nptel.ac.in/noc22_cs14/preview">https://onlinecourses.nptel.ac.in/noc22_cs14/preview</a> <a href="https://www.youtube.com/watch?v=-y8OTRJ7Cvo">https://www.youtube.com/watch?v=-y8OTRJ7Cvo</a>                                                                                             |                   |

### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 100 | 150   |

|                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|--------------------------------------|-----|-----|-----|-----|-----|------|------|------------------------------|------|------|---|
| LAB Course Code: BCSBS0518P                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                     |     |     | LAB Course Name: Compiler Design Lab |     |     |     |     |     |      |      | L                            | T    | P    | C |
| Course Offered in: B.Tech (CSBS)                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      | 0                            | 0    | 2    | 1 |
| Pre-requisite: The student should have basic knowledge of C programming, data structures, and fundamentals of theory of computation such as regular expressions, DFA, and NFA.                                                 |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
| Course Objectives: Students are able to understand the fundamental concepts of lexical analysis, parsing techniques, code generation, and code optimization, and to understand the working of different phases of a compiler.. |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
|                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      | Bloom's Knowledge Level (KL) |      |      |   |
| CO1                                                                                                                                                                                                                            | Develop language and expression and Perform code optimization and machine code                                                                                                                                                                                                                                                      |     |     |                                      |     |     |     |     |     |      |      | K3                           |      |      |   |
| CO2                                                                                                                                                                                                                            | Implement syntax analyzer in different methods and Perform code generation                                                                                                                                                                                                                                                          |     |     |                                      |     |     |     |     |     |      |      | K3                           |      |      |   |
| CO3                                                                                                                                                                                                                            | Explore semantic analyzer using different type of programs                                                                                                                                                                                                                                                                          |     |     |                                      |     |     |     |     |     |      |      | K2                           |      |      |   |
|                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
| CO-PO Mapping                                                                                                                                                                                                                  | PO1                                                                                                                                                                                                                                                                                                                                 | PO2 | PO3 | PO4                                  | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3 |   |
| CO1                                                                                                                                                                                                                            | 3                                                                                                                                                                                                                                                                                                                                   | 2   | 1   | -                                    | -   | -   | -   | -   | -   | -    | 2    | 2                            | 1    | 1    |   |
| CO2                                                                                                                                                                                                                            | 3                                                                                                                                                                                                                                                                                                                                   | 3   | 3   | 2                                    | 2   | -   | -   | 1   | -   | -    | 2    | 3                            | 2    | 1    |   |
| CO3                                                                                                                                                                                                                            | 3                                                                                                                                                                                                                                                                                                                                   | 3   | 2   | 2                                    | 2   | -   | -   | 1   | -   | -    | 2    | 3                            | 2    | 1    |   |
|                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
| List Of Practical's (Indicative & Not Limited To)                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
| Sr. No.                                                                                                                                                                                                                        | Program                                                                                                                                                                                                                                                                                                                             |     |     |                                      |     |     |     |     |     |      |      |                              | CO   |      |   |
| 1.                                                                                                                                                                                                                             | Construction of NFA from REGULAR EXPRESSION.                                                                                                                                                                                                                                                                                        |     |     |                                      |     |     |     |     |     |      |      |                              | CO1  |      |   |
| 2.                                                                                                                                                                                                                             | Construction of DFA from NFA                                                                                                                                                                                                                                                                                                        |     |     |                                      |     |     |     |     |     |      |      |                              | CO1  |      |   |
| 3.                                                                                                                                                                                                                             | Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language. |     |     |                                      |     |     |     |     |     |      |      |                              | CO1  |      |   |
| 4.                                                                                                                                                                                                                             | Implementation of LEXICAL ANALYZER for IF STATEMENT .                                                                                                                                                                                                                                                                               |     |     |                                      |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 5.                                                                                                                                                                                                                             | Implementation of LEXICAL ANALYZER for ARITHMETIC EXPRESSION.                                                                                                                                                                                                                                                                       |     |     |                                      |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 6.                                                                                                                                                                                                                             | Write a C program to implement LALR parsing.                                                                                                                                                                                                                                                                                        |     |     |                                      |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 7.                                                                                                                                                                                                                             | Implementation of OPERATOR PRECEDENCE PARSER.                                                                                                                                                                                                                                                                                       |     |     |                                      |     |     |     |     |     |      |      |                              | CO3  |      |   |
| 8.                                                                                                                                                                                                                             | Implementation of RECURSIVE DESCENT PARSER.                                                                                                                                                                                                                                                                                         |     |     |                                      |     |     |     |     |     |      |      |                              | CO3  |      |   |
| 9.                                                                                                                                                                                                                             | Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.                                                                                                                                                                                                                                         |     |     |                                      |     |     |     |     |     |      |      |                              | CO3  |      |   |
| 10.                                                                                                                                                                                                                            | Implementation of SHIFT REDUCE PARSING ALGORITHM.                                                                                                                                                                                                                                                                                   |     |     |                                      |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 11.                                                                                                                                                                                                                            | a) *Write a C program to implement operator precedence parsing.<br>b) *Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.                                                                                                      |     |     |                                      |     |     |     |     |     |      |      |                              | CO3  |      |   |
| 12.                                                                                                                                                                                                                            | Implementation of CODE GENERATOR.                                                                                                                                                                                                                                                                                                   |     |     |                                      |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 13.                                                                                                                                                                                                                            | Write a C program to generate machine code from abstract syntax tree generated by the parser                                                                                                                                                                                                                                        |     |     |                                      |     |     |     |     |     |      |      |                              | CO1  |      |   |
| 14.                                                                                                                                                                                                                            | Implementation of CODE OPTIMIZATION TECHNIQUES.                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              | CO1  |      |   |
|                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
|                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |
| Total Hours: 20 hrs                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                     |     |     |                                      |     |     |     |     |     |      |      |                              |      |      |   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----|-----|----------------------------------------------|-----|-------------------------------------|-----|-----|-----|------|------------------------------------------------------------|------------------------------|----------|----------|---|
| Course Code: BCSBS0511N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |     |     |                                              |     | Course Name: Conversational Systems |     |     |     |      |                                                            | L                            | T        | P        | C |
| Course Offered in: B.Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            | 2                            | 1        | 0        | 3 |
| Pre-requisite: Basic Knowledge of Artificial Intelligence.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| Course Objectives: The objective of this course is to understand the fundamental concepts of conversational systems, learn about NLP and applications of NLTK. It helps students to understand cloud-based platforms for developing a conversational system.                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            | Bloom's Knowledge Level (KL) |          |          |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Understand and apply the fundamental concepts of Conversational systems.              |     |     |                                              |     |                                     |     |     |     |      |                                                            | K3                           |          |          |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Explain and exemplify the concepts of NLP.                                            |     |     |                                              |     |                                     |     |     |     |      |                                                            | K2                           |          |          |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Apply concepts of conversational AI.                                                  |     |     |                                              |     |                                     |     |     |     |      |                                                            | K3                           |          |          |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Analyze role of ML & AI in conversational systems.                                    |     |     |                                              |     |                                     |     |     |     |      |                                                            | K4                           |          |          |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Develop learning chatbot.                                                             |     |     |                                              |     |                                     |     |     |     |      |                                                            | K3                           |          |          |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | PO1                                                                                   | PO2 | PO3 | PO4                                          | PO5 | PO6                                 | PO7 | PO8 | PO9 | PO10 | PO11                                                       | PSO1                         | PSO2     | PSO3     |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                                                                                     | 2   | 1   | -                                            | 1   | -                                   | -   | -   | -   | -    | 2                                                          | 2                            | 1        | 2        |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                                                                                     | 2   | 2   | 1                                            | 2   | -                                   | -   | -   | 1   | -    | 2                                                          | 2                            | 2        | 2        |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                                                                                     | 3   | 3   | 2                                            | 3   | 1                                   | -   | 1   | 2   | -    | 2                                                          | 3                            | 3        | 2        |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                                                                                     | 3   | 2   | 3                                            | 2   | 1                                   | -   | 1   | 1   | -    | 3                                                          | 3                            | 2        | 2        |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                                                                                     | 3   | 3   | 2                                            | 3   | 1                                   | -   | 2   | 2   | -    | 3                                                          | 3                            | 3        | 3        |   |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| Module 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                       |     |     | FUNDAMENTALS OF CONVERSATIONAL SYSTEMS       |     |                                     |     |     |     |      |                                                            |                              |          | 09hours  |   |
| Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To- Text, Text-To-Speech, Computer Vision etc. Google, MS, Amazon &Market trends Alexa, Google Home and other new channels, Ethical and Legal Considerations in AI Overview, Basic Python programming concepts, Node Basics, Coding, Best Practices.                                                                                                                                                                                            |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| Module 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                       |     |     | NATURAL LANGUAGE PROCESSING                  |     |                                     |     |     |     |      |                                                            |                              |          | 09 hours |   |
| Brief history, Basic Concepts, Phases of NLP, Application of chatbots etc Information Extraction, Sentiment Analysis NLP using Python - Make use of any of the NLP libraries like NLTK, spaCy, Stanford NLP etc. (Practice session to use an NLP Tool -Hands on) Affective NLG.                                                                                                                                                                                                                                                                                                                                                                            |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| Module 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                       |     |     | CONVERSATIONAL AI SYSTEMS                    |     |                                     |     |     |     |      |                                                            |                              |          | 09 hours |   |
| Fundamentals of Conversational Systems (NLU, DM and NLG) Chatbot framework & Architecture, Conversational Flow & Design, Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation UX design, APIs and SDKs, Usage of Conversational Design Tools, Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps, Overview of CE Testing techniques, A/B Testing, Introduction to Testing Frameworks - Botium /Mocha,Chai, Security & Compliance – Data Management, Storage, GDPR, PCI, Building a Voice/ChatBot – Hands-on. |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| Module 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                       |     |     | ROLE OF ML/AI IN CONVERSATIONAL TECHNOLOGIES |     |                                     |     |     |     |      |                                                            |                              |          | 09 hours |   |
| Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction, etc. to effectively converse, Introduction to Contact centers – Impact & Terminologies, Case studies & Trends, how does a Virtual Agent/Assistant fit in here? Introduction to Contact centers – Impact & Terminologies, Case studies & Trends, how does a Virtual Agent/Assistant fit in here?                                                                                                                                                                        |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| Module 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                       |     |     | OVERVIEW ON CONVERSATIONAL ANALYTICS         |     |                                     |     |     |     |      |                                                            |                              |          | 09 hours |   |
| Conversation Analytics: The need of it, Introduction to Conversational Metrics, Summary, Robots, and Sensory Applications overview, XR Technologies in Conversational Systems, XR-Commerce, What to expect next? – Future technologies and market innovations overview.                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| Total Lecture Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              | 45 hours |          |   |
| Textbook:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | GlennJ.Myatt,MakingsenseofData:ApracticalGuidetoExploratoryDataAnalysisandDataMining. |     |     |                                              |     |                                     |     |     |     |      | John Wiley Publishers, 2007.                               |                              |          |          |   |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Data Analysis and Data Mining, 2nd Edition.                                           |     |     |                                              |     |                                     |     |     |     |      | John Wiley & Sons Publication, 2014.                       |                              |          |          |   |
| Reference Books:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                       |     |     |                                              |     |                                     |     |     |     |      |                                                            |                              |          |          |   |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Open Data for Sustainable Community: Glocalized Sustainable Development Goals.        |     |     |                                              |     |                                     |     |     |     |      | Neha Sharma, Santanu Ghosh, Monodeep Saha, Springer, 2021. |                              |          |          |   |

|    |                                                     |                                                                |
|----|-----------------------------------------------------|----------------------------------------------------------------|
| 2. | The Data Science Handbook.                          | Field Cady, John Wiley & Sons, Inc, 2017.                      |
| 3. | Data Mining Concepts and Techniques, Third Edition. | Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, 2012. |

|                           |                                                                                                                                                 |                   |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Self-Study Content Links: |                                                                                                                                                 | Duration (in Hrs) |
| MOOCs                     | <a href="https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs124">https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs124</a> | 40 Hrs            |
| Video Lectures            | <a href="https://www.youtube.com/watch?v=fLvJ8VdHLA0">https://www.youtube.com/watch?v=fLvJ8VdHLA0</a>                                           | 10 min            |
|                           | <a href="https://www.youtube.com/watch?v=CMrHM8a3hqw">https://www.youtube.com/watch?v=CMrHM8a3hqw</a>                                           | 06 min            |
|                           | <a href="https://www.youtube.com/watch?v=FLZvOKSCkxY">https://www.youtube.com/watch?v=FLZvOKSCkxY</a>                                           | 20 min            |
|                           | <a href="https://www.youtube.com/watch?v=8rXD5-xhemo">https://www.youtube.com/watch?v=8rXD5-xhemo</a>                                           | 01 hr 22 min      |
|                           | <a href="https://www.youtube.com/watch?v=Ukg_U3CnJWI">https://www.youtube.com/watch?v=Ukg_U3CnJWI</a>                                           | 12 min            |
| Web References            | NA                                                                                                                                              |                   |

#### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 100 | 150   |

|                                                                                                                                                                                                                                                                                                |                                                                                                |     |     |     |                                             |     |     |     |     |      |      |                              |      |      |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----|-----|-----|---------------------------------------------|-----|-----|-----|-----|------|------|------------------------------|------|------|---|
| LAB Course Code: BCSBS0511P                                                                                                                                                                                                                                                                    |                                                                                                |     |     |     | LAB Course Name: Conversational Systems Lab |     |     |     |     |      |      | L                            | T    | P    | C |
| Course Offered in: B.Tech (CSBS)                                                                                                                                                                                                                                                               |                                                                                                |     |     |     |                                             |     |     |     |     |      |      | 0                            | 0    | 2    | 1 |
| Pre-requisite: The student should have basic knowledge of Python programming, object-oriented concepts, and fundamentals of artificial intelligence and natural language processing. Familiarity with Amazon AWS and basic text processing concepts is helpful.                                |                                                                                                |     |     |     |                                             |     |     |     |     |      |      |                              |      |      |   |
| Course Objectives: Students are able to design and develop chatbot applications using Python and build Alexa skills using AWS developer console. The course also aims to create intents and utterances, develop FAQ and navigation skills, and perform text and sentiment analysis using NLTK. |                                                                                                |     |     |     |                                             |     |     |     |     |      |      |                              |      |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                    |                                                                                                |     |     |     |                                             |     |     |     |     |      |      | Bloom's Knowledge Level (KL) |      |      |   |
| CO1                                                                                                                                                                                                                                                                                            | Develop AI Chatbots.                                                                           |     |     |     |                                             |     |     |     |     |      |      | K3                           |      |      |   |
| CO2                                                                                                                                                                                                                                                                                            | Build voice applications using the AWS Alexa Skills Kit.                                       |     |     |     |                                             |     |     |     |     |      |      | K3                           |      |      |   |
| CO3                                                                                                                                                                                                                                                                                            | Apply Intents, Invocations and slots in AWS.                                                   |     |     |     |                                             |     |     |     |     |      |      | K3                           |      |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                               |                                                                                                |     |     |     |                                             |     |     |     |     |      |      |                              |      |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                  | PO1                                                                                            | PO2 | PO3 | PO4 | PO5                                         | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                            | 3                                                                                              | 2   | 3   | 1   | 2                                           | -   | -   | 1   | 2   | -    | 2    | 3                            | 2    | 2    |   |
| CO2                                                                                                                                                                                                                                                                                            | 3                                                                                              | 2   | 2   | 1   | 3                                           | -   | -   | 1   | 1   | -    | 2    | 2                            | 3    | 1    |   |
| CO3                                                                                                                                                                                                                                                                                            | 3                                                                                              | 3   | 3   | 2   | 3                                           | -   | -   | 1   | 1   | -    | 2    | 3                            | 3    | 1    |   |
| CO4                                                                                                                                                                                                                                                                                            | 3                                                                                              | 3   | 3   | 2   | 3                                           | 1   | -   | 2   | 2   | 1    | 2    | 3                            | 3    | 2    |   |
| CO5                                                                                                                                                                                                                                                                                            | 3                                                                                              | 3   | 3   | 2   | 3                                           | 1   | -   | 1   | 1   | -    | 3    | 3                            | 3    | 3    |   |
| List Of Practical's (Indicative & Not Limited To)                                                                                                                                                                                                                                              |                                                                                                |     |     |     |                                             |     |     |     |     |      |      |                              |      |      |   |
| Sr. No.                                                                                                                                                                                                                                                                                        | Program                                                                                        |     |     |     |                                             |     |     |     |     |      |      |                              |      | CO   |   |
| 1.                                                                                                                                                                                                                                                                                             | Write a program to design a chatbot in python.                                                 |     |     |     |                                             |     |     |     |     |      |      |                              |      | CO1  |   |
| 2.                                                                                                                                                                                                                                                                                             | Creating an account in amazon AWS and understanding Alexa Skill Kit CO1 and developer console. |     |     |     |                                             |     |     |     |     |      |      |                              |      | CO2  |   |
| 3.                                                                                                                                                                                                                                                                                             | Creating Intents, utterances and invocation in AWS for developing an CO1 Alexa Skill.          |     |     |     |                                             |     |     |     |     |      |      |                              |      | CO3  |   |
| 4.                                                                                                                                                                                                                                                                                             | Creating Intents, utterances and invocation in AWS for developing an CO1 Alexa Skill.          |     |     |     |                                             |     |     |     |     |      |      |                              |      | CO3  |   |
| 5.                                                                                                                                                                                                                                                                                             | Develop an Alexa Skill for NIET Admissions FAQ.                                                |     |     |     |                                             |     |     |     |     |      |      |                              |      | CO3  |   |
| 6.                                                                                                                                                                                                                                                                                             | Develop an Alexa Skill for NIET Navigation.                                                    |     |     |     |                                             |     |     |     |     |      |      |                              |      | CO3  |   |
| 7.                                                                                                                                                                                                                                                                                             | To perform text analysis using NLTK.                                                           |     |     |     |                                             |     |     |     |     |      |      |                              |      | CO1  |   |
| 8.                                                                                                                                                                                                                                                                                             | To perform Sentiment Analysis using NLTK.                                                      |     |     |     |                                             |     |     |     |     |      |      |                              |      | CO1  |   |
| Total Hours: 30 hrs.                                                                                                                                                                                                                                                                           |                                                                                                |     |     |     |                                             |     |     |     |     |      |      |                              |      |      |   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----------------------------------------------|--------------------------------------|-----|-----|-----|------|------|------|------------------------------|------|---|
| Course Code: BCSBS0601                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                       |     |     |     |                                               | Course Name: ARTIFICIAL INTELLIGENCE |     |     |     |      |      | L    | T                            | P    | C |
| Course Offered in: B.Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      | 3    | 0                            | 0    | 3 |
| Pre-requisite: Basic knowledge of AI and Machine Learning Concepts.                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| Course Objectives: The objective of this course is to understand the fundamental concepts of the basics of computational complexity analysis and various algorithm design paradigms. The goal is to provide students with solid foundations to deal with a wide variety of computational problems, and to provide a thorough knowledge of the most common algorithms and data structures.                                                                                                            |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      | Bloom's Knowledge Level (KL) |      |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Understand the fundamentals of AI problem solving and its foundations                                                                 |     |     |     |                                               |                                      |     |     |     |      |      |      | K2                           |      |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Apply principles of AI in solutions that require problem-solving, inference, and perception                                           |     |     |     |                                               |                                      |     |     |     |      |      |      | K3                           |      |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Explain strong familiarity with a number of important AI techniques, including in particular intelligent search methods and solutions |     |     |     |                                               |                                      |     |     |     |      |      |      | K3                           |      |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Understand the basics of Logic and the ways to process logic to solve real-world problems.                                            |     |     |     |                                               |                                      |     |     |     |      |      |      | K3                           |      |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Assess/ Evaluate critically the techniques presented and apply them to real-world problems                                            |     |     |     |                                               |                                      |     |     |     |      |      |      | K5                           |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PO1                                                                                                                                   | PO2 | PO3 | PO4 | PO5                                           | PO6                                  | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2                         | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                                                                                                                                     | 2   | -   | -   | 1                                             | -                                    | -   | -   | -   | -    | 2    | 2    | 1                            | 1    |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                                                                                                                                     | 3   | 2   | 1   | 3                                             | 1                                    | -   | -   | -   | -    | 2    | 3    | 3                            | 1    |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                                                                                                                                     | 3   | 1   | 2   | 3                                             | -                                    | -   | 1   | -   | -    | 2    | 3    | 3                            | 1    |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                                                                                                                                     | 3   | -   | 2   | 2                                             | -                                    | -   | -   | -   | -    | 2    | 2    | 2                            | 1    |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                                                                                                                                     | 3   | 2   | 3   | 3                                             | 2                                    | 1   | 1   | 2   | 1    | 3    | 3    | 3                            | 2    |   |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| UNIT 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                       |     |     |     | AI AND PROBLEM SOLVING                        |                                      |     |     |     |      |      |      | 09 hours                     |      |   |
| Introduction: Introduction, Overview of Artificial intelligence: Problems of AI, AI technique, Tic-Tac-Toe problem, Intelligent Agents, Agents & environment, Nature of environment, Structure of agents, Goal-based agents, Utility-based agents, Learning agents.                                                                                                                                                                                                                                  |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| Problem Solving, Problems, Problem Space & search: Defining the problem as state-space search, production system, problem characteristics, and Issues in the design of search programs.                                                                                                                                                                                                                                                                                                              |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| UNIT 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                       |     |     |     | SEARCH TECHNIQUES                             |                                      |     |     |     |      |      |      | 09 hours                     |      |   |
| Search techniques: Problem-solving agents, searching for solutions; uniform search strategies: breadth-first search, depth-first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.                                        |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| UNIT 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                       |     |     |     | AI PROBLEMS AND KNOWLEDGE REPRESENTATION      |                                      |     |     |     |      |      |      | 09 hours                     |      |   |
| Constraint satisfaction problems: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.                                                                                                                                                                                                                                              |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| AI problems and Knowledge Representation: Water Jug Problem, Missionaries-Cannibals Problem, n-Queen problem, monkey banana problem, Travelling Salesman Problem. Knowledge representation, Knowledge representation issues, representation & mapping, approaches to knowledge representation Procedural Knowledge, Inheritable Knowledge, Declarative knowledge, Semantic nets, partitioned nets, Frames, Common Sense reasoning, and thematic role frames.                                         |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| UNIT 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                       |     |     |     | INTRODUCTION TO LOGIC                         |                                      |     |     |     |      |      |      | 09 hours                     |      |   |
| Representing simple facts in logic, Propositional Logic, Semantic Tableaux in Propositional Logic, Resolution in Propositional Logic, using predicate logic, representing instant & ISA relationship, computable functions & predicates, Semantic Tableaux in Predicate Logic, Prenex Normal Form, Skolemization, resolution, natural deduction. Representing knowledge using rules, and logic programming.                                                                                          |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| UNIT 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                       |     |     |     | Probabilistic reasoning & Expert System in AI |                                      |     |     |     |      |      |      | 09 hours                     |      |   |
| Reasoning in Uncertainty: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques, Planning with state Space Search, Conditional Planning, Continuous planning, Multi-Agent Planning, Forms of learning, inductive learning, Reinforcement Learning, learning decision trees, Neural Net learning, and Genetic learning |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |
| Expert Systems: Representing and using domain knowledge, Architecture of knowledge-Based Systems, Rule-based systems, Forward and Backward Chaining, expert system shells, and knowledge acquisition.                                                                                                                                                                                                                                                                                                |                                                                                                                                       |     |     |     |                                               |                                      |     |     |     |      |      |      |                              |      |   |

|                     |                                                                                                                                                                                                  |                                            |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Total Lecture Hours |                                                                                                                                                                                                  | 45 hours                                   |
| Textbook:           |                                                                                                                                                                                                  |                                            |
| 1.                  | “Artificial Intelligence – A Modern Approach”, Pearson Education. Fourth Edition 2021.<br>Artificial Intelligence, Russel, Pearson, Fourth Edition 2020.                                         | Stuart Russell, Peter Norvig, Peter Norvig |
| 2.                  |                                                                                                                                                                                                  | Stuart Russell, Peter Norvig               |
| Reference Books:    |                                                                                                                                                                                                  |                                            |
| 1.                  | “Artificial Intelligence”, McGraw-Hill 3rd Edition 2010<br><br>Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI<br><br>Logic & Prolog Programming, New Age International | Elaine Rich, Kevin Knight                  |
| 2.                  |                                                                                                                                                                                                  | Donald W. Patterson                        |
| 3.                  |                                                                                                                                                                                                  | Saroj Kaushik                              |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Self-Study Content Links: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Duration (in Hrs) |
| MOOCs                     | 1. <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01454951203364044845609/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01454951203364044845609/overview</a><br>2. <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01454951860172390445572/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01454951860172390445572/overview</a><br>3. <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384321260520243233957_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384321260520243233957_shared/overview</a><br>4. <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01454951107904307245298/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01454951107904307245298/overview</a> | 36 Hrs            |
| Video Lectures            | <a href="https://www.youtube.com/watch?v=uB3i-qV6VdM&amp;list=PLxCzCOWd7aiHGhOHV-nwb0HR5US5GFKFI">https://www.youtube.com/watch?v=uB3i-qV6VdM&amp;list=PLxCzCOWd7aiHGhOHV-nwb0HR5US5GFKFI</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 02 Hrs            |
|                           | <a href="https://www.youtube.com/watch?v=gm5DcqzZ3f4&amp;list=PLxCzCOWd7aiHGhOHV-nwb0HR5US5GFKFI&amp;index=2">https://www.youtube.com/watch?v=gm5DcqzZ3f4&amp;list=PLxCzCOWd7aiHGhOHV-nwb0HR5US5GFKFI&amp;index=2</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 02 Hrs            |
|                           | <a href="https://www.youtube.com/watch?v=D1eL1EnxXXQ">https://www.youtube.com/watch?v=D1eL1EnxXXQ</a> <a href="https://www.youtube.com/watch?v=O-iMkZ7FhKU">https://www.youtube.com/watch?v=O-iMkZ7FhKU</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 02 Hrs            |
|                           | <a href="https://www.youtube.com/watch?v=LrVw2LtJsYw">https://www.youtube.com/watch?v=LrVw2LtJsYw</a><br><a href="https://www.youtube.com/watch?v=O5YIRUYFDA8">https://www.youtube.com/watch?v=O5YIRUYFDA8</a><br><a href="https://www.youtube.com/watch?v=JMUxmLyrhSk">https://www.youtube.com/watch?v=JMUxmLyrhSk</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 02 Hrs            |
| Web References            | <a href="https://en.wikipedia.org/wiki/Artificial_intelligence">https://en.wikipedia.org/wiki/Artificial_intelligence</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |

### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 100 | 150   |



|                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      |                              |      |      |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|----------------------------------------------|-----|-----|-----|-----|------|------|------------------------------|------|------|---|
| LAB Course Code: BCSBS0651                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                          |     |     |     | LAB Course Name: ARTIFICIAL INTELLIGENCE LAB |     |     |     |     |      |      | L                            | T    | P    | C |
| Course Offered in: B.Tech (CSBS)                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      | 0                            | 0    | 2    | 1 |
| Pre-requisite: Basic knowledge of AI and Machine Learning Concepts.                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      |                              |      |      |   |
| Course Objectives: Introduction to history of AI and foundations, as well as knowledge with AI concepts for problem solving, inference, perception, knowledge representation, and learning, forms of learning, planning and computation statistics which are used to acquire knowledge. |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      |                              |      |      |   |
|                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      |                              |      |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      | Bloom's Knowledge Level (KL) |      |      |   |
| CO1                                                                                                                                                                                                                                                                                     | Apply R programming to create and manipulate basic data structures and solve simple computational problems.                                                                                                                                                                                                              |     |     |     |                                              |     |     |     |     |      |      | K3                           |      |      |   |
| CO2                                                                                                                                                                                                                                                                                     | Analyze datasets using R by importing data, performing statistical analysis, and applying machine learning techniques.                                                                                                                                                                                                   |     |     |     |                                              |     |     |     |     |      |      | K4                           |      |      |   |
| CO3                                                                                                                                                                                                                                                                                     | Visualize and interpret data using charts, plots, and exploratory data analysis to support informed decision-making..                                                                                                                                                                                                    |     |     |     |                                              |     |     |     |     |      |      | K4                           |      |      |   |
|                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      |                              |      |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      |                              |      |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                           | PO1                                                                                                                                                                                                                                                                                                                      | PO2 | PO3 | PO4 | PO5                                          | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                                                                                                                        | 2   | -   | -   | 3                                            | -   | -   | -   | -   | -    | 2    | 2                            | 3    | 1    |   |
| CO2                                                                                                                                                                                                                                                                                     | 2                                                                                                                                                                                                                                                                                                                        | 3   | 2   | 3   | 3                                            | -   | -   | -   | -   | -    | 2    | 3                            | 3    | 2    |   |
| CO3                                                                                                                                                                                                                                                                                     | 2                                                                                                                                                                                                                                                                                                                        | 3   | 2   | 3   | 3                                            | 1   | -   | -   | 2   | -    | 2    | 3                            | 3    | 2    |   |
|                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      |                              |      |      |   |
| List Of Practical's (Indicative & Not Limited To)                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                          |     |     |     |                                              |     |     |     |     |      |      |                              |      |      |   |
| Sr. No.                                                                                                                                                                                                                                                                                 | Program                                                                                                                                                                                                                                                                                                                  |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO   |   |
| 1.                                                                                                                                                                                                                                                                                      | Write a R program to create a Data frames which contain details of 5 employees and display the details.                                                                                                                                                                                                                  |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO1  |   |
| 2.                                                                                                                                                                                                                                                                                      | Write a R program to get the first 10 Fibonacci numbers.                                                                                                                                                                                                                                                                 |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO1  |   |
| 3.                                                                                                                                                                                                                                                                                      | Write a R program to get all prime numbers up to a given number.                                                                                                                                                                                                                                                         |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO1  |   |
| 4.                                                                                                                                                                                                                                                                                      | Write a R program to find the maximum and the minimum value of a given vector.                                                                                                                                                                                                                                           |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO1  |   |
| 5.                                                                                                                                                                                                                                                                                      | Create an array, passing in a vector of values and a vector of dimensions, also provide names for each dimension.                                                                                                                                                                                                        |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO1  |   |
| 6.                                                                                                                                                                                                                                                                                      | Write a R program to create a list containing a vector, a matrix and a list and give names to the elements in the list. Access the first and second element of the list.                                                                                                                                                 |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO1  |   |
| 7.                                                                                                                                                                                                                                                                                      | Write a R program to create a list containing a vector, a matrix and a list and add element at the end of the list                                                                                                                                                                                                       |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO1  |   |
| 8.                                                                                                                                                                                                                                                                                      | Read the following file formats in Python/R: <ul style="list-style-type: none"><li>• Comma-separated values</li><li>• XLSX</li><li>• ZIP</li><li>• Plain Text (txt)</li><li>• JSON</li><li>• XML</li><li>• HTML</li><li>• Images</li><li>• Hierarchical Data Format</li><li>• PDF</li><li>• DOCX</li><li>• MP3</li></ul> |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO2  |   |
| 9.                                                                                                                                                                                                                                                                                      | Load the Iris dataset as a list of lists                                                                                                                                                                                                                                                                                 |     |     |     |                                              |     |     |     |     |      |      |                              |      | CO2  |   |

|                             |                                                                                                                                                                                                                                                                                                   |     |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|                             | a. Compute and print the mean and the standard deviation for each of the 4 measurement columns (i.e. sepal length and width, petal length and width). Compute and print the mean and the standard deviation for each of the 4 measurement columns, separately for each of the three Iris species. |     |
| 10.                         | a. Find the data distributions using box and scatter plot.<br>b. Find the outliers using box plot<br>c. Plot the histogram, bar chart and pie chart on sample data<br><br>d. Plot Pie Chart, Histogram (3D) [including colourful ones]                                                            | CO3 |
| 11.                         | Import a sample dataset and perform Regression techniques to find out relation between variables.                                                                                                                                                                                                 | CO2 |
| 12.                         | Find the correlation matrix.<br>a. Plot the correlation plot on dataset and visualize giving an overview of relationships among variables on data set.<br><br>Analysis of covariance: variance (ANOVA) if data have categorical variables on data set.                                            | CO2 |
| 13.                         | Write a program to create 3D plot, to add title, change viewing direction, add color and shade to the plot.                                                                                                                                                                                       | CO3 |
| 14.                         | a. Create a data frame from the sample data set.<br>b. Create a table with the needed variables<br>c. Perform the Chi-Square test.                                                                                                                                                                | CO2 |
| 15.                         | Perform complete steps of exploratory data analysis on standard data sets (iris flowers, Wine Quality Dataset etc.)                                                                                                                                                                               | CO3 |
| <b>Total Hours: 30 hrs.</b> |                                                                                                                                                                                                                                                                                                   |     |
|                             |                                                                                                                                                                                                                                                                                                   |     |
|                             |                                                                                                                                                                                                                                                                                                   |     |

|                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------|-----|-----|-----|--------------------------------|-----|-----|-----|------|------|------------------------------|------|------|
| Course Code: BCSBS0602                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            |                                             |     |     |     | Course Name: Computer Networks |     |     |     | L    | T    | P                            | C    |      |
| Course Offered in: B. Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                                                             |                                                                            |                                             |     |     |     |                                |     |     |     | 3    | 0    | 0                            | 3    |      |
| Pre-requisite: Basic Knowledge of Computer Networks                                                                                                                                                                                                                                                                                                                                                                           |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
| Course objective: The objective of this course is to understand the fundamental concepts of computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems.                                                                                    |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                   |                                                                            |                                             |     |     |     |                                |     |     |     |      |      | Bloom’s Knowledge Level (KL) |      |      |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                           | Understand the basics of computer network and the Explanation of OSI model |                                             |     |     |     |                                |     |     |     |      |      |                              | K2   |      |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                           | Discuss the key technological components of the Network.                   |                                             |     |     |     |                                |     |     |     |      |      |                              | K2   |      |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                           | Study Data link layer and Medium Access sub layer in details               |                                             |     |     |     |                                |     |     |     |      |      |                              | K3   |      |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                           | Analyze Network and Transport layer                                        |                                             |     |     |     |                                |     |     |     |      |      |                              | K4   |      |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                           | Analyze Application layer and Illustrate various Network Security          |                                             |     |     |     |                                |     |     |     |      |      |                              | K4   |      |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                              |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                 | PO1                                                                        | PO2                                         | PO3 | PO4 | PO5 | PO6                            | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3 |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                                                                          | 2                                           | -   | -   | 1   | -                              | -   | -   | 1   | -    | 1    | 2                            | 1    | 1    |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                                                                          | 2                                           | 1   | -   | 2   | -                              | -   | 1   | 1   | -    | 1    | 2                            | 2    | 1    |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                                                                          | 3                                           | 1   | 1   | 2   | -                              | -   | -   | 1   | -    | 1    | 3                            | 2    | 1    |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                                                                          | 3                                           | 2   | 2   | 2   | 1                              | -   | 1   | 1   | -    | 1    | 3                            | 2    | 2    |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                                                                          | 3                                           | 2   | 2   | 2   | 2                              | 1   | 1   | 2   | -    | 2    | 3                            | 3    | 2    |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
| Unit 1                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            | INTRODUCTION TO COMPUTER NETWORKS:          |     |     |     |                                |     |     |     |      |      | 09 hours                     |      |      |
| Computer networks and distributed systems, Classifications of computer networks, Preliminaries of layered network structures. <b>Data communication Components:</b> Representation of data and its flow, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media.                                                                                                                                 |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
| Unit 2                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            | Techniques for Bandwidth utilization        |     |     |     |                                |     |     |     |      |      | 09 hours                     |      |      |
| Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.<br><b>LAN:</b> Wired LAN, Wireless LAN, Virtual LAN.                                                                                                                                                                                                                                                                         |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
| Unit 3                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            | Data Link Layer and Medium Access Sub Layer |     |     |     |                                |     |     |     |      |      | 09 hours                     |      |      |
| Fundamentals of Error Detection and Error Correction, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go-back–N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA                                                                                                                |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
| Unit 4                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            | Network Layer AND Transport Layer           |     |     |     |                                |     |     |     |      |      | 09 hours                     |      |      |
| <b>Network Layer:</b> Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.<br><br><b>Transport Layer:</b> Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service (QoS), QoS improving techniques - Leaky Bucket and Token Bucket algorithms. |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
| Unit 5                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            | Application Layer AND NETWORK SECURITY      |     |     |     |                                |     |     |     |      |      | 09 hours                     |      |      |
| <b>Application Layer:</b> DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls.<br><b>Network Security:</b> Electronic mail, directory services and network management, Basic concepts of Cryptography.                                                                                                                                                                                                       |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |
| Total Lecture Hours                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                            |                                             |     |     |     |                                |     |     |     |      |      | 45 hours                     |      |      |
| Textbook:                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                            |                                             |     |     |     |                                |     |     |     |      |      |                              |      |      |

|                                                |                                                                                                                                                                                                                                                                                                      |                                  |
|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1.                                             | Computer Networks (5th Edition) <a href="https://www.mbit.edu.in/wp-content/uploads/2020/05/Computer-Networks-5th-Edition.pdf">https://www.mbit.edu.in/wp-content/uploads/2020/05/Computer-Networks-5th-Edition.pdf</a>                                                                              | Andrew S. Tanenbaum              |
| 2.                                             | Data and Computer Communications (8th Edition) <a href="https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf">https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf</a> | William Stallings                |
| William Stallings                              |                                                                                                                                                                                                                                                                                                      |                                  |
| 1.                                             | Network Security<br>Kaufman, R. Perlman, M. Speciner                                                                                                                                                                                                                                                 | Kaufman, R. Perlman, M. Speciner |
| 2.                                             | UNIX Network Programming (Vol. 1, 2 & 3)                                                                                                                                                                                                                                                             | W. Richard Stevens               |
| Youtube / infyspringboard/ Faculty Video Link: |                                                                                                                                                                                                                                                                                                      |                                  |
|                                                |                                                                                                                                                                                                                                                                                                      |                                  |

| Self-Study Content Links: |                                                                                                                                                                                                                         | Duration (in Hrs)                                                                                                               |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| MOOCs                     | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012683751296065536354_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012683751296065536354_shared/overview</a> | 37 hr 57m                                                                                                                       |
| MOOCs                     | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012874910653456384163_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012874910653456384163_shared/overview</a> | 32hr 35 min                                                                                                                     |
| Video Lectures            | <a href="https://www.youtube.com/watch?v=UAKok0wg1p8">https://www.youtube.com/watch?v=UAKok0wg1p8</a>                                                                                                                   | 8m                                                                                                                              |
|                           | <a href="https://www.youtube.com/watch?v=JRgmPco0KWI">https://www.youtube.com/watch?v=JRgmPco0KWI</a>                                                                                                                   | 19 min                                                                                                                          |
|                           | <a href="https://www.youtube.com/watch?v=4D55Cmj2t-A&amp;list=PLxCzCOWd7aiGFBD2-2joCpWOLUrDLvVV&amp;index=2">https://www.youtube.com/watch?v=4D55Cmj2t-A&amp;list=PLxCzCOWd7aiGFBD2-2joCpWOLUrDLvVV&amp;index=2</a>     | 22 min                                                                                                                          |
|                           | <a href="https://www.youtube.com/watch?v=n0iaPtsnmxQ&amp;list=PLxCzCOWd7aiGFBD2-2joCpWOLUrDLvVV&amp;index=3">https://www.youtube.com/watch?v=n0iaPtsnmxQ&amp;list=PLxCzCOWd7aiGFBD2-2joCpWOLUrDLvVV&amp;index=3</a>     | 9 min                                                                                                                           |
| 1                         | Microsoft Learn – Azure Fundamentals                                                                                                                                                                                    | <a href="https://learn.microsoft.com/training/azure/">https://learn.microsoft.com/training/azure/</a>                           |
| 2                         | Google Cloud Skills Boost                                                                                                                                                                                               | <a href="https://www.cloudskillsboost.google/">https://www.cloudskillsboost.google/</a>                                         |
| 3                         | Coursera – Cloud Computing Specialization                                                                                                                                                                               | <a href="https://www.coursera.org/specializations/cloud-computing">https://www.coursera.org/specializations/cloud-computing</a> |
| 4                         | AWS Training & Certification                                                                                                                                                                                            | <a href="https://aws.amazon.com/training/">https://aws.amazon.com/training/</a>                                                 |

### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 100 | 150   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              |             |      |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|----------------------------------------|-----|-----|-----|-----|------|------|------------------------------|-------------|------|---|
| LAB Course Code: BCSBS0662                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                           |     |     |     | LAB Course Name: COMPUTER NETWORKS LAB |     |     |     |     |      |      | L                            | T           | P    | C |
| Course Offered in: B. Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      | 0                            | 0           | 4    | 2 |
| Pre-requisite: Basic knowledge of computers, operating systems, and networking concepts like LAN and IP addressing, along with basic hardware and command-line skills.                                                                                                                                                                                                                                                                                                                              |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              |             |      |   |
| Course Objectives: This course aims to provide practical and theoretical knowledge of network cables, devices, IP addressing, and LAN setup. Students will learn to create and test straight-through and cross-wired cables, configure and troubleshoot switches and routers, perform initial device configurations, and use basic network and Cisco IOS commands. It also focuses on connecting network devices, implementing wireless security (WEP), and managing switched networks effectively. |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              |             |      |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              |             |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      | Bloom’s Knowledge Level (KL) |             |      |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Understand network fundamentals and network devices.                                                                                      |     |     |     |                                        |     |     |     |     |      |      | K2                           |             |      |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Implement LAN, router, switch, and Cisco IOS configurations.                                                                              |     |     |     |                                        |     |     |     |     |      |      | K3                           |             |      |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Analyze network connectivity and troubleshoot network issues.                                                                             |     |     |     |                                        |     |     |     |     |      |      | K4                           |             |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              |             |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | PO1                                                                                                                                       | PO2 | PO3 | PO4 | PO5                                    | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2        | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                                                                                         | 2   | –   | –   | 2                                      | –   | –   | –   | –   | –    | 1    | 2                            | 2           | 1    |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                                                                                         | 2   | 2   | 1   | 3                                      | –   | –   | 1   | 1   | 1    | 1    | 3                            | 3           | 2    |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2                                                                                                                                         | 3   | 2   | 2   | 3                                      | 1   | 1   | 1   | 2   | 1    | 2    | 2                            | 3           | 2    |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              |             |      |   |
| List Of Practical’s (Indicative & Not Limited To)                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              |             |      |   |
| Sr. No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Program                                                                                                                                   |     |     |     |                                        |     |     |     |     |      |      |                              | CO, K level |      |   |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool |     |     |     |                                        |     |     |     |     |      |      |                              | CO1,K2      |      |   |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Study of Network Devices in Detail.<br><br>Study of network IP.                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              | CO1,K3      |      |   |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Connect the computers in Local Area Network.                                                                                              |     |     |     |                                        |     |     |     |     |      |      |                              | CO2,K3      |      |   |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Study of basic network command and Network configuration commands.                                                                        |     |     |     |                                        |     |     |     |     |      |      |                              | CO2,K3      |      |   |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Performing an Initial Switch Configuration                                                                                                |     |     |     |                                        |     |     |     |     |      |      |                              | CO2, K3     |      |   |
| 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Performing an Initial Router Configuration                                                                                                |     |     |     |                                        |     |     |     |     |      |      |                              | CO3,K3      |      |   |
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Configuring and Troubleshooting a Switched Network                                                                                        |     |     |     |                                        |     |     |     |     |      |      |                              | CO3,K4      |      |   |
| 8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Connecting a Switch                                                                                                                       |     |     |     |                                        |     |     |     |     |      |      |                              | CO2, K3     |      |   |
| 9.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Configuring WEP on a Wireless Router                                                                                                      |     |     |     |                                        |     |     |     |     |      |      |                              | CO2, K3     |      |   |
| 10.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Using the Cisco IOS Show Commands                                                                                                         |     |     |     |                                        |     |     |     |     |      |      |                              | CO3,K2      |      |   |
| 11.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | K                                                                                                                                         |     |     |     |                                        |     |     |     |     |      |      |                              | CO3 ,K3     |      |   |
| 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Study of Network Devices in Detail.<br><br>Study of network IP.                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              | CO1, K2     |      |   |
| Total Hours: 60 hrs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                           |     |     |     |                                        |     |     |     |     |      |      |                              |             |      |   |

|                                                                                                                                                                                                                                                                                                                                                                         |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|--------------------------------------|-----|-----------------------------------|-----|------|--------|------|------------------------------|-------------------|------|---|
| Course Code: BCSBS0603                                                                                                                                                                                                                                                                                                                                                  |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     | Course Name: INFORMATION SECURITY |     |      |        |      | L                            | T                 | P    | C |
| Course Offered in: B. Tech. CSBS                                                                                                                                                                                                                                                                                                                                        |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      | 3                            | 0                 | 0    | 3 |
| Pre-requisite: Basic Knowledge of programming                                                                                                                                                                                                                                                                                                                           |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Course Objectives: The objective of this course is to understand the fundamental concepts of security parameters, access control, System Design and Information Security.                                                                                                                                                                                               |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Course Outcome: After completion of the course, the students will be able to                                                                                                                                                                                                                                                                                            |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      | Bloom's Knowledge Level (KL) |                   |      |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                     | Understand confidentiality, integrity, and availability along with security parameters. |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      | K2                           |                   |      |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                     | Outline access control mechanisms and security policies.                                |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      | K2                           |                   |      |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                     | Understand and Analyze secured information systems.                                     |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      | K4                           |                   |      |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                     | Analyze malicious logics and vulnerabilities in system design.                          |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      | K4                           |                   |      |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                     | Illustrate operating system security and database security.                             |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      | K3                           |                   |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                        |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                           | PO1                                                                                     | PO2                                                                                                                                                                                                                     | PO3 | PO4 | PO5 | PO6                                  | PO7 | PO8                               | PO9 | PO10 | PO11   | PO12 | PSO 1                        | PSO 2             | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                     | 3                                                                                       | 1                                                                                                                                                                                                                       | 1   | -   | 1   | -                                    | -   | 1                                 | -   | 1    | 1      | 1    | 1                            | 2                 | 2    |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                     | 2                                                                                       | 2                                                                                                                                                                                                                       | 2   | 1   | 3   | 1                                    | -   | 2                                 | 1   | 2    | 2      | 2    | 2                            | 2                 | 2    |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                     | 2                                                                                       | 2                                                                                                                                                                                                                       | 3   | 2   | 3   | 1                                    | -   | 2                                 | 1   | 2    | 2      | 2    | 3                            | 3                 | 2    |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                     | 1                                                                                       | 3                                                                                                                                                                                                                       | 2   | 3   | 2   | 1                                    | -   | 2                                 | 1   | 2    | 1      | 1    | 2                            | 2                 | 2    |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                     | 1                                                                                       | 2                                                                                                                                                                                                                       | 2   | 2   | 2   | 1                                    | -   | 2                                 | 1   | 2    | 2      | 2    | 2                            | 2                 | 1    |   |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                              |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Unit 1                                                                                                                                                                                                                                                                                                                                                                  |                                                                                         |                                                                                                                                                                                                                         |     |     |     | Overview of Security Parameters      |     |                                   |     |      |        |      |                              | 9 hours           |      |   |
| Confidentiality, integrity and availability; Security violation and threats; Security policy, and procedure; Assumptions and Trust; Security Assurance, Implementation and Operational Issues; Security Life Cycle.                                                                                                                                                     |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Unit 2                                                                                                                                                                                                                                                                                                                                                                  |                                                                                         |                                                                                                                                                                                                                         |     |     |     | Access Control and Security Policies |     |                                   |     |      |        |      |                              | 9 hours           |      |   |
| Access Control Models: Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatial-temporal models. Different types of attacks, Firewall & its types . Security Policies: Confidentiality policies, integrity policies, hybrid policies, non-interference and policy composition, international standards. |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Unit 3                                                                                                                                                                                                                                                                                                                                                                  |                                                                                         |                                                                                                                                                                                                                         |     |     |     | Systems Design                       |     |                                   |     |      |        |      |                              | 9 hours           |      |   |
| Design principles, representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems.                                                                                                                                                                                  |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Unit 4                                                                                                                                                                                                                                                                                                                                                                  |                                                                                         |                                                                                                                                                                                                                         |     |     |     | Logic-based System                   |     |                                   |     |      |        |      |                              | 9 hours           |      |   |
| Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security. Special Topics: Data privacy, introduction to digital forensics, enterprise security specification.                                                                                                 |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Unit 5                                                                                                                                                                                                                                                                                                                                                                  |                                                                                         |                                                                                                                                                                                                                         |     |     |     | Operating Systems Security           |     |                                   |     |      |        |      |                              | 9 hours           |      |   |
| Security Architecture, Analysis of Security in Linux/Windows. Database Security: Security Architecture, Enterprise security, Database auditing.                                                                                                                                                                                                                         |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Total lecture hours                                                                                                                                                                                                                                                                                                                                                     |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              | 45 hours          |      |   |
| Textbook:                                                                                                                                                                                                                                                                                                                                                               |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| S. No                                                                                                                                                                                                                                                                                                                                                                   |                                                                                         | Book Title with publication agency & year                                                                                                                                                                               |     |     |     |                                      |     |                                   |     |      | Author |      |                              |                   |      |   |
| 1. Security Engineering, Ross Anderson.<br>2. Information Security: Principles and Practice, M. Stamp.                                                                                                                                                                                                                                                                  |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Reference Books:                                                                                                                                                                                                                                                                                                                                                        |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| 1) Security in Computing, C.P. Pfleeger, S.L. Pfleeger, J. Margulies.<br>2) Secure Programming HOWTO, David Wheeler.<br>3) Handbook of Database Security, M. Gertz, S. Jajodia.                                                                                                                                                                                         |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              |                   |      |   |
| Self-Study Content Links:                                                                                                                                                                                                                                                                                                                                               |                                                                                         |                                                                                                                                                                                                                         |     |     |     |                                      |     |                                   |     |      |        |      |                              | Duration (in Hrs) |      |   |
| MOOCs                                                                                                                                                                                                                                                                                                                                                                   |                                                                                         | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_014157699878830080202/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_014157699878830080202/overview</a>               |     |     |     |                                      |     |                                   |     |      |        |      | 12 hr 25m                    |                   |      |   |
| Video Lectures                                                                                                                                                                                                                                                                                                                                                          |                                                                                         | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013897033664872448610_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013897033664872448610_shared/overview</a> |     |     |     |                                      |     |                                   |     |      |        |      | 14 hr 51m                    |                   |      |   |

|  |                                                                                                                                                                                                             |          |
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|  | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0135015570641879047828/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0135015570641879047828/overview</a> | 1 hr 15m |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|

**Mode of Evaluation:**

| CIE |     |     |     |     |     |            | ESE | Total |
|-----|-----|-----|-----|-----|-----|------------|-----|-------|
| ST1 | ST2 | ST3 | TA1 | TA2 | TA3 | Attendance |     |       |
|     |     |     | 5   | 5   | 5   | 5          |     |       |
| 30  |     |     | 20  |     |     |            | 100 | 150   |

|                                                                                                                                                                                                                                                                                                                                           |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      |                              |      |      |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----|-----|-----|-------------------------------------------|-----|-----|-----|-----|------|------|------------------------------|------|------|---|
| LAB Course Code: BCSBS0663                                                                                                                                                                                                                                                                                                                |                                                                                                           |     |     |     | LAB Course Name: INFORMATION SECURITY LAB |     |     |     |     |      |      | L                            | T    | P    | C |
| Course Offered in: B. Tech (CSBS)                                                                                                                                                                                                                                                                                                         |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | 0                            | 0    | 2    | 1 |
| Pre-requisite: Basic Knowledge of programming                                                                                                                                                                                                                                                                                             |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      |                              |      |      |   |
| Course Objectives: To provide students with a strong understanding of information security principles including confidentiality, integrity, availability, and access control mechanisms.<br>To develop skills in designing secure systems and analyzing vulnerabilities in operating systems, databases, and overall system architecture. |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      |                              |      |      |   |
| Course Outcome: After completion of the course, the students will be able to                                                                                                                                                                                                                                                              |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | Bloom's Knowledge Level (KL) |      |      |   |
| CO1                                                                                                                                                                                                                                                                                                                                       | Analyze security and network configurations to identify potential vulnerabilities and weaknesses.         |     |     |     |                                           |     |     |     |     |      |      | K4                           |      |      |   |
| CO2                                                                                                                                                                                                                                                                                                                                       | Analyze the effectiveness of different cipher techniques in securing data transmission and communication. |     |     |     |                                           |     |     |     |     |      |      | K4                           |      |      |   |
| CO3                                                                                                                                                                                                                                                                                                                                       | Analyze security and network configurations to identify potential vulnerabilities and weaknesses.         |     |     |     |                                           |     |     |     |     |      |      | K4                           |      |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                          |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      |                              |      |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                             | PO1                                                                                                       | PO2 | PO3 | PO4 | PO5                                       | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                                                                       | 2                                                                                                         | 3   | 2   | 3   | 2                                         | 1   | -   | 2   | 1   | 2    | 1    | 2                            | 2    | 2    |   |
| CO2                                                                                                                                                                                                                                                                                                                                       | 2                                                                                                         | 2   | 1   | 2   | 2                                         | 1   | -   | 2   | 1   | 2    | 1    | 2                            | 2    | 2    |   |
| CO3                                                                                                                                                                                                                                                                                                                                       | 2                                                                                                         | 3   | 2   | 3   | 2                                         | 1   | -   | 2   | 1   | 2    | 1    | 2                            | 2    | 2    |   |
| List Of Practical's (Indicative & Not Limited To)                                                                                                                                                                                                                                                                                         |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      |                              |      |      |   |
| 1. Analysis of security.                                                                                                                                                                                                                                                                                                                  |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      |                              |      |      |   |
| 2. Study of Network Devices in Detail.                                                                                                                                                                                                                                                                                                    |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | CO1                          |      |      |   |
| 3. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:<br>a) Caesar Cipher<br>b) Playfair Cipher<br>c) Hill Cipher<br>d) Vigenere Cipher<br>e) Rail fence row & Column Transformation                                                                                                                               |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | CO2                          |      |      |   |
| 4. Implement the following algorithms<br>a)DES<br>b) RSA Algorithm<br>c) Diffiee-Hellman<br>d) MDS<br>e) SHA-1                                                                                                                                                                                                                            |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | CO2                          |      |      |   |
| 5. Implement the Signature Scheme - Digital Signature Standard                                                                                                                                                                                                                                                                            |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | CO2                          |      |      |   |
| 6. Setup a honey pot and monitor the honeypot on network (KF Sensor)                                                                                                                                                                                                                                                                      |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | CO3                          |      |      |   |
| 7. Installation of rootkits and study about the variety of options                                                                                                                                                                                                                                                                        |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | CO3                          |      |      |   |
| 8. Perform wireless audit on an access point or a router and decrypt WEP and WPA. ( NetStumbler)                                                                                                                                                                                                                                          |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | CO3                          |      |      |   |
| 9. Demonstrate intrusion detection system (ids) using any tool (snort or any others/w)                                                                                                                                                                                                                                                    |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      | CO3                          |      |      |   |
| Total 30 hrs                                                                                                                                                                                                                                                                                                                              |                                                                                                           |     |     |     |                                           |     |     |     |     |      |      |                              |      |      |   |



|                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     |                                                        |     |     |     |     |          |                              |      |      |      |
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| Course Code: BCBS0604Z                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     | Course Name: Business Communication & Value Science-IV |     |     |     |     | L        | T                            | P    |      | C    |
| Course Offered in: B. Tech. CSBS VI Semester                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     |                                                        |     |     |     |     | 2        | 0                            | 0    |      | 2    |
| Pre-requisite: Students should have successfully completed BCVS-I, II, & III                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     |                                                        |     |     |     |     |          |                              |      |      |      |
| Course Objectives: To develop effective business communication and professional writing skills through emotional intelligence, teamwork, and interpersonal effectiveness in corporate environments. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     |                                                        |     |     |     |     |          |                              |      |      |      |
| Course Outcome: After completion of the course, the students will be able to                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     |                                                        |     |     |     |     |          | Bloom's Knowledge Level (KL) |      |      |      |
| CO1                                                                                                                                                                                                 | Understand the importance of diversity in the workplace and best practices of communicative writing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |     |     |                                                        |     |     |     |     |          | K2                           |      |      |      |
| CO2                                                                                                                                                                                                 | Understand the importance of corporate social responsibility (CSR) and impact of stress in life and work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |     |     |                                                        |     |     |     |     |          | K2                           |      |      |      |
| CO3                                                                                                                                                                                                 | Apply emotional intelligence in real life                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |                                                        |     |     |     |     |          | K3                           |      |      |      |
| CO4                                                                                                                                                                                                 | Recognize and apply the concepts of multiple intelligences and learning styles, sharing of feedback for better communication and growth in a corporate environment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |     |     |                                                        |     |     |     |     |          | K3                           |      |      |      |
| CO5                                                                                                                                                                                                 | Recognize and apply the best practices for time and stress management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |     |     |                                                        |     |     |     |     |          | K3                           |      |      |      |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     |                                                        |     |     |     |     |          |                              |      |      |      |
| CO-PO Mapping                                                                                                                                                                                       | PO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | PO2 | PO3 | PO4 | PO5                                                    | PO6 | PO7 | PO8 | PO9 | PO10     | PO11                         | PSO1 | PSO2 | PSO3 |
| CO1                                                                                                                                                                                                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1   | 1   | 1   | 1                                                      | 2   | 1   | 2   | 3   | 3        | 1                            | 2    | 1    | 3    |
| CO2                                                                                                                                                                                                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -   | -   | -   | -                                                      | 1   | -   | 1   | 2   | 2        | 1                            | 2    | 2    | 3    |
| CO3                                                                                                                                                                                                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -   | -   |     | -                                                      | 1   | 1   | 1   | 3   | 1        | -                            | 3    | 1    | 3    |
| CO4                                                                                                                                                                                                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1   | -   | -   |                                                        | 2   | -   | 1   | 2   | 3        | 1                            | 2    | 1    | 3    |
| CO5                                                                                                                                                                                                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -   | -   | -   | -                                                      | -   | -   | 1   | 3   | 3        | -                            | 3    | 1    | 3    |
| Course Contents / Syllabus                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |     |     |                                                        |     |     |     |     |          |                              |      |      |      |
| Unit 1                                                                                                                                                                                              | Communicative writing: <ul style="list-style-type: none"><li>Auld Lang Syne This will be a group activity in which the lecturer will give some key words (from what they have taught in the previous semesters). Concept of diversity in corporate environments.</li><li>Communicative Writing: Principles of Communicative Writing: Formal and</li><li>Business letters, writing proposals, How to tell a story with charts and graphs?</li><li>Emotional Intelligence: Ref reading: 10 Ways to Build EI by Daniel Goleman.</li><li>Why do we need public speaking? Public speaking – best practice, Get, Set, go – sell your start-up ideas.</li><li>Let's relax : Anubhaav Activity</li></ul> |     |     |     |                                                        |     |     |     |     | 7 hours  |                              |      |      |      |
| Unit 2                                                                                                                                                                                              | Corporate Social Responsibility (CSR): <ul style="list-style-type: none"><li>Why do corporates need to engage in CSR? Is it for compliance only? Tell a CSR story</li><li>Attributes required for work and life</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |                                                        |     |     |     |     | 11 hours |                              |      |      |      |

|  |                                                                                                                                                                                                      |  |
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|  | <b>Image Management:</b> <ul style="list-style-type: none"> <li>Who am I? (Image Management. Building a perfect image)</li> <li>Locus of control</li> <li>Applying emotional intelligence</li> </ul> |  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"><li>Let’s relax: Anubhaav Activities.</li></ul>                                                                                                                                                                                                                                                  |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                    |                    |
| Unit 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Diversity:</b> <ul style="list-style-type: none"><li>Sensitivity to diversity – Quiz</li><li>Understanding conflicts</li><li>Tips to manage conflicts, Corporate etiquette</li><li>Mock interviews followed by discussions on corporate etiquette</li><li>Business idioms and Corporate Terms</li><li>Managing Stress</li></ul> | 6 hours            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                    |                    |
| Unit 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Stress and Time Management:</b> <ul style="list-style-type: none"><li>Tips to manage stress</li><li>Time management: Managing your time better</li><li>Time Squared Activity</li><li>Let’s relax: Anubhaav Activities</li><li>Create memories: Recap activity on the entire BCVS Course</li></ul>                               | 6 hours            |
| Total Hours: 30                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                    |                    |
| <b>Reference Books:</b> <ol style="list-style-type: none"><li>Emotional Intelligence: Why it Can Matter More Than IQ by Daniel Goleman</li><li>Putting Emotional Intelligence to Work by Ryback David</li><li>How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion by Dale Carnegie</li><li>TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations</li></ol> |                                                                                                                                                                                                                                                                                                                                    |                    |
| Self-Study Content Links                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                    | Duration: 30 Hours |
| Video Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                    |                    |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <a href="https://www.youtube.com/watch?v=QWTv8NbItt0">https://www.youtube.com/watch?v=QWTv8NbItt0</a>                                                                                                                                                                                                                              |                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <a href="https://www.youtube.com/watch?v=2g88Ju6nkcq">https://www.youtube.com/watch?v=2g88Ju6nkcq</a>                                                                                                                                                                                                                              |                    |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <a href="https://www.youtube.com/watch?v=4lxA7lo9GLU">https://www.youtube.com/watch?v=4lxA7lo9GLU</a>                                                                                                                                                                                                                              |                    |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <a href="https://www.youtube.com/watch?v=tApPdt_Y8jE">https://www.youtube.com/watch?v=tApPdt_Y8jE</a>                                                                                                                                                                                                                              |                    |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <a href="https://www.coursera.org/learn/python-text-mining/lecture/sVe8B/regular-expressions">https://www.coursera.org/learn/python-text-mining/lecture/sVe8B/regular-expressions</a>                                                                                                                                              |                    |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <a href="https://www.tata.com/about-us/tata-group-our-heritage">https://www.tata.com/about-us/tata-group-our-heritage</a>                                                                                                                                                                                                          |                    |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <a href="https://economictimes.indiatimes.com/tata-success-story-is-based-on-humanity-philanthropy-and-ethics/articleshow/41766592.cms">https://economictimes.indiatimes.com/tata-success-story-is-based-on-humanity-philanthropy-and-ethics/articleshow/41766592.cms</a>                                                          |                    |
| Assignment                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                    |                    |
| Creating Proof of Concept                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                    |                    |

| CIE |     |     |     |     |     |            | ESE | Total |
|-----|-----|-----|-----|-----|-----|------------|-----|-------|
| ST1 | ST2 | ST3 | TA1 | TA2 | TA3 | Attendance |     |       |
|     |     |     | 5   | 5   | 5   | 5          |     |       |
|     |     |     |     |     |     |            |     |       |
| 30  |     |     | 20  |     |     |            | 50  | 100   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      |          |
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| LAB Course Code: BCBS0654                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |      |     |     | LAB Course Name: Business Communication and Value Science-IV Lab |     |     |     |     | L   | T    | P    | C    |      |          |
| Course Offered in: CSBS VI Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |     |     |                                                                  |     |     |     |     | 0   | 0    | 2    | 1    |      |          |
| Pre-requisite: Students should have successfully completed BCVS-I, BCVS-II, and BCVS-III.                                                                                                                                                                                                                                                                                                                                                                                                            |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      |          |
| Course Objectives: To equip students with stress management, time management, and leadership skills for personal and professional growth and create awareness about diversity, corporate social responsibility, and professional etiquette.                                                                                                                                                                                                                                                          |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      |          |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      |          |
| 1. Design and demonstrate effective business communication, professional writing, and public speaking skills in simulated corporate situations. (K6)<br>2. Evaluate and apply emotional intelligence, diversity sensitivity, corporate etiquette, and conflict management strategies in workplace activities. (K5)<br>3. Create and present professional solutions such as proposals, CSR presentations, and start-up POCs by applying time management, stress management, and teamwork skills. (K6) |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      |          |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CO-PO Mapping | PO 1 | PO2 | PO3 | PO4                                                              | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CO1           | 3    | 3   | -   | -                                                                | 2   | -   | -   | 1   | -   | -    | -    | 2    | -    | 2        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CO2           | 3    | 3   | -   | 2                                                                | 2   | -   | -   | 1   | -   | -    | -    | 2    | -    | 2        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CO3           | 3    | 3   | -   | 2                                                                | 2   | -   | -   | 1   | -   | -    | -    | 2    | -    | 2        |
| List Of Practical's (Indicative & Not Limited To)                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      |          |
| 1. Group Activity on "Auld Lang Syne" and discussion on diversity in corporate environments                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO2      |
| 2. Drafting formal and business letters based on workplace scenarios                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO1      |
| 3. Writing proposals and presenting stories using charts and graphs                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO1, CO3 |
| 4. Emotional Intelligence activities based on Daniel Goleman's reading                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO2      |
| 5. Public speaking practice and start-up idea presentations                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO1, CO3 |
| 6. CSR storytelling and discussion activities                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO3      |
| 7. Image management and locus of control self-assessment activity                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO2      |
| 8. Diversity sensitivity quiz and conflict management exercises                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO2      |
| 9. Mock interviews, corporate etiquette practice, business idioms, and stress management activities                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO1, CO2 |
| 10. Time management, Time Squared Activity, and final start-up POC presentation                                                                                                                                                                                                                                                                                                                                                                                                                      |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO3      |
| 11. Creating self-introduction videos                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO1      |
| 12. Case Study on CSR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO2      |
| 13. Project Presentations                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      | CO3      |
| Total Hours: 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |      |     |     |                                                                  |     |     |     |     |     |      |      |      |      |          |

|                                                                                                                                                                                                                                                                     |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
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| Course Code: BCSBS0605                                                                                                                                                                                                                                              |                                                                                                                                                          |     |                                          |     |     | Course Name: Financial and Cost Accounting |     |     |     |      |      | L                            | T        | P    | C |
| Course Offered in: CSBS                                                                                                                                                                                                                                             |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      | 2                            | 0        | 0    | 2 |
| Pre-requisite: Basic knowledge of mathematics and an understanding of business transactions and numerical operations.                                                                                                                                               |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| Course Objectives:                                                                                                                                                                                                                                                  |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| To develop the ability to apply accounting principles, prepare and analyze financial statements, and use cost and management accounting techniques for informed business decision-making.                                                                           |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                         |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      | Bloom's Knowledge Level (KL) |          |      |   |
| CO1                                                                                                                                                                                                                                                                 | Explain the fundamental accounting principles, concepts, conventions, and accounting standards used in recording business transactions.                  |     |                                          |     |     |                                            |     |     |     |      |      | K2                           |          |      |   |
| CO2                                                                                                                                                                                                                                                                 | Prepare journal entries, ledger accounts, trial balance, cash book, and financial statements using the double-entry accounting system.                   |     |                                          |     |     |                                            |     |     |     |      |      | K3                           |          |      |   |
| CO3                                                                                                                                                                                                                                                                 | Analyse and interpret financial statements, including cash flow and fund flow statements, for evaluating organizational performance and decision-making. |     |                                          |     |     |                                            |     |     |     |      |      | K4                           |          |      |   |
| CO4                                                                                                                                                                                                                                                                 | Apply cost and management accounting techniques such as costing methods, budgeting, marginal costing, and CVP analysis for managerial decision-making.   |     |                                          |     |     |                                            |     |     |     |      |      | K4                           |          |      |   |
| CO5                                                                                                                                                                                                                                                                 | Evaluate corporate financial reports, statutory disclosures, audit reports, and ethical issues in financial reporting practices.                         |     |                                          |     |     |                                            |     |     |     |      |      | K5                           |          |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                    |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                       | PO1                                                                                                                                                      | PO2 | PO3                                      | PO4 | PO5 | PO6                                        | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2     | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                 | 2                                                                                                                                                        | 1   | –                                        | –   | –   | –                                          | –   | –   | –   | 1    | –    | 1                            | 2        | 1    |   |
| CO2                                                                                                                                                                                                                                                                 | 3                                                                                                                                                        | 2   | 1                                        | –   | 1   | –                                          | –   | –   | –   | 1    | –    | 2                            | 3        | 1    |   |
| CO3                                                                                                                                                                                                                                                                 | 2                                                                                                                                                        | 3   | 2                                        | 1   | 1   | 1                                          | –   | –   | –   | 2    | 1    | 2                            | 3        | 2    |   |
| CO4                                                                                                                                                                                                                                                                 | 2                                                                                                                                                        | 3   | 3                                        | 2   | 1   | 1                                          | 1   | –   | 1   | 2    | 2    | 2                            | 3        | 2    |   |
| CO5                                                                                                                                                                                                                                                                 | 2                                                                                                                                                        | 3   | 2                                        | 2   | 1   | 2                                          | 1   | 3   | 1   | 2    | 2    | 2                            | 3        | 2    |   |
| Course Contents / Syllabus                                                                                                                                                                                                                                          |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| Unit 1                                                                                                                                                                                                                                                              |                                                                                                                                                          |     | Accounting Fundamentals and Process      |     |     |                                            |     |     |     |      |      |                              | 08 hours |      |   |
| Accounting- Introduction, Techniques and Conventions, Bookkeeping and Record Maintenance. Fundamental Principles & Accounting Standards, Double Entry System, Journal, Ledger, Trial Balance, Balance Sheet. Cash Book & Subsidiary Books, Rectification of Errors. |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| Unit 2                                                                                                                                                                                                                                                              |                                                                                                                                                          |     | Financial Statements and Analysis        |     |     |                                            |     |     |     |      |      |                              | 07 hours |      |   |
| Form and Contents of Financial Statements, Analyzing & Interpreting Financial Statements, Cash Flow Statement, Fund Flow Statement, Difference between Cash Flow & Fund Flow, Case Study: Corporate Accounting Fraud (Satyam).                                      |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| Unit 3                                                                                                                                                                                                                                                              |                                                                                                                                                          |     | Cost and Management Accounting           |     |     |                                            |     |     |     |      |      |                              | 08 hours |      |   |
| Cost Accounting-Elements of Cost, Cost Behavior, Cost Allocation & Overhead Allocation Unit, Process, and Job Costing.                                                                                                                                              |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| Management Accounting- Absorption Costing, Marginal Costing, Cost-Volume-Profit (CVP) Analysis, Budgeting and Budgetary Control, ABC Analysis.                                                                                                                      |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| Unit 4                                                                                                                                                                                                                                                              |                                                                                                                                                          |     | Company Accounts and Financial Reporting |     |     |                                            |     |     |     |      |      |                              | 07 hours |      |   |
| Audit Reports and Statutory Requirements, Directors' Report, Notes to Accounts, Pitfalls in Financial Reporting.                                                                                                                                                    |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| Total Lecture Hours                                                                                                                                                                                                                                                 |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              | 30 hours |      |   |
| Textbook:                                                                                                                                                                                                                                                           |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| 1. Accounting: Texts and Cases, McGraw-Hill. Robert N Anthony, David Hawkins, Kenneth Marchant,                                                                                                                                                                     |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| 2. Financial Accounting I Oxford University Press Soumya Mukherjee, Abhik Kr. Mukherjee                                                                                                                                                                             |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |
| 3. Financial Accounting: A Managerial Perspective (PHL,5th Ed) Narayanswami.                                                                                                                                                                                        |                                                                                                                                                          |     |                                          |     |     |                                            |     |     |     |      |      |                              |          |      |   |

**Reference Books:**

1. Financial Accounting, 10e Wiley PLUS Jerry J. Weygandt
2. A Textbook of Cost and Financial Accounting- 9<sup>th</sup> Edition- Vikas Publication. MN Arora
3. Financial Accounting and Analysis-Taxmann Publication-2016. N.L. Ahuja

**Self-Study Content Links:****Duration (in Hrs)**

MOOCs

[https://ugcmoocs.inflibnet.ac.in/index.php/courses/view\\_ug/249](https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/249)  
<https://www.youtube.com/watch?v=UxfPGWlxgHQ&list=PLOzRYVm0a65d4DQntP-1Rl-PAOITrQXLX>

20

Video Lectures

[https://www.youtube.com/watch?v=OT5RdoJakhY&list=PLPjSqITyvDeUTeAOGhip\\_ubjN3y8oqT13](https://www.youtube.com/watch?v=OT5RdoJakhY&list=PLPjSqITyvDeUTeAOGhip_ubjN3y8oqT13)

10

Web References

<https://www.icaai.org/post/sm-foundation-paper1>

Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.

**Mode of Evaluation**

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 50  | 100   |

|                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------------------------------------------------|-----|-----|----------------------------------------|-----|-----|-----|------|------|------------------------------|---------|------|---|
| Course Code: BCSBS0613Z                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                    |     |                                                  |     |     | Course Name: DATA MINING AND ANALYTICS |     |     |     |      |      | L                            | T       | P    | C |
| Course Offered in: B.Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      | 2                            | 0       | 0    | 2 |
| <ul style="list-style-type: none"><li><b>Pre-requisite:</b> Basic knowledge of Statistics, Mathematics, Database Management Systems (DBMS), and Programming fundamentals.</li></ul>                                                                                                                                                                                                                                 |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| <b>Course Objectives:</b> The objective of this course is to provide an understanding of data mining concepts, preprocessing techniques, analytical models, and forecasting methods, and to develop the skills required to apply data mining, predictive analytics, time series analysis, and optimization techniques using modern analytical tools for effective decision-making.                                  |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| <b>Course Outcome:</b> After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      | Bloom's Knowledge Level (KL) |         |      |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                 | Understand the fundamental concepts, techniques, processes, and applications of Data Mining.                                                                       |     |                                                  |     |     |                                        |     |     |     |      |      | K2                           |         |      |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                 | Apply data preprocessing, knowledge representation, visualization, and attribute-oriented analysis techniques using Weka 3 for efficient data analysis and mining. |     |                                                  |     |     |                                        |     |     |     |      |      | K3                           |         |      |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                 | Understand the basic concepts of association rules, classification, and prediction techniques used in data mining.                                                 |     |                                                  |     |     |                                        |     |     |     |      |      | K2                           |         |      |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                 | Apply linear, logistic, generalized linear, and non-linear regression techniques for predictive data analysis and model interpretation.                            |     |                                                  |     |     |                                        |     |     |     |      |      | K3                           |         |      |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                 | Understand time series analysis, forecasting models, ARIMA techniques, and prescriptive analytics methods for decision-making and predictive analysis.             |     |                                                  |     |     |                                        |     |     |     |      |      | K2                           |         |      |   |
| <b>CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)</b>                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                       | PO1                                                                                                                                                                | PO2 | PO3                                              | PO4 | PO5 | PO6                                    | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2    | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                                                                                                                  | 2   | 2                                                | 1   | 1   | 1                                      | -   | -   | 1   | 1    | -    | 3                            | 3       | 2    |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                                                                                                                  | 3   | 3                                                | 2   | 2   | 1                                      | -   | -   | 2   | 2    | -    | 3                            | 3       | 2    |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                                                                                                                  | 3   | 3                                                | 2   | 2   | 1                                      | -   | 2   | 2   | 2    | -    | 3                            | 3       | 2    |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                                                                                                                  | 3   | 3                                                | 2   | 2   | 1                                      | -   | -   | 1   | 1    | -    | 3                            | 3       | -    |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                 | 2                                                                                                                                                                  | 2   | 2                                                | 1   | 3   | 1                                      | -   | -   | 1   | 1    | -    | 3                            | 3       | -    |   |
| <b>Course Contents / Syllabus</b>                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| UNIT-I                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                    |     | INTRODUCTION TO DATA MINING & DATA PREPROCESSING |     |     |                                        |     |     |     |      |      |                              | 8 Hours |      |   |
| <b>Introduction:</b> What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications. Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System, Experiments with Weka - filters, discretization. |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| <b>Data mining knowledge representation:</b> Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques.                                                                                                                                                                                                                                                      |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| <b>Attribute-oriented analysis:</b> Attribute generalization, Attribute relevance, Class comparison, Statistical measures.                                                                                                                                                                                                                                                                                          |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| UNIT-II                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                    |     | DATA MINING ALGORITHMS                           |     |     |                                        |     |     |     |      |      |                              | 8 Hours |      |   |
| <b>Association rules</b> Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis.                                                                                                                                                                                                                                         |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| <b>Classification:</b> Basic learning/mining tasks, inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules.                                                                                                                                                                                                                                                                                     |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| <b>Prediction:</b> The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), linear models.                                                                                                                                                                                                                                                         |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |
| UNIT-III                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                    |     | DESCRIPTIVE ANALYTICS                            |     |     |                                        |     |     |     |      |      |                              | 7 Hours |      |   |
| Data Modeling, Trend Analysis, Simple Linear Regression Analysis.                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                    |     |                                                  |     |     |                                        |     |     |     |      |      |                              |         |      |   |

**Forecasting models:** Heuristic methods, predictive modeling and pattern discovery, Logistic Regression: Logit transform, ML estimation, Tests of hypotheses, Wald test, LR test, score test, test for overall regression, multiple logistic regression, forward, backward method, interpretation of parameters, relation with categorical data analysis. Interpreting Regression Models, Implementing Predictive Models.

**Generalized Linear model:** link functions such as Poisson, binomial, inverse binomial, inverse Gaussian, Gamma.

**Non-Linear Regression (NLS):** Linearization transforms, their uses & limitations, examination of non-linearity, initial estimates, iterative procedures for NLS, grid search, Newton-Raphson, steepest descent, Marquardt's methods. Introduction to semiparametric regression models, additive regression models. Introduction to nonparametric regression methods.

|                                                                                                                                                                                                                                                                                                                                     |                             |                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------|
| <b>UNIT-IV</b>                                                                                                                                                                                                                                                                                                                      | <b>TIME SERIES ANALYSIS</b> | <b>7 Hours</b>  |
| Auto - Covariance, Auto-correlation, and their properties. Exploratory time series analysis, Test for trend and seasonality, Exponential and moving average smoothing, Holt – Winter smoothing, forecasting based on smoothing.                                                                                                     |                             |                 |
| <b>Linear Time Series Models:</b> Autoregressive, Moving Average, Autoregressive Moving Average and Autoregressive Integrated Moving Average models; Estimation of ARMA models such as Yule-Walker estimation for AR Processes, Maximum likelihood and least-squares estimation for ARMA Processes, Forecasting using ARIMA models. |                             |                 |
| <b>Prescriptive Analytics:</b> Mathematical optimization, Networks modeling-Multi-objective optimization-Stochastic modeling, Decision and Risk Analysis, Decision trees.                                                                                                                                                           |                             |                 |
| <b>Total Lecture Hours</b>                                                                                                                                                                                                                                                                                                          |                             | <b>30 hours</b> |

**Textbook:**

|    |                                               |                                 |
|----|-----------------------------------------------|---------------------------------|
| 1. | Data Mining: Concepts and Techniques.         | Jiawei Han and Micheline Kamber |
| 2. | Data Mining and Knowledge Discovery Handbook  | Lior Rokach and Oded Maimon,    |
| 3. | Time Series Analysis, Forecasting and Control | G.E.P and Jenkins               |

**Reference Books:**

|    |                                     |                                                    |
|----|-------------------------------------|----------------------------------------------------|
| 1. | Applied Regression Analysis         | Draper, N. R. and Smith (John Wiley) Third Edition |
| 2. | Applied Logistic Regression (Wiley) | D. W. and Lemeshow                                 |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Self-Study Content Links: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Duration (in Hrs) |
| MOOCs                     | Introduction to Data Mining<br><a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138417857735475203984_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138417857735475203984_shared/overview</a><br>Learning Data Mining with R<br><a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944319259934722288_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944319259934722288_shared/overview</a><br>More on Data Mining<br><a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138417874966773763693_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138417874966773763693_shared/overview</a><br><a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01458327141082726431642/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01458327141082726431642/overview</a> | 19 Hrs            |
| Video Links:              | <a href="https://www.youtube.com/watch?time_continue=4&amp;v=IZZA_gajkLY&amp;feature=emb_1">https://www.youtube.com/watch?time_continue=4&amp;v=IZZA_gajkLY&amp;feature=emb_1</a><br><a href="https://www.youtube.com/watch?v=L8ZJajcQzew">https://www.youtube.com/watch?v=L8ZJajcQzew</a><br><a href="https://www.youtube.com/watch?v=WPgslzdr60g">https://www.youtube.com/watch?v=WPgslzdr60g</a><br><a href="https://www.youtube.com/watch?v=mgxYPYRneyk">https://www.youtube.com/watch?v=mgxYPYRneyk</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2 Hrs 3 Min       |

**Mode of Evaluation**

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |

|    |    |    |     |
|----|----|----|-----|
| 30 | 20 | 50 | 100 |
|    |    |    |     |
|    |    |    |     |



|                                                                                                                                                                                                                                                                         |                                                                                                                                                                          |     |     |     |     |     |                                                |     |     |      |      |                              |      |             |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|------------------------------------------------|-----|-----|------|------|------------------------------|------|-------------|---|
| LAB Course Code: BCSBS0613P                                                                                                                                                                                                                                             |                                                                                                                                                                          |     |     |     |     |     | LAB Course Name: DATA MINING AND ANALYTICS LAB |     |     |      |      | L                            | T    | P           | C |
| Course Offered in: B.Tech (CSBS)                                                                                                                                                                                                                                        |                                                                                                                                                                          |     |     |     |     |     |                                                |     |     |      |      | 0                            | 0    | 2           | 1 |
| Pre-requisite: The student should have basic knowledge of statistics, probability, data preprocessing, programming fundamentals, and basic data analysis techniques.                                                                                                    |                                                                                                                                                                          |     |     |     |     |     |                                                |     |     |      |      |                              |      |             |   |
| Course Objectives: Students are able to understand the fundamental concepts of Data Mining and Analytics and apply various data mining techniques to extract useful patterns, analyze large datasets, build predictive models, and support data-driven decision-making. |                                                                                                                                                                          |     |     |     |     |     |                                                |     |     |      |      |                              |      |             |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                             |                                                                                                                                                                          |     |     |     |     |     |                                                |     |     |      |      | Bloom’s Knowledge Level (KL) |      |             |   |
| CO1                                                                                                                                                                                                                                                                     | Apply WEKA for data preprocessing, association rule mining, and classification.                                                                                          |     |     |     |     |     |                                                |     |     |      |      | K3                           |      |             |   |
| CO2                                                                                                                                                                                                                                                                     | Perform clustering, regression, visualization, and prediction using data mining techniques.                                                                              |     |     |     |     |     |                                                |     |     |      |      | K5                           |      |             |   |
| CO3                                                                                                                                                                                                                                                                     | * Analyze real-world datasets and develop effective data mining models for decision-making.                                                                              |     |     |     |     |     |                                                |     |     |      |      | K4                           |      |             |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                        |                                                                                                                                                                          |     |     |     |     |     |                                                |     |     |      |      |                              |      |             |   |
| CO-PO Mapping                                                                                                                                                                                                                                                           | PO1                                                                                                                                                                      | PO2 | PO3 | PO4 | PO5 | PO6 | PO7                                            | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3        |   |
| CO1                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                        | 3   | 2   | 2   | 3   | -   | -                                              | -   | 1   | 1    | -    | 2                            | 3    | 1           |   |
| CO2                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                        | 3   | 3   | 3   | 3   | -   | -                                              | -   | 1   | 1    | -    | 2                            | 3    | 2           |   |
| CO3                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                        | 3   | 3   | 3   | 3   | 1   | -                                              | 1   | 2   | 2    | 1    | 2                            | 3    | 2           |   |
| List Of Practical’s (Indicative & Not Limited To)                                                                                                                                                                                                                       |                                                                                                                                                                          |     |     |     |     |     |                                                |     |     |      |      |                              |      |             |   |
| Sr. No.                                                                                                                                                                                                                                                                 | Program                                                                                                                                                                  |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO, K level |   |
| 1.                                                                                                                                                                                                                                                                      | Create a basic data warehouse and familiarize yourself with the WEKA environment and tools.                                                                              |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO1, K2     |   |
| 2.                                                                                                                                                                                                                                                                      | Perform data cleaning, handling missing values, normalization, discretization, and attribute selection on datasets.                                                      |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO1, K3     |   |
| 3.                                                                                                                                                                                                                                                                      | Generate association rules using the Apriori algorithm and analyze frequent itemsets.                                                                                    |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO2, K3     |   |
| 4.                                                                                                                                                                                                                                                                      | Implement classification algorithms such as Naïve Bayes, J48 Decision Tree, and Random Forest, and evaluate their performance.                                           |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO2, K3     |   |
| 5.                                                                                                                                                                                                                                                                      | Apply clustering algorithms such as K-Means and Hierarchical Clustering to group similar data objects                                                                    |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO2, K3     |   |
| 6.                                                                                                                                                                                                                                                                      | Perform regression using Linear Regression and evaluate prediction accuracy on numerical datasets                                                                        |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO2, K3     |   |
| 7.                                                                                                                                                                                                                                                                      | Analyze the German Credit dataset using preprocessing, classification, and prediction techniques to assess credit risk.                                                  |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO3, K4     |   |
| 8.                                                                                                                                                                                                                                                                      | Apply data mining techniques to hospital management data for analysis and decision support..                                                                             |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO3, K4     |   |
| 9.                                                                                                                                                                                                                                                                      | Perform preprocessing and apply classification, clustering, association rule mining, and regression on a real-world dataset (Medical/Retail/Banking).                    |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO3, K4     |   |
| 10.                                                                                                                                                                                                                                                                     | Visualize datasets using WEKA, apply filters and statistical analysis, generate association rules, decision trees, and prediction models, and compare their performance. |     |     |     |     |     |                                                |     |     |      |      |                              |      | CO3, K4     |   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------|-----|------------------------------------------|-----|-----|-----|-----|----------------------------------------|------|----------|---------|------------------------------|------|--|
| Course Code: BCSBS0617                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                          |                                                                 |     | Course Name: Natural Language Processing |     |     |     |     |                                        | L    | T        | P       |                              | C    |  |
| Course Offered in: B. Tech CSBS                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        | 2    | 0        | 0       |                              | 2    |  |
| Pre-requisite: Machine learning, formal languages, Data Structures, Algorithms Probability and Statistics                                                                                                                                                                                                                                                                                                                                                        |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| Course Objectives:                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| The goal of natural language processing (NLP) is to design and build computer systems that are able to analyze natural languages like English, and that generate their outputs in a natural language.                                                                                                                                                                                                                                                            |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                      |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         | Bloom’s Knowledge Level (KL) |      |  |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Understand and explain the fundamentals of Natural Language Processing   |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              | K2   |  |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Apply text vectorization and similarity techniques.                      |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              | K3   |  |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Analyze text analytics methods                                           |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              | K4   |  |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Demonstrate knowledge of sequential models and transformer architectures |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              | K3   |  |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Evaluate real-world NLP applications                                     |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              | K5   |  |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                                                    | PO1                                                                      | PO2                                                             | PO3 | PO4                                      | PO5 | PO6 | PO7 | PO8 | PO9                                    | PO10 | PO11     | PSO1    | PSO2                         | PSO3 |  |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                                                                        | 3                                                               | 1   | 1                                        | 2   | -   | -   | -   | 1                                      | 1    | -        | 2       | 1                            | 1    |  |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                                                                        | 3                                                               | 2   | 2                                        | 3   | -   | -   | -   | 1                                      | 1    | -        | 3       | 2                            | 1    |  |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                                                                        | 3                                                               | 2   | 3                                        | 3   | 1   | -   | -   | 1                                      | 2    | 1        | 3       | 3                            | 2    |  |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                                                                        | 2                                                               | 3   | 2                                        | 3   | 1   | -   | -   | 1                                      | 2    | 1        | 3       | 3                            | 2    |  |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                                                                        | 3                                                               | 3   | 2                                        | 3   | 2   | 1   | 1   | 1                                      | 2    | 1        | 3       | 3                            | 3    |  |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| Unit 1                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                          | Introduction to Natural Language Processing and text Processing |     |                                          |     |     |     |     |                                        |      |          | 9 Hours |                              |      |  |
| Definition, Applications and emerging trends in NLP, Challenges. Ambiguity. NLP tasks using NLTK: Tokenization, stemming, lemmatization, stop-word removal, POS tagging, Parsing, Named Entity Recognition, coreference resolution.<br>Text Vectorization: Bag-of-Words model, N-Gram Models and vector space models, Term Presence, TF-IDF<br>Textual Similarity: Cosine similarity, Word Mover’s distance, Word embedding: Word2Vec (Skip Gram & CBOW), GloVe. |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| Unit 2                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                          | Text Analytics                                                  |     |                                          |     |     |     |     |                                        |      |          | 7 hours |                              |      |  |
| Text classification, Sentiment Analysis, Topic modelling, LSA, LDA, Opinion Mining, Information Extraction, Information Retrieval.                                                                                                                                                                                                                                                                                                                               |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| Unit 3                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                          | Sequential Modelling and Transformers                           |     |                                          |     |     |     |     |                                        |      |          | 7 hours |                              |      |  |
| Sequential data, Introduction to sequence models - RNN and LSTM, Attention Mechanism, Transformer, Transformer-based models: BERT, FastText, Elmo, GPT, T5, Introduction to Hugging Face Transformers.                                                                                                                                                                                                                                                           |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| Unit 4                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                          | Applications and Case Studies                                   |     |                                          |     |     |     |     |                                        |      |          | 7 hours |                              |      |  |
| NLP applications: Machine translation: Rule-based and statistical approaches, Text summarization Dialog systems, conversational agents and chatbots.<br>Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modelling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results.                                                                              |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| Total Lecture Hours                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      | 30 hours |         |                              |      |  |
| Textbook:                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| S.No                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Book Title                                                               |                                                                 |     |                                          |     |     |     |     | Authors:                               |      |          |         |                              |      |  |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Speech and Language Processing, 3rd Edition, Pearson Education, 2008     |                                                                 |     |                                          |     |     |     |     | Daniel Jurafsky, James H.Martin        |      |          |         |                              |      |  |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Deep Learning for Natural Language Processing, 1st Edition, Apress, 2018 |                                                                 |     |                                          |     |     |     |     | Palash Goyal, Sumit Pandey, Karan Jain |      |          |         |                              |      |  |
| Reference Books:                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                          |                                                                 |     |                                          |     |     |     |     |                                        |      |          |         |                              |      |  |
| S.no                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Book Title                                                               |                                                                 |     |                                          |     |     |     |     | Authors:                               |      |          |         |                              |      |  |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Natural Language Understanding, 2nd Edition, Pearson, 1995               |                                                                 |     |                                          |     |     |     |     | James Allen                            |      |          |         |                              |      |  |

|                           |                                                                                                                                                                                                                                                                                                 |                   |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <b>2.</b>                 | Neural Network Methods for Natural Language Processing,<br>1st Edition, Morgan & Claypool Publishers, 2017                                                                                                                                                                                      | Yaov Goldeberg    |
| Self-Study Content Links: |                                                                                                                                                                                                                                                                                                 | Duration (in Hrs) |
| MOOCs                     | Natural Language Processing using Python<br><a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0125953625493258244_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0125953625493258244_shared/overview</a>                                 | 15 Hrs 45 min     |
| Video Lectures            | <a href="https://web.stanford.edu/class/cs224n/?utm">https://web.stanford.edu/class/cs224n/?utm</a>                                                                                                                                                                                             | 45Hrs             |
| Web References            | <a href="https://www.nltk.org/?utm">https://www.nltk.org/?utm</a><br><a href="https://huggingface.co/docs/transformers/index?utm">https://huggingface.co/docs/transformers/index?utm</a><br><a href="https://web.stanford.edu/class/cs224n/?utm">https://web.stanford.edu/class/cs224n/?utm</a> | 30Hrs             |

Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.

### Mode of Evaluation

| CIE       |     |     |           |     |     |            | ESE       | Total      |
|-----------|-----|-----|-----------|-----|-----|------------|-----------|------------|
| ST1       | ST2 | ST3 | TA1       | TA2 | TA3 | Attendance |           |            |
|           |     |     | 5         | 5   | 5   | 5          |           |            |
| <b>30</b> |     |     | <b>20</b> |     |     |            | <b>50</b> | <b>100</b> |

|                                                                             |                                                                               |     |     |     |                                                  |     |     |     |     |      |      |                              |      |      |   |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----|-----|-----|--------------------------------------------------|-----|-----|-----|-----|------|------|------------------------------|------|------|---|
| LAB Course Code: BCSBS0617P                                                 |                                                                               |     |     |     | LAB Course Name: Natural Language Processing Lab |     |     |     |     |      |      | L                            | T    | P    | C |
| Course Offered in: CSE(AI)/CSE(AIML)                                        |                                                                               |     |     |     |                                                  |     |     |     |     |      |      | 0                            | 0    | 2    | 1 |
| Course Outcome: After completion of the course, the student will be able to |                                                                               |     |     |     |                                                  |     |     |     |     |      |      | Bloom's Knowledge Level (KL) |      |      |   |
| CO1                                                                         | Apply and demonstrate NLP preprocessing techniques using NLTK and spaCy.      |     |     |     |                                                  |     |     |     |     |      |      | K3                           |      |      |   |
| CO2                                                                         | Analyze and justify ML/DL models for text analytics and classification tasks. |     |     |     |                                                  |     |     |     |     |      |      | K5                           |      |      |   |
| CO3                                                                         | Design and develop transformer-based NLP applications and chatbots.           |     |     |     |                                                  |     |     |     |     |      |      | K6                           |      |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                            |                                                                               |     |     |     |                                                  |     |     |     |     |      |      |                              |      |      |   |
| CO-PO Mapping                                                               | PO1                                                                           | PO2 | PO3 | PO4 | PO5                                              | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3 |   |
| CO1                                                                         | 3                                                                             | 2   | 1   | 1   | 3                                                | -   | -   | -   | 1   | 1    | -    | 3                            | 1    | 1    |   |
| CO2                                                                         | 3                                                                             | 3   | 2   | 2   | 3                                                | 1   | -   | -   | 1   | 2    | 1    | 3                            | 3    | 2    |   |
| CO3                                                                         | 3                                                                             | 3   | 3   | 3   | 3                                                | 1   | 1   | 1   | 2   | 2    | 1    | 3                            | 3    | 3    |   |
| List Of Practical's (Indicative & Not Limited To)                           |                                                                               |     |     |     |                                                  |     |     |     |     |      |      |                              |      |      |   |
| S.No                                                                        | List of Program                                                               |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO   |   |
| 1                                                                           | Tokenization of Sentences and Words using NLTK and spaCy                      |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO1  |   |
| 2                                                                           | Stemming and Lemmatization on sample text                                     |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO1  |   |
| 3                                                                           | Stop-word Removal from a document                                             |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO1  |   |
| 4                                                                           | Part-of-Speech (POS) Tagging of a given sentence                              |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO1  |   |
| 5                                                                           | Parsing and Chunking using regex and spaCy                                    |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO1  |   |
| 6                                                                           | Named Entity Recognition (NER) using spaCy                                    |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO1  |   |
| 7                                                                           | Coreference Resolution using neuralcoref (or similar)                         |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 8                                                                           | Bag-of-Words (BoW) vectorization and representation                           |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 9                                                                           | TF-IDF Implementation and comparison with BoW                                 |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 10                                                                          | N-Gram Model (uni-, bi-, tri-gram) generation from corpus                     |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 11                                                                          | Cosine Similarity computation between text documents                          |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 12                                                                          | Word2Vec word embeddings using gensim on a custom corpus                      |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 13                                                                          | GloVe Embeddings loading and vector representation                            |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 14                                                                          | Text Similarity using Word Mover's Distance (WMD)                             |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 15                                                                          | Text Classification using Naïve Bayes/SVM with TF-IDF                         |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 16                                                                          | Sentiment Analysis using TextBlob and VADER                                   |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 17                                                                          | Topic Modeling using Latent Dirichlet Allocation (LDA)                        |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 18                                                                          | Topic Modeling using Latent Semantic Analysis (LSA)                           |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 19                                                                          | Opinion Mining on product/service reviews dataset                             |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 20                                                                          | Information Extraction (IE) from structured/unstructured documents            |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 21                                                                          | Information Retrieval system with ranking using TF-IDF                        |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 22                                                                          | Sequence Classification using RNN/LSTM (Keras/TensorFlow)                     |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 23                                                                          | Implementing Attention Mechanism (Basic custom model)                         |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO2  |   |
| 24                                                                          | Fine-Tuning BERT for text classification using Hugging Face                   |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO3  |   |
| 25                                                                          | Sentence Embeddings using BERT and GPT-2                                      |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO3  |   |
| 26                                                                          | Text Generation using GPT-2 on a custom dataset                               |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO3  |   |
| 27                                                                          | Named Entity Recognition using Transformers (BERT)                            |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO3  |   |
| 28                                                                          | Machine Translation using MarianMT or T5 (Hugging Face)                       |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO3  |   |
| 29                                                                          | Text Summarization using BART or T5                                           |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO3  |   |
| 30                                                                          | Chatbot Development using pre-trained transformer (DialogPT/ChatGPT-style)    |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO3  |   |
| 31                                                                          | Automatic Document Classification and Separation using ML                     |     |     |     |                                                  |     |     |     |     |      |      |                              |      | CO3  |   |

|    |                                                                                    |     |
|----|------------------------------------------------------------------------------------|-----|
| 32 | Hybrid Probabilistic + FSM-Based Sequence Modeling for document boundary detection | CO3 |
|----|------------------------------------------------------------------------------------|-----|

|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------------------------|-------------|-----------------|-------------|-------------|-------------|
| <b>Course Code:</b><br>BCSBS0612Z                                                                                                                                                                                                                                                                                                                                                                          |                                                                      | <b>Course Name: MODERN WEB APPLICATIONS</b>          |            |            |            |            |            |            |            | <b>L</b>                     | <b>T</b>    | <b>P</b>        | <b>C</b>    |             |             |
| <b>Course Offered in: B. Tech. CSBS</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                      |                                                      |            |            |            |            |            |            |            | <b>2</b>                     | <b>0</b>    | <b>0</b>        | <b>2</b>    |             |             |
| <b>Pre-requisite: Basic Knowledge of programming</b>                                                                                                                                                                                                                                                                                                                                                       |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>Course Objectives:</b> The objective of this course is to enable students to learn new technologies by applying foundation paradigms. It helps students to develop modern web application by leveraging latest technologies. The course aims to build strong expertise to develop end to end application - web frontend and backend development making students job ready as per industry requirements. |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>Course Outcome:</b> After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                         |                                                                      |                                                      |            |            |            |            |            |            |            | Bloom's Knowledge Level (KL) |             |                 |             |             |             |
| <b>CO1</b>                                                                                                                                                                                                                                                                                                                                                                                                 | Understand the basic concepts and architecture of web applications   |                                                      |            |            |            |            |            |            |            | K2                           |             |                 |             |             |             |
| <b>CO2</b>                                                                                                                                                                                                                                                                                                                                                                                                 | Apply and use basic coding in HTML and CSS for responsive web design |                                                      |            |            |            |            |            |            |            | K3                           |             |                 |             |             |             |
| <b>CO3</b>                                                                                                                                                                                                                                                                                                                                                                                                 | Build dynamic web applications with support of JavaScript.           |                                                      |            |            |            |            |            |            |            | K6                           |             |                 |             |             |             |
| <b>CO4</b>                                                                                                                                                                                                                                                                                                                                                                                                 | Analyze web applications with front end systems.                     |                                                      |            |            |            |            |            |            |            | K4                           |             |                 |             |             |             |
| <b>CO5</b>                                                                                                                                                                                                                                                                                                                                                                                                 | Examine web applications with back end technologies.                 |                                                      |            |            |            |            |            |            |            | K4                           |             |                 |             |             |             |
| <b>CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)</b>                                                                                                                                                                                                                                                                                                                                                    |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>CO-PO Mapping</b>                                                                                                                                                                                                                                                                                                                                                                                       | <b>PO1</b>                                                           | <b>PO2</b>                                           | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b>                  | <b>PO11</b> | <b>PO12</b>     | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| <b>CO1</b>                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                    | 2                                                    | 1          | 1          | 2          | 1          | 1          | 1          | 1          | 0                            | 2           | 2               | 2           | 1           | 2           |
| <b>CO2</b>                                                                                                                                                                                                                                                                                                                                                                                                 | 2                                                                    | 2                                                    | 3          | 1          | 3          | 1          | 1          | 2          | 2          | 1                            | 2           | 3               | 3           | 2           | 3           |
| <b>CO3</b>                                                                                                                                                                                                                                                                                                                                                                                                 | 2                                                                    | 3                                                    | 3          | 2          | 3          | 1          | 1          | 2          | 2          | 1                            | 2           | 3               | 3           | 2           | 2           |
| <b>CO4</b>                                                                                                                                                                                                                                                                                                                                                                                                 | 2                                                                    | 3                                                    | 2          | 3          | 2          | 2          | 1          | 2          | 2          | 1                            | 3           | 2               | 2           | 3           | 2           |
| <b>CO5</b>                                                                                                                                                                                                                                                                                                                                                                                                 | 2                                                                    | 3                                                    | 3          | 3          | 3          | 2          | 1          | 2          | 2          | 2                            | 3           | 3               | 3           | 3           | 3           |
| <b>Course Contents / Syllabus</b>                                                                                                                                                                                                                                                                                                                                                                          |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>Unit-1</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                      | <b>Introduction</b>                                  |            |            |            |            |            |            |            |                              |             | <b>8 hours</b>  |             |             |             |
| Concept of website, its need and purpose, <b>Types of websites:</b> Static and Dynamic, Introduction to HTML, XML, JSON, Web Browsers, Web Servers, Uniform Resource Locator, Tools and Web Programming Languages, Web Standards, <b>Tiered Architecture:</b> Client Server Model, Three Tier Model, Service Oriented Architectures, REST services.                                                        |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>Unit-2</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                      | <b>CORE TECHNOLOGIES FOR WEB APPS</b>                |            |            |            |            |            |            |            |                              |             | <b>8 hours</b>  |             |             |             |
| <b>HTML:</b> Languages used for website development, HTML5: basic tags, formatting tags, Adding images, Lists, Embedding multimedia in Web pages, Inserting tables, Internal and External Linking, Frames, Forms.                                                                                                                                                                                          |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>CSS:</b> Basics of Cascading Style sheets, Advantages of CSS, External Style sheet, Internal style sheet, Inline style sheet, CSS Syntax, color, background, Font, images                                                                                                                                                                                                                               |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>Unit-3</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                      | <b>DYNAMIC BEHAVIOUR WITH JAVA SCRIPT</b>            |            |            |            |            |            |            |            |                              |             | <b>6 hours</b>  |             |             |             |
| Features of JavaScript, extension of JavaScript, Syntax of JavaScript: data types, operators, variables, tag, Document Object Model (DOM) with JavaScript, Selection Statement using if and Switch, Iterative statement: for, for/in, while, do while, break and continue.                                                                                                                                 |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>Unit-4</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                      | <b>FRONT END FRAMEWORK AND BACK-END TECHNOLOGIES</b> |            |            |            |            |            |            |            |                              |             | <b>8 hours</b>  |             |             |             |
| <b>Introduction to jQuery</b> - Syntax, Selectors, Events, Traversing, AJAX, Introduction to Bootstrap – Basics, Grids, Themes <b>Angular JS</b> – Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, Validation. Introduction to RESTful services, Resources, Messages (Request, Response), Addressing, Methods – (GET, POST, PUT, DELETE).                 |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>Total Lecture Hours</b>                                                                                                                                                                                                                                                                                                                                                                                 |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             | <b>30 hours</b> |             |             |             |
| <b>Textbook:</b>                                                                                                                                                                                                                                                                                                                                                                                           |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>S. No</b>                                                                                                                                                                                                                                                                                                                                                                                               | <b>Book Title with publication agency &amp; year</b>                 |                                                      |            |            |            |            |            |            |            | <b>Author</b>                |             |                 |             |             |             |
| 1. Steven M. Schafer, "HTML, XHTML, and CSS Bible, 5ed", Wiley India                                                                                                                                                                                                                                                                                                                                       |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| 2. Ian Pouncey, Richard York, "Beginning CSS: Cascading Style Sheets for Web Design", Wiley India                                                                                                                                                                                                                                                                                                          |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| 3. Ian Pouncey, Richard York, "Beginning CSS: Cascading Style Sheets for Web Design", Wiley India                                                                                                                                                                                                                                                                                                          |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                                                                                                                    |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| 1) Joel Sklar, "Principal of web Design" Vikash and Thomas Learning                                                                                                                                                                                                                                                                                                                                        |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| 2) Chris Bates, "Web Programing Building Internet Applications", 2nd Edition, WILEY, Dreamtech                                                                                                                                                                                                                                                                                                             |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |
| 3) Ivan Bayross, "HTML, DHTML, Java Script, Perl & CGI", BPB Publication                                                                                                                                                                                                                                                                                                                                   |                                                                      |                                                      |            |            |            |            |            |            |            |                              |             |                 |             |             |             |

4) Ramesh Bangia, “Internet and Web Design” , New Age International

| Self-Study Content Links: |                                                                                                                                                                                                                                                                                                                            | Duration (in Hrs) |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| MOOCs                     | 1. NPTEL – Programming in HTML5 with JavaScript and CSS<br><a href="https://onlinecourses.nptel.ac.in/e-learning">https://onlinecourses.nptel.ac.in/e-learning</a>                                                                                                                                                         | 08 Hrs            |
|                           | 2. Coursera – Introduction to Web Development with HTML, CSS & JavaScript<br><a href="https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javascript/?utm_source=chatgpt.com">https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javascript/?utm_source=chatgpt.com</a> | 20 Hrs            |
|                           | 3. Web Development with HTML5, CSS, and JavaScript Specialization<br><a href="https://www.coursera.org/specializations/web-development-html-css-javascript/?utm_source=chatgpt.com">https://www.coursera.org/specializations/web-development-html-css-javascript/?utm_source=chatgpt.com</a>                               | 36 Hrs            |
| Video Lectures            | 1. <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_014157697606279168211/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_014157697606279168211/overview</a>                                                                                                               | 06 min            |
|                           | 2. <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01255430762840064023_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01255430762840064023_shared/overview</a>                                                                                                   | 02 min            |
|                           | 3. <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012676725298765824905_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012676725298765824905_shared/overview</a>                                                                                                 | 14 min            |
|                           | 4. <a href="https://www.coursehero.com/file/66643350/Lesson-1-Introduction-to-Web-Application-Development-1pdf/">https://www.coursehero.com/file/66643350/Lesson-1-Introduction-to-Web-Application-Development-1pdf/</a>                                                                                                   | 30 min            |
| Web References            | 1. W3Schools – HTML, CSS, JavaScript, jQuery, Bootstrap, AngularJS Tutorials<br>2. MDN Web Docs – HTML, CSS, JavaScript, DOM & Web APIs<br>3. REST API Tutorial – RESTful Web Services<br>4. Bootstrap Official Documentation<br>5. jQuery Official Documentation<br>6. AngularJS Official Documentation                   |                   |

#### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 50  | 100   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                              |     |     |     |     |     |     |     |      |      |                              |      |      |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----|-----|-----|-----|-----|-----|-----|------|------|------------------------------|------|------|---|
| LAB Course Code:<br>BCSBS0612P                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | LAB Course Name: MODERN WEB APPLICATIONS LAB |     |     |     |     |     |     |     |      |      | L                            | T    | P    | C |
| Course Offered in: B.Tech CSBS                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                              |     |     |     |     |     |     |     |      |      | 0                            | 0    | 2    | 1 |
| Pre-requisite: Basic Knowledge of programming                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                              |     |     |     |     |     |     |     |      |      |                              |      |      |   |
| Course Objectives: The objective of this course is to enable students to understand fundamental concepts of web technologies and design principles. It helps students to develop static and dynamic web applications using HTML, CSS, JavaScript, and modern front-end frameworks. The course aims to build strong expertise in developing end-to-end web applications including both front-end and back-end technologies, making students industry-ready. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                              |     |     |     |     |     |     |     |      |      |                              |      |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                              |     |     |     |     |     |     |     |      |      | Bloom's Knowledge Level (KL) |      |      |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Build well-structured and visually appealing web pages using HTML and CSS.                                                                                                                                                                                                                                                                                                                                                                                                           |                                              |     |     |     |     |     |     |     |      |      | K3                           |      |      |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Develop interactive web pages using JavaScript and jQuery for user interaction and validation.                                                                                                                                                                                                                                                                                                                                                                                       |                                              |     |     |     |     |     |     |     |      |      | K3                           |      |      |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Create dynamic web applications using AngularJS, backend programming, and database operations                                                                                                                                                                                                                                                                                                                                                                                        |                                              |     |     |     |     |     |     |     |      |      | K6                           |      |      |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                              |     |     |     |     |     |     |     |      |      |                              |      |      |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                                              | PO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | PO2                                          | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2                                            | 3   | –   | 2   | –   | –   | –   | 2   | –    | 1    | 3                            | 2    | 1    |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                            | 3   | –   | 3   | –   | –   | –   | 2   | –    | 1    | 3                            | 3    | 2    |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                            | 3   | 2   | 3   | 1   | –   | 2   | 2   | 2    | 3    | 3                            | 3    | 2    |   |
| List Of Practical's (Indicative & Not Limited To)                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                              |     |     |     |     |     |     |     |      |      |                              |      |      |   |
| Sr. No.                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Program                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                              |     |     |     |     |     |     |     |      |      |                              | CO   |      |   |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Draft a survey document of ten websites which you like and dislike with various reasons.                                                                                                                                                                                                                                                                                                                                                                                             |                                              |     |     |     |     |     |     |     |      |      |                              | CO1  |      |   |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Implement Basic Html Tags Implement Table Tags Implement Frames.                                                                                                                                                                                                                                                                                                                                                                                                                     |                                              |     |     |     |     |     |     |     |      |      |                              | CO1, |      |   |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Create your profile page i.e. educational details, Hobbies, Achievement, My Ideals etc.                                                                                                                                                                                                                                                                                                                                                                                              |                                              |     |     |     |     |     |     |     |      |      |                              | CO1  |      |   |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Design the following static web pages required for an online book store web site.<br>a) HOME PAGE: The static home page must contain three frames.<br>b) LOGIN PAGE<br>c) CATALOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table. d) REGISTRATION PAGE                                                                                                                                                                  |                                              |     |     |     |     |     |     |     |      |      |                              | CO1  |      |   |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Develop and demonstrate the usage of inline, internal and external style sheet using CSS.                                                                                                                                                                                                                                                                                                                                                                                            |                                              |     |     |     |     |     |     |     |      |      |                              | CO1  |      |   |
| 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color,bold and font size).                                                                                                                                                                                                                             |                                              |     |     |     |     |     |     |     |      |      |                              | CO1  |      |   |
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient                                                                                                                                                                                                                                                                                                                                                          |                                              |     |     |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 8.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Write JavaScript to validate the following fields of the Registration page.<br>a) First Name (Name should contains alphabets and the length should not be less than 6 characters).<br>b) Password (Password should not be less than 6 characters length).<br>c) E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)<br>d) Mobile Number (Phone number should contain 10 digits only).<br>e) Last Name and Address (should not be Empty). |                                              |     |     |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 9.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.                                                                                                                                                                                                                                          |                                              |     |     |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 10.                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Develop and demonstrate a HTML file that includes JavaScript script that uses functions for the following problems: a) Parameter: A string Output: The position in the string of the left-most vowel<br>b) Parameter: A number Output: The number with its digits in the reverse order                                                                                                                                                                                               |                                              |     |     |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 11.                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Using JQuery Implement:<br>a) Selecting Element, Getting Values, Setting Values.<br>b) Events                                                                                                                                                                                                                                                                                                                                                                                        |                                              |     |     |     |     |     |     |     |      |      |                              | CO2  |      |   |
| 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Using Angular JS Implement:<br>a) Input Validation<br>b) Backend Building                                                                                                                                                                                                                                                                                                                                                                                                            |                                              |     |     |     |     |     |     |     |      |      |                              | CO3  |      |   |
| 13.                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Write a backend application program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings, current time of server                                                                                                                                                                                                                                                                                                |                                              |     |     |     |     |     |     |     |      |      |                              | CO3  |      |   |



|     |                                                                                                                                                                                                             |                             |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 14. | Write a backend application program to sort the student records which are stored in the database using selection sort.                                                                                      | CO3                         |
| 15. | Write the backend application to do the following:<br>a) Implement simple calculator operations.<br>b) Find the transpose of a matrix.<br>c) Multiplication of two matrices.<br>d) Addition of two matrices | CO3                         |
|     |                                                                                                                                                                                                             | <b>Total Hours: 30 hrs.</b> |
|     |                                                                                                                                                                                                             |                             |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------|-----|--------------------------------------------|-----|-----|-----|------|------|----------|------------------------------|------|
| Course Code: BCSBS0611Z                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                       |     |     |                                                                                                                                         |     | Course Name: Robotics and Embedded Systems |     |     |     | L    | T    |          | P                            | C    |
| Course Offered in: B. Tech (CSBS)                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     | 2    | 0    |          | 0                            | 2    |
| Pre-requisites: Basic Knowledge of Programming (Python), Artificial Intelligence, Computer Vision, and Cloud Computing.                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
| Course objective:<br>To acquire knowledge about modern-day robotics and understand computer vision in robotics and apply the concepts of Python, Cloud computing, and computer vision in this future technology.                                                                                                                                                                                                                                                                    |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          | Bloom's Knowledge Level (KL) |      |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Understand basic concepts and technological advancements in AI and robotics.                                          |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          | K3                           |      |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Develop skills of using advanced software for solving practical problems in robotics pertaining to various industries |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          | K2                           |      |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Understand and apply several statistical analysis techniques and business analytics for cognitive robotics.           |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          | K3                           |      |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Understand and apply the programming of robots using python and R languages.                                          |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          | K3                           |      |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Understand and apply the concept of cloud computing in robotics.                                                      |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          | K3                           |      |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | PO1                                                                                                                   | PO2 | PO3 | PO4                                                                                                                                     | PO5 | PO6                                        | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1     | PSO2                         | PSO3 |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                                                                     | 2   | –   | –                                                                                                                                       | 1   | –                                          | –   | –   | –   | –    | 2    | 1        | 1                            | 2    |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2                                                                                                                     | 3   | 2   | 2                                                                                                                                       | 3   | –                                          | –   | 1   | 1   | 1    | 2    | 3        | 3                            | 2    |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2                                                                                                                     | 3   | 2   | 3                                                                                                                                       | 2   | 1                                          | –   | 1   | 1   | –    | 2    | 3        | 2                            | 2    |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                                                                     | 2   | 2   | 2                                                                                                                                       | 3   | –                                          | –   | 1   | 1   | 1    | 2    | 3        | 3                            | 2    |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2                                                                                                                     | 2   | 2   | 2                                                                                                                                       | 3   | 1                                          | –   | 1   | 1   | 1    | 3    | 2        | 3                            | 3    |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
| Unit 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                       |     |     | Introduction to Modern Day Robotics and their industrial applications and computer vision and application of Vision Systems in Robotics |     |                                            |     |     |     |      |      | 7 hours  |                              |      |
| Industry 4.0 Concept: Background and Overview-Industry 4.0 technologies: implementation patterns in manufacturing companies- Evolution of Industrial Robots and their Applications-Advancements in Robotics and Its Future Uses-Types of robotics in various fields for applications.                                                                                                                                                                                               |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
| Technologies essential for Cognitive Robotics: Computer systems and Technologies relevant to modern day robotics-Robotic Process Automation: Overview of RPA and its applications-RPA, AI, and Cognitive Technologies for Leaders-Introduction to Robotics: Analysis, Control, Applications.                                                                                                                                                                                        |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
| Concepts of computer vision and the how vision systems are becoming essential part of Robotics-Computer Vision: Models, Learning, and Inference -Mastering Computer Vision with TensorFlow 2.x: Build advanced computer vision applications using machine learning and deep learning techniques- Machine Vision Applications-                                                                                                                                                       |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
| Application areas for vision systems-Robot inspection case study-Autonomous driving using 3D imaging case study.                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
| Unit 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                       |     |     | AI in the context of Cognitive Robotics and Role of AI in Robotics                                                                      |     |                                            |     |     |     |      |      | 07 hours |                              |      |
| Foundation for Advanced Robotics and AI- A Concept for a Practical Robot Design Process- Demo to train A Robot Using AI - Deep learning core applications-Deep learning business applications. Data Science and Big Data in the context of Cognitive Robotics: Cognitive Technologies: The Next Step Up for Data and Analytics in robotics-Cognitive Deep Learning Technology for Big Data Cognitive Assistant Robots for Reducing Variability in Industrial Human-Robot Activities |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |
| Artificial Intelligence and Robotics - The Review of Reliability Factors Related to Industrial Robots -Failure analysis of mature robots in automated production- Data Analytics for Predictive Maintenance of Industrial Robots - Failure Is an Option: How the Severity of Robot Errors Affects Human-Robot Interaction.                                                                                                                                                          |                                                                                                                       |     |     |                                                                                                                                         |     |                                            |     |     |     |      |      |          |                              |      |

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| <b>Unit 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Concepts of Cloud computing, cloud platforms and it applications in Robotics:</b>                                                                                     | <b>08 hours</b>                    |
| <p>Learning Cloud Computing: Core Concepts - Cloud Computing: Private Cloud Platforms -Robot as a Service in Cloud Computing - Cloud Computing Technology and Its Application in Robot Control - A Comprehensive Survey of Recent Trends in Cloud</p> <p><b>Robotics Architectures and Applications</b> - Google's cloud robotics and high computing needs of industrial automation and systems- The role of cloud and opensource software in the future of robotics-The Power of Cloud Robotics by Robotics Industry Association.</p>                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                          |                                    |
| <b>Unit 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Basics of Robotic operating System</b>                                                                                                                                | <b>08 hours</b>                    |
| <p>ROS for beginners an overview- Introduction to the Robot Operating System (ROS) Middleware - Secure communication for the Robot Operating System - An Introduction to Robot Operating System: The Ultimate Robot Application Framework by Adnan Quality of Service and Cybersecurity Communication Protocols -Analysis for the Robot Operating System</p> <p><b>Robotics systems communication-</b> Threat modelling using ROS. Introduction to Python and R Programming in the context of Robotics: Introduction to Python - Python Functions for Data Science-Basic ROS Learning Python for robotics- An introduction to R -The R in Robotics ros R: A New Language Extension for the Robot Operating System.</p> <p><b>Towards cloud robotic system:</b> A case study of online co-localization for fair resource competence-A Case Study on Model-Based Development of Robotic Systems using Monti Arc with Embedded Automata.</p> |                                                                                                                                                                          |                                    |
| <b>Total Lecture Hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                          | <b>30 hours</b>                    |
| <b>Textbook:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                          |                                    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Introduction to Robotics: Analysis, Control, Applications”, Wiley Publishers, 2 <sup>nd</sup> edition,2011.                                                              | Saeed Benjamin Niku,               |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.                                                                                     | Simon J. D. Prince                 |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                          |                                    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | “Artificial Intelligence for Robotics: Build Intelligent Robots that Perform Human Tasks Using AI Techniques”, Packt publishing,2018.                                    | Francis X. Govers                  |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | “Mastering Computer Vision with TensorFlow 2.x: Build Advanced Computer Vision Applications Using Machine Learning and Deep Learning Techniques”, Packt publishing,2020. | Krishnendu Kar,                    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ” Introduction to Deep Learning Business Applications for Developers from Conversational Bots in Customer Service to Medical Image processing”,Apress,2018.              | Armando Vieira, Bernardete Ribeiro |

|                           |                                                                 |                 |
|---------------------------|-----------------------------------------------------------------|-----------------|
| Self-Study Content Links: |                                                                 | Duration in (h) |
| Moocs                     | <a href="#">Industrial Robotics - TOC   Infosys Springboard</a> | 6 h             |
|                           | <a href="#">Robotics Course - TOC   Infosys Springboard</a>     | 2h              |

|               |                                                                                                                                                                                                   |                  |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|               | <a href="#">Robotic Process Automation (RPA): Overview and Build a Robot - TOC   Infosys Springboard</a><br><a href="#">Robotic Process Automation for Developers - TOC   Infosys Springboard</a> | 3h<br><br><br>6h |
| Video         | <a href="https://www.youtube.com/playlist?list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_">https://www.youtube.com/playlist?list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_</a>                                   | 20h              |
| Web-Reference | ROS (Robot Operating System) Documentation                                                                                                                                                        |                  |

#### Mode of Evaluation

| CIE |     |     |          |          |          |                 | ESE | Total |
|-----|-----|-----|----------|----------|----------|-----------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>5 | TA2<br>5 | TA3<br>5 | Attendance<br>5 |     |       |
| 30  |     |     | 20       |          |          |                 | 50  | 100   |

|                                                                                                                                                                                                                                                                                                                                                    |                                                                                    |     |     |     |                                                    |     |     |     |     |      |      |                              |      |            |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----|-----|-----|----------------------------------------------------|-----|-----|-----|-----|------|------|------------------------------|------|------------|---|
| LAB Course Code: BCSBS0611P                                                                                                                                                                                                                                                                                                                        |                                                                                    |     |     |     | LAB Course Name: Robotics and Embedded Systems Lab |     |     |     |     |      |      | L                            | T    | P          | C |
| Course Offered in: B. Tech (CSBS)                                                                                                                                                                                                                                                                                                                  |                                                                                    |     |     |     |                                                    |     |     |     |     |      |      | 0                            | 0    | 2          | 1 |
| Pre-requisite: Basic Knowledge of Programming (Python), Artificial Intelligence, Computer Vision, and Cloud Computing.                                                                                                                                                                                                                             |                                                                                    |     |     |     |                                                    |     |     |     |     |      |      |                              |      |            |   |
| Course Objectives: To acquire knowledge about modern robotics and understand robot configurations, RPA, computer vision, and autonomous systems. The course also aims to apply the concepts of Python, ROS, cloud computing, and AI techniques for designing, developing, and implementing intelligent robotic systems in real-world applications. |                                                                                    |     |     |     |                                                    |     |     |     |     |      |      |                              |      |            |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                        |                                                                                    |     |     |     |                                                    |     |     |     |     |      |      | Bloom's Knowledge Level (KL) |      |            |   |
| CO1                                                                                                                                                                                                                                                                                                                                                | Apply the basic concepts of RPA and robotic configuration.                         |     |     |     |                                                    |     |     |     |     |      |      | K3                           |      |            |   |
| CO2                                                                                                                                                                                                                                                                                                                                                | Appy the skills of using the advance software for autonomous driving.              |     |     |     |                                                    |     |     |     |     |      |      | K3                           |      |            |   |
| CO3                                                                                                                                                                                                                                                                                                                                                | To be able to apply the concept of the industrial robotics and the concept of ROS. |     |     |     |                                                    |     |     |     |     |      |      | K3                           |      |            |   |
| CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)                                                                                                                                                                                                                                                                                                   |                                                                                    |     |     |     |                                                    |     |     |     |     |      |      |                              |      |            |   |
| CO-PO Mapping                                                                                                                                                                                                                                                                                                                                      | PO1                                                                                | PO2 | PO3 | PO4 | PO5                                                | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1                         | PSO2 | PSO3       |   |
| CO1                                                                                                                                                                                                                                                                                                                                                | 3                                                                                  | 2   | 1   | -   | 1                                                  | –   | –   | -   | -   | –    | 2    | 2                            | 1    | 2          |   |
| CO2                                                                                                                                                                                                                                                                                                                                                | 2                                                                                  | 3   | 2   | 2   | 3                                                  | 1   | –   | 1   | 1   | 1    | 2    | 3                            | 3    | 2          |   |
| CO3                                                                                                                                                                                                                                                                                                                                                | 2                                                                                  | 2   | 3   | 2   | 3                                                  | 1   |     | 1   | 1   | 1    | 2    | 3                            | 3    | 2          |   |
| List Of Practical's (Indicative & Not Limited To)                                                                                                                                                                                                                                                                                                  |                                                                                    |     |     |     |                                                    |     |     |     |     |      |      |                              |      |            |   |
| Sr. No.                                                                                                                                                                                                                                                                                                                                            | Program                                                                            |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO,K level |   |
| 1.                                                                                                                                                                                                                                                                                                                                                 | To study an introduction of the robot configuration..                              |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO1, K3    |   |
| 2.                                                                                                                                                                                                                                                                                                                                                 | To study and implement the basic concept of RPA with one simulation.               |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO1, K3    |   |
| 3.                                                                                                                                                                                                                                                                                                                                                 | To study and apply the computer vision with tensor flow.                           |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO2, K3    |   |
| 4.                                                                                                                                                                                                                                                                                                                                                 | To study and apply the autonomous driving .                                        |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO2, K3    |   |
| 5.                                                                                                                                                                                                                                                                                                                                                 | To demonstrate the training of a robot using AI.                                   |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO2, K3    |   |
| 6.                                                                                                                                                                                                                                                                                                                                                 | To demonstrate the usage of the industrial robotics.                               |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO3, K3    |   |
| 7.                                                                                                                                                                                                                                                                                                                                                 | To demonstrate and apply the cloud computing in robotics.                          |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO3, K3    |   |
| 8.                                                                                                                                                                                                                                                                                                                                                 | To demonstrate and apply the google cloud robotics.                                |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO3, K3    |   |
| 9.                                                                                                                                                                                                                                                                                                                                                 | To demonstrate robot with 2 dof, 3 dof, 4 dof                                      |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO3, K3    |   |
| 10.                                                                                                                                                                                                                                                                                                                                                | Two assignments on programming the robot for applications                          |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO3, K3    |   |
| 11.                                                                                                                                                                                                                                                                                                                                                | To implement the modern based development of robotic systems.                      |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO3, K3    |   |
| 12.                                                                                                                                                                                                                                                                                                                                                | To explore and apply the basic commands of ROS using Python.                       |     |     |     |                                                    |     |     |     |     |      |      |                              |      | CO3, K3    |   |
| Total Hours: 30 hrs.                                                                                                                                                                                                                                                                                                                               |                                                                                    |     |     |     |                                                    |     |     |     |     |      |      |                              |      |            |   |