

**NOIDA INSTITUTE OF ENGINEERING AND 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  
Master of Integrated Technology  
Computer Science and Engineering**

**Fourth Year**

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

**NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA**  
**(An Autonomous Institute)**

**M.TECH Int. (CSE)**  
**Evaluation Scheme**  
**SEMESTER VII**

| Sl. No.                      | Subject Codes          | Subject Name                                                 | Type of Subject       | Periods |   |   | Evaluation Schemes |     |       |     | End Semester |    | Total | Credit |
|------------------------------|------------------------|--------------------------------------------------------------|-----------------------|---------|---|---|--------------------|-----|-------|-----|--------------|----|-------|--------|
|                              |                        |                                                              |                       | L       | T | P | CT                 | TA  | TOTAL | PS  | TE           | PE |       |        |
| COMPULSORY INDUCTION PROGRAM |                        |                                                              |                       |         |   |   |                    |     |       |     |              |    |       |        |
| 1                            | BMICSE0702             | Research Process & Methodology                               | Mandatory             | 3       | 0 | 0 | 30                 | 20  | 50    |     | 100          |    | 150   | 3      |
| 2                            | BMICSAI0702            | Artificial Intelligence                                      | Mandatory             | 3       | 0 | 0 | 30                 | 20  | 50    |     | 100          |    | 150   | 3      |
| 3                            | BMICSML0702            | Deep Learning                                                | Mandatory             | 3       | 0 | 0 | 30                 | 20  | 50    |     | 100          |    | 150   | 3      |
| 4                            |                        | Department Elective -V                                       | Departmental Elective | 3       | 0 | 0 | 30                 | 20  | 50    |     | 100          |    | 150   | 3      |
| 5                            |                        | Open Elective-II                                             | Open Elective         | 3       | 0 | 0 | 30                 | 20  | 50    |     | 100          |    | 150   | 3      |
| 6                            | BMICSAI0752            | Artificial Intelligence Lab                                  | Mandatory             | 0       | 0 | 2 |                    |     |       | 25  |              | 25 | 50    | 1      |
| 7                            | BMICSML0752            | Deep Learning Lab                                            | Mandatory             | 0       | 0 | 2 |                    |     |       | 25  |              | 25 | 50    | 1      |
| 8                            | BMICSE0759 /BMICSE0758 | Internship Assessment/ Minor Project                         | Mandatory             | 0       | 0 | 2 |                    |     |       | 50  |              |    | 50    | 1      |
| 9                            | BNC0701/ BNC0702       | Foundations of Entrepreneurship/ CRM Fundamentals            | Mandatory             | 2       | 0 | 0 | 30                 | 20  | 50    |     | 50           |    | 100   | NA     |
| 10                           |                        | *Massive Open Online Courses (For M.Tech. Int. Hons. Degree) | *MOOCs                |         |   |   |                    |     |       |     |              |    |       |        |
|                              |                        | TOTAL                                                        |                       | 17      | 0 | 6 | 180                | 100 | 250   | 100 | 400          | 50 | 1000  | 18     |

**\* List of MOOCs (Infosys) Based Recommended Courses for Fourth year M. Tech Int Students**

| S. No. | Subject Code | Course Name                                                           | University/ Industry Partner Name      | N. of Hours | Credits |
|--------|--------------|-----------------------------------------------------------------------|----------------------------------------|-------------|---------|
| 1.     | BMC0111      | Deep Learning for Developers                                          | Infosys Wingspan (Infosys Springboard) | 34h 51m     | 2.5     |
| 2.     | BMC0138      | Spring Boot and Angular-React Stack-DevOps Tools and Capstone Project | Infosys Wingspan (Infosys Springboard) | 107h 50m    | 4       |
| 3      | BMC0143      | Continuous Integration and Delivery - DevOps                          | Infosys Wingspan (Infosys Springboard) | 46h 41m     | 3.5     |
| 4      | BMC0113      | Certificate Program in Deep Learning/NLP/Artificial Intelligence      | NASSCOM                                | 30h         | 2       |
| 5.     | BMC0126      | TechA Computer Vision Certificate                                     | Infosys Wingspan (Infosys Springboard) | 18h 20m     | 1       |

**PLEASE NOTE: -**

- **Internship (3-4 weeks) shall be conducted during summer break after semester-VI and will be assessed during semester-VII**
- **Compulsory Audit Courses (Non-Credit - BNC0701/BNC0702)**
  - All Compulsory Audit Courses (a qualifying exam) has no credit.
  - Total and obtained marks are not added in the Grand Total.

**Abbreviation Used:**

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam.,  
 PE: Practical End Semester Exam, CE: Core Elective, OE: Open Elective, DE: Departmental Elective, CA: Compulsory Audit,  
 MOOCs: Massive Open Online Courses.

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**List of Department Elective: -**

| S. No. | Subject Code | Subject Name                                 | Bucket Name            | Semester |
|--------|--------------|----------------------------------------------|------------------------|----------|
| 1      | BMICSE0713   | Web Development using MERN STACK with DevOps | Full stack Development | VII      |
| 2      | BMICSE0712   | RPA Implementation                           | CRM/RPA                | VII      |
| 3      | BMICSAI0714  | Cloud Security                               | Cloud Computing        | VII      |

**List of Open Elective: -**

| S. No. | Subject Code | Name of open Elective Subjects                | Type of Subject  | Subject offered to Program | Semester |
|--------|--------------|-----------------------------------------------|------------------|----------------------------|----------|
| 1      | BOE0766      | Sensor Technologies                           | Open Elective-II | All Programs               | 7        |
| 2      | BOE0762      | Biology for Engineers                         | Open Elective-II | All Programs except BT     | 7        |
| 3      | BOE0765      | Human Psychology and Organizational Behaviour | Open Elective-II | All Programs               | 7        |

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**M. TECH Int. (CSE)**  
**Evaluation Scheme**  
**SEMESTER VIII**

| Sl. No.                                                                                                                                         | Subject Codes             | Subject Name                                                    | Type of Subject | Periods  |          |           | Evaluation Schemes |           |            |            | End Semester |            | Total      | Credit    |
|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------|-----------------|----------|----------|-----------|--------------------|-----------|------------|------------|--------------|------------|------------|-----------|
|                                                                                                                                                 |                           |                                                                 |                 | L        | T        | P         | CT                 | TA        | TOTAL      | PS         | TE           | PE         |            |           |
| 1                                                                                                                                               | BMICSE0801                | Computer Vision                                                 | Mandatory       | 3        | 0        | 0         | 30                 | 20        | 50         |            | 100          |            | 150        | 3         |
| 2                                                                                                                                               |                           | Open Elective -III                                              | Open Elective   | 3        | 0        | 0         | 30                 | 20        | 50         | 25         | 100          |            | 150        | 3         |
| 3                                                                                                                                               | BMICSE0851                | Computer Vision Lab                                             | Mandatory       | 0        | 0        | 2         |                    |           |            | 100        |              | 25         | 50         | 1         |
| 4                                                                                                                                               | BMICSE0858/<br>BMICSE0859 | Capstone Project/<br>Industrial Internship                      | Mandatory       | 0        | 0        | 18        |                    |           |            |            |              | 300        | 400        | 9         |
| 5                                                                                                                                               | BNC0802/<br>BNC0801       | CRM Fundamentals/<br>Foundations of<br>Entrepreneurship         | Mandatory       | 2        | 0        | 0         | 30                 | 20        | 50         |            | 50           |            | 100        | NA        |
|                                                                                                                                                 |                           | *Massive Open Online Courses<br>(For M.Tech. Int. Hons. Degree) | *MOOCs          |          |          |           |                    |           |            |            |              |            |            |           |
|                                                                                                                                                 |                           | <b>TOTAL</b>                                                    |                 | <b>8</b> | <b>0</b> | <b>20</b> | <b>90</b>          | <b>60</b> | <b>150</b> | <b>125</b> | <b>250</b>   | <b>325</b> | <b>850</b> | <b>16</b> |
| <b>Mini Project or Internship (3-4 weeks) shall be conducted during summer break after VI semester and will be assessed during VII semester</b> |                           |                                                                 |                 |          |          |           |                    |           |            |            |              |            |            |           |

**Abbreviation Used:**

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam.,  
PE: Practical End Semester Exam, CE: Core Elective, OE: Open Elective, DE: Departmental Elective, CA: Compulsory Audit,  
MOOCs: Massive Open Online Courses.

**\* List of MOOCs (Infosys) Based Recommended Courses for Fourth year M. Tech Int Students**

| S. No. | Subject Code | Course Name                            | University/ Industry Partner Name      | N. of Hours | Credits |
|--------|--------------|----------------------------------------|----------------------------------------|-------------|---------|
| 1.     | BMC0158      | Building Apps Powered by Generative AI | NASSCOM                                | 30h         | 2       |
| 2.     | BMC0109      | Mobile App Development using Flutter   | Infosys Wingspan (Infosys Springboard) | 44h 37m     | 3.5     |
| 3.     | BMC0159      | Angular                                | Infosys Wingspan (Infosys Springboard) | 36h 43m     | 3       |
| 4.     | BMC0160      | Decision Trees using Python            | Infosys Wingspan (Infosys Springboard) | 10h 47m     | 0.5     |
| 5.     | BMC0161      | Azure Devops                           | Infosys Wingspan (Infosys Springboard) | 14h 6m      | 1       |

**List of Open Elective: -**

| S. No. | Subject Code | Name of open Elective Subjects | Type of Subject   | Subject offered to Program           | Semester |
|--------|--------------|--------------------------------|-------------------|--------------------------------------|----------|
| 1      | BOE0872      | Nano Technology                | Open Elective-III | All Programs except BT               | 7        |
| 2      | BOE0873      | Wireless communication         | Open Elective-III | All Programs except<br>EC,ME,BT, IOT | 7        |
| 3      | BOE0871      | Industry 4.0                   | Open Elective-IV  | All Programs except ME               | 8        |

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**AICTE Guidelines in Model Curriculum:**

A student will be eligible to get Under Graduate 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

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             |                |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------------------|------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------------------------------|-------------|----------------|--|
|                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                                                                              |            |            | <b>NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY</b><br><b>GREATER NOIDA-201306</b><br><b>(An Autonomous Institute)</b><br><b>School of Computer Science and Information Technology</b> |            |            |            |            |             |             |             |                                     |             |                |  |
| <b>Course Code:</b> BMICSE0702                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                                                                              |            |            | <b>Course Name:</b> Research Process and Methodology                                                                                                                                    |            |            |            |            | <b>L</b>    | <b>T</b>    | <b>P</b>    | <b>C</b>                            |             |                |  |
| <b>Course Offered in:</b> M.Tech Int. (CSE)                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            | <b>3</b>    | <b>0</b>    | <b>0</b>    | <b>3</b>                            |             |                |  |
| <b>Prerequisite:</b> Familiarity with networking concepts, cybersecurity principles, and mobile application development.                                                                                                                                                                                                                                                                                                                                                                           |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             |                |  |
| <b>Course Objectives:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             |                |  |
| The course objective is to analyse the concept / fundamentals of research and apply research design methods to develop analysis and technical paper writing skills.                                                                                                                                                                                                                                                                                                                                |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             |                |  |
| <b>Course Outcome:</b> After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                                                                                                                                 |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             | <b>Bloom's Knowledge Level (KL)</b> |             |                |  |
| <b>CO1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | Understand the concept/ fundamentals of different types of research                          |            |            |                                                                                                                                                                                         |            |            |            |            |             |             | <b>K1</b>   |                                     |             |                |  |
| <b>CO2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | Analyze relevant research design technique for research process                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             | <b>K3</b>   |                                     |             |                |  |
| <b>CO3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | Apply appropriate Data Collection technique                                                  |            |            |                                                                                                                                                                                         |            |            |            |            |             |             | <b>K4</b>   |                                     |             |                |  |
| <b>CO4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | Evaluate statistical analysis which includes various parametric test and non-parametric test |            |            |                                                                                                                                                                                         |            |            |            |            |             |             | <b>K4</b>   |                                     |             |                |  |
| <b>CO5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | Create research paper and publish ethically                                                  |            |            |                                                                                                                                                                                         |            |            |            |            |             |             | <b>K4</b>   |                                     |             |                |  |
| <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          | 3                                                                                            | -          | 2          | -                                                                                                                                                                                       | -          | -          | 2          | -          | 1           | -           | 2           | 3                                   | 2           | 1              |  |
| <b>CO2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3          | 3                                                                                            | 2          | 3          | 2                                                                                                                                                                                       | -          | -          | 2          | -          | 2           | 1           | 2           | 3                                   | 3           | 2              |  |
| <b>CO3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3          | 3                                                                                            | 3          | 2          | 3                                                                                                                                                                                       | 2          | -          | -          | -          | 2           | 1           | 2           | 3                                   | 3           | 2              |  |
| <b>CO4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3          | 3                                                                                            | 3          | 3          | 2                                                                                                                                                                                       | -          | -          | 2          | -          | 2           | 2           | 2           | 3                                   | 3           | 2              |  |
| <b>CO5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2          | 2                                                                                            | -          | 2          | -                                                                                                                                                                                       | 3          | 3          | 3          | 1          | 3           | 3           | 3           | 3                                   | 3           | 3              |  |
| <b>Course Contents / Syllabus</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             |                |  |
| <b>Unit 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                                                                              |            |            | <b>Introduction to Research</b>                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             | <b>8 hours</b> |  |
| Definition, objective and motivation of research, types and approaches of research, Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research methods versus Methodology, significance of research, criteria of good research. Research Process. Conceptualization and formulation of research problems.                                                                                                                               |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             |                |  |
| <b>Unit 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                                                                              |            |            | <b>Research Formulation and Design</b>                                                                                                                                                  |            |            |            |            |             |             |             |                                     |             | <b>8 hours</b> |  |
| Research process and steps involved, Definition and necessity of research problem. Importance and objective of Literature review, locating relevant literature, Reliability of a source, writing a survey and identifying the research problem, Literature Survey, Research Design, Methods of research design. Defining the methodology: Deciding the units of analysis, Interpreting the findings.                                                                                               |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             |                |  |
| <b>Unit 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                                                                              |            |            | <b>Data Collection</b>                                                                                                                                                                  |            |            |            |            |             |             |             |                                     |             | <b>8 hours</b> |  |
| Classification of Data accepts of method validation, Methods of Data Collection, Collection of primary and secondary data, sampling, need of sampling, sampling theory and Techniques, steps in sampling design, different types of sample designs, ethical considerations in research. Data Interpretation: Descriptive statistics and inferential statistics                                                                                                                                     |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             |                |  |
| <b>Unit 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                                                                              |            |            | <b>Data Analysis</b>                                                                                                                                                                    |            |            |            |            |             |             |             |                                     |             | <b>8 hours</b> |  |
| Processing Operations, Data analysis, Types of analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis Testing, Data processing software (e.g. SPSS etc.), statistical inference, Chi-Square Test, Analysis of variance (ANOVA) and covariance, Data Visualization – Monitoring Research Experiments. Data processing software, Correlation and regression analysis – discriminate analysis – factor analysis – cluster analysis, measures of relationship. |            |                                                                                              |            |            |                                                                                                                                                                                         |            |            |            |            |             |             |             |                                     |             |                |  |
| <b>Unit 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                                                                              |            |            | <b>Technical Writing and Reporting of Research</b>                                                                                                                                      |            |            |            |            |             |             |             |                                     |             | <b>8 hours</b> |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                        |                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing, citation of Journals and Impact factor, Types of Indexing. Significance of conferences and their ranking, plagiarism, IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper. |                                                                                                                                                                                                                                                                                                                        |                                  |
| <b>Total Lecture Hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                        | <b>40 hours</b>                  |
| <b>Textbook:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                        |                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                        | <b>Author</b>                    |
| 1. Research Methodology Methods and Techniques”, New Age International publishers,5th Edition, 2023.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                        | C. R. Kothari, Gaurav Garg       |
| 2. Research Methodology: A Step-by-Step Guide for Beginners, SAGE Publication, 4 <sup>th</sup> Edition, 2023.                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                        | Ranjit Kumar                     |
| 3. Research Methodology, Vikas Publication,2 <sup>nd</sup> Edition,2018.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                        | Deepak Chawla, Neena Sondhi      |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                        |                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                        | <b>Author</b>                    |
| 1. Business Research Methods, TMGH, 12th edition, 2018                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                        | Donald Cooper & Pamela Schindler |
| 2. Research design: Qualitative, quantitative, and mixed methods approach sage publications,5 <sup>th</sup> Edition, 2018                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                        | Creswell, John W                 |
| <b>Self-Study Content Links:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                        | <b>Duration (in Hrs)</b>         |
| <b>MOOCs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01458327937738342431948/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01458327937738342431948/overview</a>                                                                                                          | 4 hrs                            |
| <b>Video Lectures</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1. <a href="https://nptel.ac.in/courses/1211060">https://nptel.ac.in/courses/1211060</a><br>2. <a href="https://nptel.ac.in/courses/121106007">https://nptel.ac.in/courses/121106007</a>                                                                                                                               | 35 hrs                           |
| <b>Web References</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1. <a href="https://www.scribbr.com/category/research-paper/">https://www.scribbr.com/category/research-paper/</a><br>2. <a href="https://www.researchgate.net/publication/222527002_How_to_Write_a_Paper_for_Publication">https://www.researchgate.net/publication/222527002_How_to_Write_a_Paper_for_Publication</a> | 5 Hrs                            |
| Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                        |                                  |



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**GREATER NOIDA-201306**  
**(An Autonomous Institute)**  
**School of Computer Science and Information Technology**

|                                 |                                             |          |          |          |          |
|---------------------------------|---------------------------------------------|----------|----------|----------|----------|
| <b>Course Code:</b> BMICSAI0702 | <b>Course Name:</b> ARTIFICIAL INTELLIGENCE | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|---------------------------------|---------------------------------------------|----------|----------|----------|----------|

|                                            |  |          |          |          |          |
|--------------------------------------------|--|----------|----------|----------|----------|
| <b>Course Offered in:</b> M.Tech Int (CSE) |  | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |
|--------------------------------------------|--|----------|----------|----------|----------|

**Pre-requisite:** Basic Knowledge of Transform techniques

**Course Objectives:**

Introductory knowledge of historical perspective of AI and its foundations and familiarity with principles of AI toward problem solving, inference, perception, knowledge representation, and learning. Acquiring the knowledge of various forms of learning and computation statistics.

|                                                                                    |                              |
|------------------------------------------------------------------------------------|------------------------------|
| <b>Course Outcome:</b> After completion of the course, the student will be able to | Bloom's Knowledge Level (KL) |
|------------------------------------------------------------------------------------|------------------------------|

|            |                                                                                                                                                                  |           |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>CO1</b> | After completion of this course students will be able to Understand fundamental understanding of the history of artificial intelligence (AI) and its foundations | <b>K2</b> |
| <b>CO2</b> | Apply principles of AI in solutions that require problem solving, inference and perception.                                                                      | <b>K3</b> |
| <b>CO3</b> | Explain strong familiarity with a number of important AI techniques, including in particular intelligent search methods and solutions                            | <b>K3</b> |
| <b>CO4</b> | Apply the concepts of knowledge & reasoning of predicate logic and representing knowledge using rules, Probabilistic reasoning                                   | <b>K3</b> |
| <b>CO5</b> | Assess/ Evaluate critically the techniques presented and apply them to real world                                                                                | <b>K5</b> |

**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 | PSO3 |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>CO1</b>    | 3   | 3   | 2   | 2   | 3   | -   | -   | 1   | -   | -    | -    | 1    | 3    | 1    | 2    |
| <b>CO2</b>    | 3   | 3   | 2   | 2   | 3   | -   | -   | 1   | -   | -    | -    | 2    | 3    | 1    | 2    |
| <b>CO3</b>    | 2   | 2   | -   | 1   | 2   | -   | -   | -   | -   | -    | -    | 2    | 3    | 1    | 3    |
| <b>CO4</b>    | 3   | 3   | -   | 2   | 3   | -   | -   | -   | -   | -    | -    | 2    | 3    | 1    | 3    |
| <b>CO5</b>    | 3   | 3   | 2   | 2   | 3   | -   | -   | 1   | -   | -    | -    | 3    | 3    | 1    | 2    |

**Course Contents / Syllabus**

|               |                     |                |
|---------------|---------------------|----------------|
| <b>Unit 1</b> | <b>INTRODUCTION</b> | <b>9 hours</b> |
|---------------|---------------------|----------------|

Introduction to Artificial Intelligence, Historical developments of Artificial Intelligence, well defined learning problems, Designing a Learning System, Basics of problem-solving: problem representation paradigms, state space, Problem reduction, Constraint satisfaction, Applications of AI.

|               |                          |                |
|---------------|--------------------------|----------------|
| <b>Unit 2</b> | <b>SEARCH TECHNIQUES</b> | <b>9 hours</b> |
|---------------|--------------------------|----------------|

Searching for solutions, Uninformed Search Strategies: DFS, BFS, Informed Search Strategies: Local search algorithms and optimistic problems, adversarial Search, Search for games, minimax, Alpha - Beta pruning, Heuristic Search techniques, Hill Climbing, Best-first search, Means Ends Analysis, Iterative deepening Heuristic Search and A\*.

|               |                                           |                |
|---------------|-------------------------------------------|----------------|
| <b>Unit 3</b> | <b>LOGIC AND KNOWLEDGE REPRESENTATION</b> | <b>9 hours</b> |
|---------------|-------------------------------------------|----------------|

Introduction of Logic, Propositional Logic Concepts, Semantic Tableaux and Resolution in Propositional logic, FOPL, Semantic Tableaux and Resolution in FOPL, Logic Programming in Prolog. Production systems and rules for some AI problems: Water Jug Problem, Missionaries-Cannibals Problem, n-Queen problem, monkey banana problem, Travelling Salesman Problem. Knowledge representation, semantic nets, partitioned nets, parallel implementation of semantic nets. Frames, Common Sense reasoning and thematic role frames.

|               |                      |                |
|---------------|----------------------|----------------|
| <b>Unit 4</b> | <b>EXPERT SYSTEM</b> | <b>9 hours</b> |
|---------------|----------------------|----------------|

Architecture of knowledge-Based System, Rule-based systems, Forward and Backward Chaining, Frame Based systems. Architecture of Expert System, Agents and Environment, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

|               |                                   |                |
|---------------|-----------------------------------|----------------|
| <b>Unit 5</b> | <b>PLANNING &amp; UNCERTAINTY</b> | <b>9 hours</b> |
|---------------|-----------------------------------|----------------|

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. Probabilistic Methods, Bayesian Theory, Dempster Shafer Theory, Bayes Network. 19 Evolutionary computations: Swarm Intelligence, ant colony optimization Agents, Intelligent Agents, Structure of Intelligent Agents, Virtual Agents, Multi-agent systems.

Case Study: Health Care, E Commerce, Smart Cities.

| Total Lecture Hours       |     |                                                                                                                                                                                                                                                                                        |           |           |           |                  |         |  |                              | 45 hours |  |
|---------------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|------------------|---------|--|------------------------------|----------|--|
| Textbook                  |     |                                                                                                                                                                                                                                                                                        |           |           |           |                  |         |  |                              |          |  |
| S NO.                     |     | Book Title                                                                                                                                                                                                                                                                             |           |           |           |                  |         |  | Author                       |          |  |
| 1.                        |     | Artificial Intelligence – A Modern Approach”, Pearson Education. Fourth Edition 2021.                                                                                                                                                                                                  |           |           |           |                  |         |  | Stuart Russell, Peter Norvig |          |  |
| 2.                        |     | “Artificial Intelligence”, McGraw-Hill 3rdEdition 2010.                                                                                                                                                                                                                                |           |           |           |                  |         |  | Elaine Rich and Kevin Knight |          |  |
| Reference Books:          |     |                                                                                                                                                                                                                                                                                        |           |           |           |                  |         |  |                              |          |  |
| 1                         |     | Artificial Intelligence and Machine Learning , Dreamtech Press, 1st Edition, 2020                                                                                                                                                                                                      |           |           |           |                  |         |  | P. S. Deshpande              |          |  |
| 2                         |     | Introduction to Artificial Intelligence , Springer, 2nd Revised Edition (English Translation), 2017                                                                                                                                                                                    |           |           |           |                  |         |  | Wolfgang Ertel,              |          |  |
| Self-Study Content Links: |     |                                                                                                                                                                                                                                                                                        |           |           |           |                  |         |  |                              | Duration |  |
| MOOCs                     |     | https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384279663126937623575_shared/overview                                                                                                                                                                                 |           |           |           |                  |         |  | 7 hours                      |          |  |
|                           |     | https://infyspringboard.onwingspan.com/web/en/app/toc/lex_8840337130015322000_shared/overview                                                                                                                                                                                          |           |           |           |                  |         |  | 6 hours                      |          |  |
| Video Lectures            |     | https://www.youtube.com/watch?v=qHhwkV00KJ8&ab_channel=URBS-LabwithRyanUrbanowicz<br>https://www.youtube.com/watch?v=-IO4fPO0rxk&ab_channel=StanfordOnline<br>https://www.youtube.com/watch?v=l-hh51ncgDI<br>https://www.youtube.com/watch?v=adx04dTgJsw&ab_channel=MohammadUmarFarooq |           |           |           |                  |         |  | 20 hours                     |          |  |
| Web References            |     | https://www.cet.edu.in/noticefiles/271_AI%20Lect%20Notes.pdf                                                                                                                                                                                                                           |           |           |           |                  |         |  | -                            |          |  |
| CIE                       |     |                                                                                                                                                                                                                                                                                        |           |           |           |                  | End Sem |  | Total                        |          |  |
| ST1                       | ST2 | ST3                                                                                                                                                                                                                                                                                    | TA1<br>10 | TA2<br>10 | TA3<br>10 | Attendance<br>10 |         |  |                              |          |  |
| 30                        |     |                                                                                                                                                                                                                                                                                        | 20        |           |           |                  | 100     |  | 150                          |          |  |

**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
**GREATER NOIDA-201306**  
**(An Autonomous Institute)**

**School of Computer Science and Information Technology**

|                                             |                                   |          |          |          |          |
|---------------------------------------------|-----------------------------------|----------|----------|----------|----------|
| <b>Course Code:</b> BMICSML0702             | <b>Course Name:</b> Deep Learning | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Offered in:</b> M.Tech Int. (CSE) |                                   | 3        | 0        | 0        | 3        |

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**Pre-requisite:** Python, Machine Learning

**Course Outcome:** After completion of the course, the student will be able to

| Bloom's Knowledge Level (KL) | Question                               | Answer                                                                                                                                                                                                                                                                                                          |
|------------------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                            | What is the main purpose of the study? | The main purpose of the study is to investigate the effect of the proposed system on the performance of the system.                                                                                                                                                                                             |
| 2                            | What are the research objectives?      | The research objectives are to evaluate the performance of the proposed system, to compare the performance of the proposed system with the existing system, and to identify the factors that affect the performance of the proposed system.                                                                     |
| 3                            | What are the research hypotheses?      | The research hypotheses are that the proposed system will have a positive effect on the performance of the system, that the proposed system will perform better than the existing system, and that the performance of the proposed system will be affected by the factors mentioned in the research objectives. |
| 4                            | What are the research methods?         | The research methods are the experimental method, the survey method, and the case study method.                                                                                                                                                                                                                 |
| 5                            | What are the research results?         | The research results are that the proposed system has a positive effect on the performance of the system, that the proposed system performs better than the existing system, and that the performance of the proposed system is affected by the factors mentioned in the research objectives.                   |
| 6                            | What are the research conclusions?     | The research conclusions are that the proposed system is a good solution for the problem, that the proposed system should be implemented, and that the factors mentioned in the research objectives should be considered when implementing the proposed system.                                                 |

|     |                                                                                                     |    |
|-----|-----------------------------------------------------------------------------------------------------|----|
| CO1 | Describe ANN architectures, activation functions, and learning strategies in deep learning.         | K2 |
| CO2 | Discuss CNN, RNN, and Autoencoder architectures for intelligent applications.                       | K2 |
| CO3 | Develop ANN and CNN models for classification and object detection problems.                        | K3 |
| CO4 | Employ RNN, LSTM, and GRU models for sequence analysis and prediction tasks.                        | K3 |
| CO5 | Evaluate Autoencoders and optimization methods for feature extraction and dimensionality reduction. | K4 |

| CO \ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 3   | 1   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 3    | -    | 2    |
| CO2     | 3   | 2   | 3   | 2   | 3   | -   | -   | 1   | 1   | -    | 2    | 1    | 3    | 1    | 2    |
| CO3     | 2   | 3   | 2   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 3    | 1    | 2    |
| CO4     | 3   | 3   | 2   | 2   | 3   | -   | -   | 1   | 1   | -    | 3    | 2    | 3    | -    | 3    |
| CO5     | 3   | 3   | 2   | 3   | 3   | -   | -   | -   | -   | -    | 2    | 2    | 3    | -    | 3    |

## Course Contents / Syllabus

|                 |                     |                 |
|-----------------|---------------------|-----------------|
| <b>Module 1</b> | <b>Introduction</b> | <b>10 hours</b> |
|-----------------|---------------------|-----------------|

**Artificial Neural Network:** Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: Single layer and Multilayer feed forward networks. Various learning techniques; Perception and Convergence rule, Hebb Learning. Perceptron's, Multilayer perceptron, Gradient descent and the Delta rule, Multilayer networks, Derivation of Backpropagation Algorithm Introduction to Deep Learning.

Regularization for Deep Learning -Parameter Norm Penalties, Dataset Augmentation, Noise Robustness, Early Stopping, Dropout, Batch Normalization.

|                 |                                   |                |
|-----------------|-----------------------------------|----------------|
| <b>Module 2</b> | <b>CONVOLUTION NEURAL NETWORK</b> | <b>9 hours</b> |
|-----------------|-----------------------------------|----------------|

Introduction to Computer Vision and CNN, Train a simple convolutional neural net, Explore the design space for convolutional nets, Pooling layer motivation in CNN, Design a convolutional layered application, Understanding and visualizing a CNN, Transfer learning and fine- tuning CNN, Image classification, Text classification, Image classification and hyper-parameter tuning.

|                 |                                    |                |
|-----------------|------------------------------------|----------------|
| <b>Module 3</b> | <b>DETECTION &amp; RECOGNITION</b> | <b>9 hours</b> |
|-----------------|------------------------------------|----------------|

**Object Detection Fundamentals:** Bounding Box and Localization, IoU; **Evaluation metrics:** Precision, Recall, mAP;  
**Real-Time Detection:** YOLO, SSD; **Advanced Object Detection Models:** YOLOv8, RetinaNet; **Object Tracking:** Tracking by Detection, Algorithm: SORT, Deep SORT

|                 |                                  |                |
|-----------------|----------------------------------|----------------|
| <b>Module 4</b> | <b>RECURRENT NEURAL NETWORKS</b> | <b>9 hours</b> |
|-----------------|----------------------------------|----------------|

Sequential Data, Sequence models, Recurrent Neural Network Model, Notation, Back-propagation through time (BTT), Different types of RNNs, Language model and sequence generation, Sampling novel sequences, Vanishing gradients with RNNs, Gated Recurrent Unit (GRU), Long Short-Term Memory (LSTM), Bidirectional RNN, Deep RNNs

|                 |                                       |                |
|-----------------|---------------------------------------|----------------|
| <b>Module 5</b> | <b>AUTO ENCODERS IN DEEP LEARNING</b> | <b>9 hours</b> |
|-----------------|---------------------------------------|----------------|

Definition and Motivation, Architecture of Autoencoder, Loss Functions in Autoencoders, Type of Autoencoder, Variational Autoencoder, Stacked auto-encoders, Sequence Autoencoder: Application of Autoencoder

|                            |  |                                                                                                                                                                                                                       |  |     |  |     |     |     |                                                  |                      |     |  |
|----------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|--|-----|-----|-----|--------------------------------------------------|----------------------|-----|--|
| Total Lecture Hours        |  |                                                                                                                                                                                                                       |  |     |  |     |     |     |                                                  | 46 hours             |     |  |
| Textbook:                  |  |                                                                                                                                                                                                                       |  |     |  |     |     |     |                                                  |                      |     |  |
| S.No                       |  | Book Title                                                                                                                                                                                                            |  |     |  |     |     |     | Author                                           |                      |     |  |
| 1.                         |  | Deep Learning: An MIT Press Book                                                                                                                                                                                      |  |     |  |     |     |     | Ian Goodfellow and Yoshua Bengio Aaron Courville |                      |     |  |
| 2.                         |  | Neural Networks and Deep Learning, Determiation Press,2015,                                                                                                                                                           |  |     |  |     |     |     | Michael Nielson                                  |                      |     |  |
| 3.                         |  | Neural networks: A classroom Approach, Tata McGraw-Hill Education, 2004,                                                                                                                                              |  |     |  |     |     |     | Satish Kumar                                     |                      |     |  |
| Reference Books:           |  |                                                                                                                                                                                                                       |  |     |  |     |     |     |                                                  |                      |     |  |
| S.No                       |  | Book Title                                                                                                                                                                                                            |  |     |  |     |     |     | Author                                           |                      |     |  |
| 1.                         |  | Deep Learning with Python, Manning publications, 2018,                                                                                                                                                                |  |     |  |     |     |     | Francois Chollet                                 |                      |     |  |
| 2.                         |  | Advanced Deep Learning with Keras, PACKT Publications, 2018,                                                                                                                                                          |  |     |  |     |     |     | Rowel Atienza                                    |                      |     |  |
| 3.                         |  | Machine Learning: A Probabilistic Perspective, MIT Press, 2012,                                                                                                                                                       |  |     |  |     |     |     | Murphy, K. P                                     |                      |     |  |
| 4.                         |  | The Elements of Statistical Learning, 2nd Edition, Springer, 2009.                                                                                                                                                    |  |     |  |     |     |     | Hastie, T., Tibshirani, R., and Friedman, J      |                      |     |  |
|                            |  |                                                                                                                                                                                                                       |  |     |  |     |     |     |                                                  |                      |     |  |
| Self-Study Contents Links: |  |                                                                                                                                                                                                                       |  |     |  |     |     |     |                                                  | Duration             |     |  |
| MOOCs                      |  | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01274814254931148859_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01274814254931148859_shared/overview</a> |  |     |  |     |     |     |                                                  | 34 hour<br>51 min    |     |  |
| Video Lectures             |  | <a href="#">YOLOv8 Full Tutorial Playlist   Object Detection, Segmentation &amp; Classification Explained - YouTube:</a>                                                                                              |  |     |  |     |     |     |                                                  | 10<br>Hour<br>30 min |     |  |
|                            |  |                                                                                                                                                                                                                       |  |     |  |     |     |     |                                                  |                      |     |  |
| Web References             |  | <a href="https://www.datacamp.com/blog/yolo-object-detection-explained">https://www.datacamp.com/blog/yolo-object-detection-explained</a>                                                                             |  |     |  |     |     |     |                                                  | 2 hour               |     |  |
| CIE                        |  |                                                                                                                                                                                                                       |  |     |  |     | ESE |     | Total                                            |                      |     |  |
| ST1                        |  | ST2                                                                                                                                                                                                                   |  | ST3 |  | TA1 | TA2 | TA3 | Attendance                                       |                      |     |  |
| 10                         |  |                                                                                                                                                                                                                       |  |     |  | 10  | 10  | 10  | 10                                               |                      |     |  |
| 30                         |  |                                                                                                                                                                                                                       |  |     |  |     | 20  |     | 100                                              |                      | 150 |  |
|                            |  |                                                                                                                                                                                                                       |  |     |  |     |     |     |                                                  |                      |     |  |

**Total Hours: 30 hrs.**

|                                                                                   |                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                      |                                    |   |   |   |   |
|--------------------------------------|------------------------------------|---|---|---|---|
| LAB Course Code: BMICSML0752         | LAB Course Name: Deep Learning Lab | L | T | P | C |
| Course Offered in: M.Tech Int. (CSE) |                                    | 0 | 0 | 2 | 1 |

**Pre-requisite:** Python Programming

**Course Objectives:**

The course aims to develop practical skills in data preprocessing, feature engineering, supervised and unsupervised machine learning

**Course Outcome:** After completion of the course, the student will be able to  
Level

**Bloom Knowledge**

|     |                                                                                                 |    |
|-----|-------------------------------------------------------------------------------------------------|----|
| CO1 | Outline ANN implementation, optimization, and regularization techniques.                        | K2 |
| CO2 | Construct CNN and transfer learning models for image classification and detection tasks.        | K3 |
| CO3 | Examine RNN, LSTM, GRU, and Autoencoder models for sequence learning and feature representation | K4 |

**CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3   | 3   | 2   | 2   | 3   | 1   | -   | 1   | 1   | -    | 2    | -    | 3    | 2    | 2    |
| CO2 | 3   | 3   | 3   | 3   | 3   | 1   | -   | 1   | 1   | 1    | 2    | 1    | 3    | 2    | 3    |
| CO3 | 3   | 3   | 3   | 3   | 3   | 1   | -   | 1   | 1   | 1    | 3    | 1    | 3    | 3    | 2    |

**List Of Practical's (Indicative & Not Limited To)**

| S.No | Experiment (Case Study Based Question)                                                                                                                                                                | CO Mapping |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1    | Build and train an Artificial Neural Network using a custom dataset (e.g., digit or medical classification).                                                                                          | CO1        |
| 2    | Write a program to Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.                                                    | CO1        |
| 3    | Demonstrate dropout and batch normalization in training a deep network.                                                                                                                               | CO1        |
| 4    | Visualize the behavior of different activation functions (sigmoid, softmax, ReLU, leaky ReLU, ELU, and tanh). Compare their outputs by plotting how each activation function transforms input values. | CO1        |
| 5    | Train a CNN on image data (e.g., CIFAR-10 or MNIST) and evaluate performance.                                                                                                                         | CO2        |
| 6    | Apply Transfer Learning using pre-trained models like VGG16 or ResNet on a custom dataset.                                                                                                            | CO2        |
| 7    | Perform hyperparameter tuning (batch size, learning rate, filters) on a CNN                                                                                                                           | CO2        |
| 8    | Implement Precision, Recall, F1 Score for a classification task using confusion matrix.                                                                                                               | CO2        |
| 9    | Design a simple object detection model using YOLOv8 on sample images.                                                                                                                                 | CO2        |
| 10   | Implement a basic RNN for text generation or sequence prediction.                                                                                                                                     | CO3        |
| 11   | Build LSTM/GRU-based language model (e.g., sentiment analysis or next-word prediction).                                                                                                               | CO3        |
| 12   | Implement Long Short-Term Memory Networks using sample data.                                                                                                                                          | CO3        |
| 13   | Implement a Denoising Autoencoder.                                                                                                                                                                    | CO3        |
| 14   | Implement an Autoencoder on MNIST to reconstruct images.                                                                                                                                              | CO3        |
| 15   | Implement a Variational Autoencoder (VAE) on the MNIST dataset for image generation                                                                                                                   | CO3        |

**Total Hours: 30 Hours**

|                                                                                                                                                       |                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>NIET</b><br>Greater Noida<br><small>Autonomous Institute</small> | <b>NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY</b><br><b>GREATER NOIDA-201306</b><br><b>(An Autonomous Institute)</b><br><b>School of Computer Science and Information Technology</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                             |                                                     |          |          |          |          |
|---------------------------------------------|-----------------------------------------------------|----------|----------|----------|----------|
| <b>Course Code:</b> BNC0701                 | <b>Course Name:</b> Foundations of Entrepreneurship | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Offered in:</b> M.Tech Int. (CSE) |                                                     | <b>2</b> | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-requisite:**

**Course Objectives:**

The objective of this course is to make students understand and explore the dimensions of entrepreneurship; develop an understanding of intellectual property rights and be familiar with the financial support associated with new venture startups, Understand the various sources of idea generation and screening and to create awareness on the policy framework for promoting entrepreneurship and providing finance to entrepreneurs.

**Course Outcome: After completion of the course, the student will be able to**

**Bloom's Knowledge Level (KL)**

|             |                                                                                                                |           |
|-------------|----------------------------------------------------------------------------------------------------------------|-----------|
| <b>CO-1</b> | Develop an understanding of basic concepts of entrepreneurship.                                                | <b>K2</b> |
| <b>CO-2</b> | Develop an understanding on fundamentals of Intellectual Property Rights.                                      | <b>K2</b> |
| <b>CO-3</b> | Evaluating and understanding a holistic approach of launching a new business venture.                          | <b>K4</b> |
| <b>CO-4</b> | Understanding of converting an idea to an opportunity and various funding sources.                             | <b>K2</b> |
| <b>CO-5</b> | Develop knowledge on Entrepreneurial Finance, Assistance and the role of Entrepreneurial Development Agencies. | <b>K5</b> |

**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 | PSO3 |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>CO1</b>    | 2   | 2   | 1   | -   | -   | 2   | 2   | 1   | 1   | 2    | 3    | 1    | 1    | 2    | 3    |
| <b>CO2</b>    | 2   | 2   | 1   | -   | -   | 2   | 3   | -   | 1   | 1    | 2    | 1    | 1    | 3    | 2    |
| <b>CO3</b>    | 2   | 3   | 3   | 2   | 1   | 2   | 2   | 2   | 2   | 3    | 2    | 2    | 2    | 3    | 3    |
| <b>CO4</b>    | 2   | 3   | 3   | 1   | 1   | 2   | 2   | 2   | 2   | 3    | 2    | 2    | 2    | 3    | 3    |
| <b>CO5</b>    | 2   | 2   | 2   | 1   | 1   | 2   | 2   | 2   | 2   | 3    | 2    | 2    | 2    | 2    | 3    |

**Course Contents / Syllabus**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                         |                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------|
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Introduction to Entrepreneurship</b> | <b>5 hours</b> |
| <b>About Entrepreneurship:</b> Concept of Entrepreneurship - Role of Entrepreneurship in Economic Development -Entrepreneurial decision process – Entrepreneurial traits, types, culture and structure, competing theories of Entrepreneurship<br><b>About Entrepreneurs:</b> — Qualities of a successful entrepreneur - Entrepreneurial motivation –Corporate Entrepreneurship and Intrapreneurship                                                                                                                                                                                 |                                         |                |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Intellectual Property Rights</b>     | <b>6 hours</b> |
| <b>About IPR:</b> Introduction to intellectual property rights (IPR), intellectual property and its protection, Forms of Protection depending on the product; Patent, copyright, trademark, design know-how, trade secrets, etc.                                                                                                                                                                                                                                                                                                                                                     |                                         |                |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Launching a New Venture</b>          | <b>8 hours</b> |
| <b>Business Plan:</b> The business plan, Business Planning Process: elements of business planning, preparation of project plan, components of an ideal business plan – market plan, financial plan, operational plan<br><br><b>Feasibility Analysis: Feasibility Analysis</b> – aspects and methods: Economic, financial, and market analysis - and technological feasibility.<br><br>Forms of ownership and understanding phases of Business unit: Various Forms of business ownership, Registration of business units; start-up to going IPO; revival, exit, and end to a venture. |                                         |                |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Idea Generation and Screening</b>    | <b>7 hours</b> |

|                                                                                                                                                                                                          |                                                                                                                                                                                 |                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <b>Methods of Generating Ideas:</b> Linear techniques – Morphological Analysis, Attribute Listing, Scamper, Alternative Scenarios, Forced Association, Value Analysis                                    |                                                                                                                                                                                 |                                                 |
| <b>Product Planning and Development Process:</b> Establishing evaluation criteria, idea Stage, Concept Stage, Product Development Stage and Test marketing and commercialization.                        |                                                                                                                                                                                 |                                                 |
| <b>Module-5</b>                                                                                                                                                                                          | <b>Entrepreneurial Finance, Assistance and Entrepreneurial Development Agencies</b>                                                                                             | <b>4 hours</b>                                  |
| <b>Sources of finance:</b> Banks and financial institutions – IFCI, ICICI, IDBI and SIDBI), financing of Small Business<br>Role of central government and State Government in promoting entrepreneurship |                                                                                                                                                                                 |                                                 |
| <b>Entrepreneurial Development Agencies:</b> Overview of MSME policy of government in India. Role of agencies assisting Entrepreneur Development Institute (EDI).                                        |                                                                                                                                                                                 |                                                 |
|                                                                                                                                                                                                          |                                                                                                                                                                                 |                                                 |
| <b>Total Lecture Hours</b>                                                                                                                                                                               |                                                                                                                                                                                 | <b>30 hours</b>                                 |
| <b>Textbook:</b>                                                                                                                                                                                         |                                                                                                                                                                                 |                                                 |
| <b>S.NO</b>                                                                                                                                                                                              | <b>Title</b>                                                                                                                                                                    | <b>Authors Name</b>                             |
| 1.                                                                                                                                                                                                       | Entrepreneurship”, Mc.Graw- Hill, 2023                                                                                                                                          | . Hisrich, R.D., Peters, M.P., & Shepherd, D. A |
| 2.                                                                                                                                                                                                       | Entrepreneurship: the art, science, and process for success”. McGraw-Hill, 2021                                                                                                 | Bamford, C.E., & Burton, G. D                   |
| <b>Reference Books:</b>                                                                                                                                                                                  |                                                                                                                                                                                 |                                                 |
| <b>Book Details</b>                                                                                                                                                                                      |                                                                                                                                                                                 | <b>Authors Name</b>                             |
| 1.                                                                                                                                                                                                       | “How to start your own business : ... and make it work”.,                                                                                                                       | Rickman, C. D                                   |
| 2.                                                                                                                                                                                                       | Entrepreneurship successfully launching new ventures” Harlow London New York, Ny Boston [U.A.] Pearson, 6th ed., 2019                                                           | Barringer, B. R., & R Duane Ireland             |
|                                                                                                                                                                                                          |                                                                                                                                                                                 |                                                 |
| <b>Self-Study Content Links:</b>                                                                                                                                                                         |                                                                                                                                                                                 | <b>Duration (in Hrs)</b>                        |
| <b>MOOCs</b>                                                                                                                                                                                             | <a href="https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg80">https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg80</a>                                   | 20 hours                                        |
|                                                                                                                                                                                                          | <a href="https://nptel.ac.in/courses/110106141">https://nptel.ac.in/courses/110106141</a>                                                                                       | 20 hours                                        |
| <b>Video Lectures</b>                                                                                                                                                                                    | <a href="https://www.youtube.com/watch?v=UEngvxZ11sw">https://www.youtube.com/watch?v=UEngvxZ11sw</a>                                                                           | 5 hours                                         |
| <b>Web References</b>                                                                                                                                                                                    | <a href="https://www.researchgate.net/publication/326190494_Entrepreneurship_lecture_note">https://www.researchgate.net/publication/326190494_Entrepreneurship_lecture note</a> |                                                 |

|                                                                                   |                                                                                                                                                                                                                                                                        |
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|  | <p align="center"><b>NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY</b></p> <p align="center"><b>GREATER NOIDA-201306</b></p> <p align="center"><b>(An Autonomous Institute)</b></p> <p align="center"><b>School of Computer Science and Information Technology</b></p> |
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|                                             |                                      |          |          |          |          |
|---------------------------------------------|--------------------------------------|----------|----------|----------|----------|
| <b>Course Code:</b> BNC0702                 | <b>Course Name:</b> CRM Fundamentals | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Offered in:</b> M.Tech Int. (CSE) |                                      | <b>2</b> | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-requisite:** None

**Course Objectives:**

This course is designed to help in understanding the fundamentals of CRM. It will help in providing better services for Sales, Marketing and Customer Relations in an Enterprise. To make the students understand the organizational need, benefits and process of creating long-term value for individual customers. To disseminate knowledge regarding the concept of e-CRM and e-CRM technologies. To enable the students understand the technological and human issues relating to implementation of Customer Relationship Management in the organizations.

| <b>Course Outcome: After completion of the course, the student will be able to</b> |                                                                                 | <b>Bloom's Knowledge Level (KL)</b> |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------|
| <b>CO-1</b>                                                                        | Understand the basic concepts of Customer relationship management.              | <b>K2</b>                           |
| <b>CO-2</b>                                                                        | To understand strategy and framework of Customer relationship management.       | <b>K2</b>                           |
| <b>CO-3</b>                                                                        | Learn basics of Cloud Based Customer relationship management.                   | <b>K1</b>                           |
| <b>CO-4</b>                                                                        | Understand Customer relationship management in context with business use cases. | <b>K3</b>                           |
| <b>CO-5</b>                                                                        | Understand implementation basics of CRM.                                        | <b>K3</b>                           |

**CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)**

| <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>PO11</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
|----------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO1</b>           | 3          | 1          | -          | -          | 1          | -          | 1          | -          | -          | -           | 2           | 1           | 1           | 1           | 2           |
| <b>CO2</b>           | 2          | 3          | 2          | -          | 1          | 2          | 2          | 1          | 1          | 2           | 2           | 1           | 2           | 2           | 2           |
| <b>CO3</b>           | 2          | 2          | 1          | 1          | 3          | -          | 1          | -          | -          | 1           | 2           | 2           | 3           | 1           | 2           |
| <b>CO4</b>           | 2          | 3          | 3          | 2          | 2          | 2          | 2          | 2          | 2          | 2           | 2           | 2           | 2           | 3           | 2           |
| <b>CO5</b>           | 2          |            | 3          | 2          | 3          | 1          | 1          | 2          | 2          | 32          | 2           | 2           | 3           | 2           | 3           |

**Course Contents / Syllabus**

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                         |                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------|
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Introduction</b>                     | <b>8 hours</b> |
| CRM- definition, history, goals. Sources of CRM value. Components of CRM: people, process, technology. Evolution of CRM: marketing and its principles, customer relations to CRM. Dynamics of Customer Supplier Relationships, Nature and context of CRM, Strategy and Organization of CRM: strategy, The relationship-oriented organization: Mission, Culture, Structure, People, Communication & Information Systems.              |                                         |                |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>CRM Strategy and Framework</b>       | <b>8 hours</b> |
| Developing a CRM strategy. Customer oriented (C in CRM), Relationship driven, 360 degree view of customer.                                                                                                                                                                                                                                                                                                                           |                                         |                |
| CRM system features- functions, application, benefits and solutions. Importance of loyalty- active, passive, split, shifting and switchers, customer profiling, customer segmentation model, Customer Experience, relationship marketing and journey, Case study.                                                                                                                                                                    |                                         |                |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Solution Design and Architecture</b> | <b>8 hours</b> |
| CRM system solution- specifications, Data Analysis, Solution Requirements. Types of CRM- On-Premise, cloud based. Pros and Cons of each. Integration CRM with other enterprise applications. The Technology of CRM: Data warehouses and customer relationships, creating data mart model, components of operational data warehouse.                                                                                                  |                                         |                |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>CRM for Business</b>                 | <b>8 hours</b> |
| CRM in Sales, Service, Marketing, E-commerce. Social Customer Relationship Management. Analytical CRM: Predictive Analytics vs Operational Analytics. Channel Partner Relationship management, Collaborative CRM (using data pooling), Business Benefits of Cloud Based System, SLAs, Practical Challenges                                                                                                                           |                                         |                |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>CRM implementation</b>               | <b>8 hours</b> |
| Building CRM roadmaps: current processes, customers, strategic goals, technology issues, pilot and proof of concept projects. Preliminary Roadmap and its template, developing roadmap midstream. Design stage, custom development, integration, reporting, data migration, and implementation, testing, launching and application management. Introduction to following CRM tools: ZOHO, Pega, Microsoft Dynamics 365, Sales force. |                                         |                |

|                           |                                                                                                                                                                                                                             | Total Lecture Hours                               | 40 hours          |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------|
| Textbook:                 |                                                                                                                                                                                                                             |                                                   |                   |
| S.NO                      | Title                                                                                                                                                                                                                       | Authors Name                                      |                   |
| 1.                        | “CRM Fundamentals”, Apress, 2011.                                                                                                                                                                                           | Scott Kostojohn, Brian Paulen, and Mathew Johnson |                   |
| 2.                        | “Customer Relationship Management- How to develop and execute a CRM strategy”, Business Expert Press, 2021.                                                                                                                 | Michael Pearce                                    |                   |
| Reference Books:          |                                                                                                                                                                                                                             |                                                   |                   |
| Book Details              |                                                                                                                                                                                                                             | Authors Name                                      |                   |
| 1.                        | “The CRM Handbook-A Business Guide to Customer Relationship” Management, Addison-Wesley (for case studies)                                                                                                                  | Jill Dyché                                        |                   |
| 2.                        | “Customer Relationship Management Systems handbook”, CRC Press Company                                                                                                                                                      | Duane E Sharp. Auerbach                           |                   |
|                           |                                                                                                                                                                                                                             |                                                   |                   |
| Self-Study Content Links: |                                                                                                                                                                                                                             |                                                   | Duration (in Hrs) |
| MOOCs                     | <a href="https://onlinecourses.nptel.ac.in/noc20_mg57/preview">https://onlinecourses.nptel.ac.in/noc20_mg57/preview</a>                                                                                                     | 12 hours                                          |                   |
|                           | <a href="https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384353007332556840240_shared/overview">https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384353007332556840240_shared/overview</a> | 3 hours                                           |                   |
| Video Lectures            | <a href="https://www.youtube.com/watch?v=Ci_qMjf8JRg&amp;t=40s">https://www.youtube.com/watch?v=Ci_qMjf8JRg&amp;t=40s</a>                                                                                                   | 1 hour                                            |                   |
|                           | <a href="https://www.youtube.com/watch?v=bqW8-TvWvqk">https://www.youtube.com/watch?v=bqW8-TvWvqk</a>                                                                                                                       | 1 hour 30 min                                     |                   |
| Web References            | <a href="https://backup.pondiuni.edu.in/sites/default/files/CRM-260214.pdf">https://backup.pondiuni.edu.in/sites/default/files/CRM-260214.pdf</a>                                                                           |                                                   |                   |

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|                                             |                                                                  |          |          |          |          |
|---------------------------------------------|------------------------------------------------------------------|----------|----------|----------|----------|
| <b>Course Code:</b> BMICSE0713              | <b>Course Name:</b> Web Development using MERN STACK with Devops | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Offered in:</b> M.Tech Int. (CSE) |                                                                  | 3        | 0        | 0        | 3        |

**Pre-requisite:** Basic knowledge of HTML, CSS, JavaScript, and fundamental programming concepts in any language.

**Course Objectives:** This course aims to equip students with practical skills in building dynamic full-stack applications using React, Node.js, Express, and MongoDB. It also introduces DevOps principles, Agile methodologies, and CI/CD automation using tools like GitHub, Jenkins, Docker, and Kubernetes.

**Course Outcome:** After completion of the course, the student will be able to

Bloom's Knowledge Level (KL)

|            |                                                                                                                                                |           |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>CO1</b> | Apply the knowledge of ES6 that are vital to implement react application over the web.                                                         | <b>K3</b> |
| <b>CO2</b> | Implement and Understand the impact of web designing by database connectivity with Mongoddb.                                                   | <b>K3</b> |
| <b>CO3</b> | Explain, analyze and apply the role of server side scripting language like Nodejs and Express js framework.                                    | <b>K4</b> |
| <b>CO4</b> | Apply the benefits of DevOps over other software development processes to Gain insights into the DevOps environment.                           | <b>K4</b> |
| <b>CO5</b> | Demonstrate popular open-source tools with features and associated terminology used to perform Continuous Integration and Continuous Delivery. | <b>K3</b> |

**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 | PSO3 |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>CO1</b>    | 3   | 2   | 3   | 1   | 3   | 1   | 1   | -   | 1   | -    | 2    | 1    | 2    | 2    | 3    |
| <b>CO2</b>    | 3   | 2   | 3   | 1   | 3   | 1   | 1   | -   | 1   | -    | 2    | 1    | 2    | 2    | 3    |
| <b>CO3</b>    | 3   | 2   | 3   | 1   | 3   | 1   | 1   | 2   | 1   | 2    | 2    | 1    | 2    | 2    | 2    |
| <b>CO4</b>    | 3   | 1   | 1   | 1   | 3   | 2   | -   | -   | 2   | 1    | 2    | 2    | 2    | 1    | 2    |
| <b>CO5</b>    | 3   | 1   | 1   | 1   | 3   | 1   | -   | -   | 2   | 1    | 2    | 2    | 2    | 1    | 3    |

**Course Contents / Syllabus**

|                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                  |                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------------|
| <b>Module 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Modern Frontend Development with React JS</b> | <b>8 hours</b> |
| <b>Introduction:</b> to React, Setting up React projects, React Folder Structure, JSX, Functional Components, and React Hooks (useState, useEffect, use Context), Props vs State, Stateless vs Stateful Components, Component Lifecycle, Routing with react-router-dom Introduction to Next.js for Server-Side Rendering and SEO, Integrating APIs with axios or fetch,.                                                                     |                                                  |                |
| <b>Module 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>UI Libraries &amp; MongoDB Integration</b>    | <b>8 hours</b> |
| <b>UI Libraries :</b> Introduction to Google Material UI, Tailwind CSS, Theming and responsive design with MUI, Creating reusable UI components (Navbar, Toolbar, Dialogs), Introduction to MongoDB, CRUD Operations using Mongoose Indexes: Creating, Getting, Dropping, Aggregation Pipelines and Query Optimization, Data Modeling & Relationships, Auto-Sharding and Replication Concepts, Modern MongoDB tools: MongoDB Atlas, Compass. |                                                  |                |
| <b>Module 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Backend with Node.js &amp; Express</b>        | <b>8 hours</b> |
| <b>Node.js:</b> Introduction to Node.js Setting up Express applications, Routing & Middleware, Restful API Design , JWT-based Authentication & Authorization ,Working with dotenv, CORS, body-parser. Express MVC Architecture in Express, File Upload Handling with Multer, Connecting Frontend with Backend via APIs, Introduction to GraphQL.                                                                                             |                                                  |                |
| <b>Module 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>DevOps Culture and Lifecycle</b>              | <b>8 hours</b> |
| <b>Introduction to DevOps:</b> Culture & Principles, DevOps Lifecycle and Agile vs DevOps, SDLC Models: Agile, Lean, Scrum, Kanban, Scrum: Process flow, Planning, Testing, Release Management, Introduction to Site Reliability Engineering (SRE), Overview of Terraform/Ansible, Configuration Management basics                                                                                                                           |                                                  |                |
| <b>Module 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>CI/CD, Docker &amp; Kubernetes</b>            | <b>8 hours</b> |
| <b>Git &amp; GitHub:</b> Introduction to Git, GitHub, Branching strategies, CI/CD Pipelines: Jenkins, GitHub Actions, Creating Jenkins Jobs and Pipelines, Integrating Git, Maven, and SonarQube, Introduction to Docker: Images, Containers, Lifecycle ,Building                                                                                                                                                                            |                                                  |                |

|                                                                                                                                                                                                                |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          |                                                   |                                                                               |                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|-------------------|--------------------------|---------------------------------------------------|-------------------------------------------------------------------------------|-----------------|
| custom Docker Images, Docker Compose for multi-container apps, Container orchestration with Kubernetes<br>Creating Deployments, Services, and scaling with K8s, Basic monitoring tools: Prometheus and Grafana |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          |                                                   |                                                                               |                 |
|                                                                                                                                                                                                                |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          |                                                   | <b>Total Lecture Hours</b>                                                    | <b>40 hours</b> |
| <b>Textbook:</b>                                                                                                                                                                                               |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          |                                                   |                                                                               |                 |
| <b>S.No</b>                                                                                                                                                                                                    | <b>Book Title</b>                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          | <b>Author</b>                                     |                                                                               |                 |
| 1.                                                                                                                                                                                                             | Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node Paperback, 2 <sup>nd</sup> Edition (2017)   |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          | Vasan Subramanian                                 |                                                                               |                 |
| 2.                                                                                                                                                                                                             | Hands-On MERN Stack Web Development: Build production-grade web apps and APIs with MERN stack ,3 <sup>rd</sup> Edition (2019)   |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          | Shama Hoque                                       |                                                                               |                 |
| 3.                                                                                                                                                                                                             | Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App 2 <sup>nd</sup> Edition (2021)         |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          | Greg Lim                                          |                                                                               |                 |
| <b>Reference Books:</b>                                                                                                                                                                                        |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          |                                                   |                                                                               |                 |
| <b>S.No</b>                                                                                                                                                                                                    | <b>Book Title</b>                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          | <b>Author</b>                                     |                                                                               |                 |
| 1.                                                                                                                                                                                                             | The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations 2nd Edition (2003). |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          | Gene Kim, Jez Humble, Patrick Debois, John Willis |                                                                               |                 |
| 2.                                                                                                                                                                                                             | Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, 2nd Edition (2004).             |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          | Jez Humble, David Farley                          |                                                                               |                 |
| 3.                                                                                                                                                                                                             | Test and Deploy Production-Grade Web Applications 1st Edition (2023).                                                           |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          | Nabendu Biswas                                    |                                                                               |                 |
| <b>Self Study Content Link:</b>                                                                                                                                                                                |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          |                                                   |                                                                               |                 |
| <b>MOOCs</b>                                                                                                                                                                                                   |                                                                                                                                 | <a href="https://www.coursera.org/learn/fullstack-web-development">https://www.coursera.org/learn/fullstack-web-development</a><br><a href="https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer">https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer</a>                                                              |                   |                   |                   |                          |                                                   | <b>4 Weeks</b>                                                                |                 |
|                                                                                                                                                                                                                |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          |                                                   | <b>6 Months</b>                                                               |                 |
| <b>Video Lectures</b>                                                                                                                                                                                          |                                                                                                                                 | <a href="https://youtu.be/CvCiNeLnZ00">https://youtu.be/CvCiNeLnZ00</a><br><a href="https://youtu.be/4nKWREmCvsE">https://youtu.be/4nKWREmCvsE</a><br><a href="https://youtu.be/f2EqECiTBL8">https://youtu.be/f2EqECiTBL8</a><br><a href="https://youtu.be/6GQRb4fGvtk">https://youtu.be/6GQRb4fGvtk</a><br><a href="https://youtu.be/kTp5xUtcaw">https://youtu.be/kTp5xUtcaw</a> |                   |                   |                   |                          |                                                   | <b>8 hrs</b><br><b>25 Min</b><br><b>7 hrs</b><br><b>8 Min</b><br><b>6 hrs</b> |                 |
| <b>Web References</b>                                                                                                                                                                                          |                                                                                                                                 | <a href="https://react.dev">https://react.dev</a><br><a href="https://docs.docker.com">https://docs.docker.com</a>                                                                                                                                                                                                                                                                |                   |                   |                   |                          |                                                   |                                                                               |                 |
| <b>Mode of Evaluation</b>                                                                                                                                                                                      |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          |                                                   |                                                                               |                 |
| <b>CIE</b>                                                                                                                                                                                                     |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                   |                   |                   |                          | <b>ESE</b>                                        |                                                                               | <b>Total</b>    |
| <b>ST1</b>                                                                                                                                                                                                     | <b>ST2</b>                                                                                                                      | <b>ST3</b>                                                                                                                                                                                                                                                                                                                                                                        | <b>TA1<br/>10</b> | <b>TA2<br/>10</b> | <b>TA3<br/>10</b> | <b>Attendance<br/>10</b> |                                                   |                                                                               |                 |
| <b>30</b>                                                                                                                                                                                                      |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   | <b>20</b>         |                   |                   |                          | <b>100</b>                                        |                                                                               | <b>150</b>      |

|                                                                                                                                                       |                                                                                                                                                                                         |
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|  <b>NIET</b><br>Greater Noida<br><small>Autonomous Institute</small> | <b>NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY</b><br><b>GREATER NOIDA-201306</b><br><b>(An Autonomous Institute)</b><br><b>School of Computer Science and Information Technology</b> |
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|                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----|-----|-----|-----|----------------------------------|-----|-----|------|------|--------------------|------------------------------|------|------|---|
| Course Code: BMICSE0712                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                            |                                                                                                     |     |     |     |     | Course Name: RPA Implementation  |     |     |      |      |                    | L                            | T    | P    | C |
| Course Offered in: M.Tech Int.(CSE)                                                                                                                                                                                                                                                                                                                                                |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    | 3                            | 0    | 0    | 3 |
| Pre-requisite: Basic Knowledge of C Programming                                                                                                                                                                                                                                                                                                                                    |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Course Objectives: This course is designed to give a thorough understanding and practical skills in developing and deploying software robots for Robotic Process Automation (RPA).                                                                                                                                                                                                 |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Course Outcome: After completion of the course, the student will be able to                                                                                                                                                                                                                                                                                                        |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    | Bloom’s Knowledge Level (KL) |      |      |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                | Apply the concepts and methods for data manipulation.                                                                      |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    | K3                           |      |      |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                | Learn basic implementation of Selectors.                                                                                   |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    | K2                           |      |      |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                | Implement the knowledge of RPA tools, and functions in various industries                                                  |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    | K4                           |      |      |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                | Gain expertise in Desktop, Web & Citrix Automation and use RE-Framework to build a structured business automation process. |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    | K2                           |      |      |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                | Develop a real-world workflow automation project and will be able to debug a workflow.                                     |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    | 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 | PO1 2              | PSO 1                        | PSO2 | PSO3 |   |
| CO1                                                                                                                                                                                                                                                                                                                                                                                | 3                                                                                                                          | 2                                                                                                   | 1   | 1   | 2   | -   | -                                | -   | -   | -    | 1    | 1                  | 2                            | –    | 2    |   |
| CO2                                                                                                                                                                                                                                                                                                                                                                                | 2                                                                                                                          | 2                                                                                                   | 1   | -   | 3   | -   | -                                | -   | -   | -    | 1    | 1                  | 1                            | –    | 2    |   |
| CO3                                                                                                                                                                                                                                                                                                                                                                                | 2                                                                                                                          | 2                                                                                                   | 2   | 1   | 3   | 1   | -                                | 1   | -   | 1    | 2    | 1                  | 3                            | –    | 2    |   |
| CO4                                                                                                                                                                                                                                                                                                                                                                                | 2                                                                                                                          | 3                                                                                                   | 3   | 2   | 3   | 1   | -                                | 1   | 1   | 2    | 2    | 2                  | 3                            | –    | 3    |   |
| CO5                                                                                                                                                                                                                                                                                                                                                                                | 2                                                                                                                          | 3                                                                                                   | 3   | 2   | 3   | 1   | 1                                | 2   | 2   | 3    | 2    | 2                  | 3                            | –    | 3    |   |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Module 1                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                            |                                                                                                     |     |     |     |     | Data Manipulation                |     |     |      |      |                    | 8 hours                      |      |      |   |
| Introduction to Data Manipulation, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data ,Recording and Advanced UI Interaction; Recording Introduction, Basic and Desktop Recording, Web Recording, Input/output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques                                    |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Module 2                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                            |                                                                                                     |     |     |     |     | Selectors                        |     |     |      |      |                    | 8 hours                      |      |      |   |
| Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge, Image, Text & Advanced Citrix Automation, Introduction to Image & Text Automation, Image- based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices using tab for Images Starting Apps |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Module 3                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                            |                                                                                                     |     |     |     |     | Data Tables and Automation       |     |     |      |      |                    | 8 hours                      |      |      |   |
| Excel Data Tables & PDF, Data Tables in RPA, Excel and Data Table Basics Data Manipulation in Excel, Extracting Data from PDF, extracting a single piece of data, Anchors, Using anchors in PDF                                                                                                                                                                                    |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Email Automation: Email Automation, Incoming Email automation, Sending Email automation                                                                                                                                                                                                                                                                                            |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Module 4                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                            |                                                                                                     |     |     |     |     | Debugging and Exception Handling |     |     |      |      |                    | 8 hours                      |      |      |   |
| Debugging and Exception Handling: Debugging Tools, Strategies for solving issues, Catching errors.                                                                                                                                                                                                                                                                                 |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Orchestrator: Tenants, Authentication, Users, Roles, Robots, Environments, Queues & Transactions, Schedules                                                                                                                                                                                                                                                                        |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Module 5                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                            |                                                                                                     |     |     |     |     | Robotic Framework                |     |     |      |      |                    | 8 hours                      |      |      |   |
| Re-Framework template, Re-Framework template works, Use Re-Framework to automate your own processes. .NET Classes and Objects                                                                                                                                                                                                                                                      |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| Total Lecture Hours                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    | 40 hours                     |      |      |   |
| Textbook:                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                            |                                                                                                     |     |     |     |     |                                  |     |     |      |      |                    |                              |      |      |   |
| S.No                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                            | Book Title                                                                                          |     |     |     |     |                                  |     |     |      |      | Author             |                              |      |      |   |
| 1.                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                            | Crisper Learning: For UiPath”, Latest Edition, Independently Published, 2018.                       |     |     |     |     |                                  |     |     |      |      | Jain Vaibhav       |                              |      |      |   |
| 2.                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                            | Learning Robotics Process Automation”, Latest Edition, Packt Publishing ltd, Birmingham. March 2018 |     |     |     |     |                                  |     |     |      |      | Tripathi Alok Mani |                              |      |      |   |

| Reference Books:         |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |           |           |                  |                   |       |
|--------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|------------------|-------------------|-------|
| S.No                     |     | Book Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |           |           |                  | Author            |       |
| 1.                       |     | The Simple Implementation Guide to Robotic Process Automation (RPA)", Latest Edition, iUniverse Press, 2018.                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |           |           |                  | Wibbenmeyer Kelly |       |
| 2.                       |     | https://www.uipath.com/hubfs/ebook-its-time-to-automate.pdf                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |           |           |                  | -                 |       |
| Self Study Content Link: |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |           |           |                  |                   |       |
| MOOCs                    |     | https://www.coursera.org/specializations/roboticprocessautomation?utm_medium=sem&utm_source=gg&utm_campaign=b2c_india_x_multi_ftcof_career-academy_cx_dr_bau_gg_pmax_gc_in_all_m_hyb_24-03_desktop&campaignid=21104989118&adgroupid=&device=c&keyword=&matchtype=&network=x&devicemodel=&creativeid=&assetgroupid=6544944776&targetid=&extensionid=&placement=&gad_source=1&gad_campaignid=21104990591&gbraid=0AAAAADdKX6aXcPLWGmJWBIA433bccIMYa&gclid=CjwKCAjwx7RBhA5EiwAQ-AAJGt-GPrxE7nSRqYwH3uZiSRIdivr2driMGoBV_dG-XXfgwjyPtRoCtpQQAvD_BwE |           |           |           |                  | 51 hours          |       |
| Video Lectures           |     | https://www.youtube.com/watch?v=MBI-3Yb30FA&list=PL9ooVrP1hQOEeFvW5KaSea6mrlEU6TZ9s,                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |           |           |                  | 10 hours          |       |
|                          |     | https://www.youtube.com/watch?v=T3gssUSHonI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |           |           |                  | 11 hours          |       |
| Web Reference s          |     | https://www.researchgate.net/publication/390855446_Robotic_process_automation_Implementation<br><br>https://nibmehub.com/opac-service/pdf/read/The%20Robotic%20Process%20Automation%20Handbook%20by%20Tom%20Taulli.pdf                                                                                                                                                                                                                                                                                                                         |           |           |           |                  |                   |       |
| Mode of Evaluation       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |           |           |                  |                   |       |
| CIE                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |           |           |                  | ESE               | Total |
| ST1                      | ST2 | ST3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TA1<br>10 | TA2<br>10 | TA3<br>10 | Attendance<br>10 |                   |       |
| 30                       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20        |           |           |                  |                   |       |
|                          |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |           |           |                  | 100               | 150   |

|                                                                                   |                                                                                                                                                                                                                                                                        |
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|  | <p align="center"><b>NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY</b></p> <p align="center"><b>GREATER NOIDA-201306</b></p> <p align="center"><b>(An Autonomous Institute)</b></p> <p align="center"><b>School of Computer Science and Information Technology</b></p> |
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|                                                           |                                    |          |          |          |          |
|-----------------------------------------------------------|------------------------------------|----------|----------|----------|----------|
| <b>Course Code:</b> BMICSAI0714                           | <b>Course Name:</b> Cloud Security | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Offered in:</b> CSE/CSE(R)/IT/M.Tech Int. (CSE) |                                    | 3        | 0        | 0        | 3        |

**Pre-requisite:** Basics of Cloud Computing

**Course Objectives:** To provide in-depth knowledge of securing cloud environments, with practical alignment to AWS security services, best practices, and certification domains.

|                                                                                    |                              |
|------------------------------------------------------------------------------------|------------------------------|
| <b>Course Outcome:</b> After completion of the course, the student will be able to | Bloom's Knowledge Level (KL) |
|------------------------------------------------------------------------------------|------------------------------|

|     |                                                                                     |    |
|-----|-------------------------------------------------------------------------------------|----|
| CO1 | Explain cloud security principles, threat landscape, and governance frameworks.     | K2 |
| CO2 | Infer identity and access management techniques for secure cloud environments.      | K2 |
| CO3 | Assess data protection mechanisms including encryption and secure storage practices | K4 |
| CO4 | Analyze cloud infrastructure security components and network protection mechanisms  | K4 |
| CO5 | Analyze monitoring, incident response, and compliance strategies in cloud systems.  | 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 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1           | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | 1    | 1    | 3    | —    | 2    |
| CO2           | 2   | 3   | 2   | -   | 3   | -   | -   | -   | -   | -    | 2    | 2    | 3    | 1    | 2    |
| CO3           | 2   | 3   | 3   | -   | 2   | -   | -   | -   | 2   | -    | -    | -    | 3    | 1    | 2    |
| CO4           | 2   | 2   | 3   | 3   | 3   | -   | -   | -   | 2   | -    | 1    | 1    | 3    | 1    | 3    |
| CO5           | 2   | 3   | -   | -   | -   | 2   | 2   | 3   | -   | -    | -    | -    | 3    | —    | 2    |

**Course Contents/ Syllabus**

|                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                  |         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|---------|
| <b>UNIT-I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Cloud Security Foundations &amp; Governance</b>               | 9 hours |
| Introduction to cloud security concepts, Security benefits and challenges in cloud computing, Cloud Threat Landscape, CSA Top Threats, Insider Threats, Data Breaches, Security design principles (defense in depth, least privilege, zero trust), Edge Locations, AWS Shared Responsibility Model(customer vs provider responsibilities), AWS Well-Architected Framework (Security Pillar), Policies, Standards, Cloud Governance Framework. |                                                                  |         |
| <b>UNIT-II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Identity, Access Management &amp; Security Administration</b> | 9 hours |
| <b>IAM:</b> Introduction, JSON elements, Users, Roles, Groups, Policies, Policy evaluation logic, role chaining, Managed vs inline policies, permission boundaries, Principle of least privilege and policy optimization, Authentication & Authorization, Multi-Factor Authentication, Federation & Single Sign-On, SAML, Open Authorization basics.                                                                                          |                                                                  |         |
| <b>Access Control Models:</b> RBAC vs ABAC, Trust Boundaries, Temporary credentials using AWS Security Token Service.                                                                                                                                                                                                                                                                                                                         |                                                                  |         |
| <b>UNIT-III</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Data Security &amp; Protection</b>                            | 9 hours |
| <b>Data Security Concepts:</b> CIA Triad (Confidentiality, Integrity, Availability), <b>Data States:</b> Data at Rest, In Transit, In Use.                                                                                                                                                                                                                                                                                                    |                                                                  |         |
| <b>Encryption Techniques:</b> Symmetric vs Asymmetric Encryption, Encryption at rest and in transit (TLS/SSL), AWS Key Management, KMS, Envelope Encryption, Key Rotation.                                                                                                                                                                                                                                                                    |                                                                  |         |
| <b>Secure Storage:</b> S3 Security (Bucket Policies, Versioning, Access Control), Database security (RDS encryption, backups, IAM                                                                                                                                                                                                                                                                                                             |                                                                  |         |

authentication).

|                                                                                                                                                                                        |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
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| UNIT-IV                                                                                                                                                                                |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Cloud Infrastructure Security                    |           |           |                                             | 9 hours                                                                |       |
| Infrastructure Security: Host-Level, Network-Level, Application-Level Security, Secure Cloud Architecture, VM Security, Auto Scaling, Load Balancing.                                  |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| Amazon VPC Design: Subnets (Public/Private), Routing Tables, Internet Gateway, NAT Gateway, Bastion Hosts, DNS security with Amazon Route 53.                                          |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| Security Controls: Security Groups vs Network ACLs (stateful vs stateless), DDoS Protection & Mitigation, Hybrid Cloud Security, VPN, Direct Connect.                                  |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| UNIT-V                                                                                                                                                                                 |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Cloud Monitoring, Incident Response & Compliance |           |           |                                             | 9 hours                                                                |       |
| Monitoring & Logging: CloudTrail, CloudWatch, Log Analysis, Threat Detection (Behavioral Analysis, Anomaly Detection, Incident Response Lifecycle, Preparation) Containment, Recovery. |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| AWS Security Services: GuardDuty, CloudWatch, Security Hub, Application Security.                                                                                                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| Privacy & Compliance, Data Privacy Concepts, GDPR, HIPAA, Digital Personal Data Protection Act-2023, ISO 27001 basics, Legal & Regulatory Framework.                                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| Total Lecture Hours                                                                                                                                                                    |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             | 45 hours                                                               |       |
| Textbook:                                                                                                                                                                              |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| S. No                                                                                                                                                                                  |     | Book Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                  |           |           | Author                                      |                                                                        |       |
| 1.                                                                                                                                                                                     |     | “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance” O'ReillyMedia; 1edition [ISBN:0596802765], 2009                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           | Tim Mather, Subra Kumara swamy,Shahed Latif |                                                                        |       |
| 2.                                                                                                                                                                                     |     | “Cloud Security Handbook: Find out how to effectively secure cloud environments using AWS, Azure, and GCP”, Packt Publishing; 1st edition, 2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           | Eyal Estrin                                 |                                                                        |       |
| Reference Books:                                                                                                                                                                       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| S.No                                                                                                                                                                                   |     | Book Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                  |           |           | Author                                      |                                                                        |       |
| 1.                                                                                                                                                                                     |     | “Cloud Computing Security: Strategies and Best Practices”, CRC Press; 1st edition, 2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                  |           |           | Krishnendu Gupta, Nabanita Roy              |                                                                        |       |
| 2.                                                                                                                                                                                     |     | “Cloud Security: Concepts, Applications and Practices”, Springer; 1st edition, 2017,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                  |           |           | Kumar Saurabh                               |                                                                        |       |
| Self Study Content Link:                                                                                                                                                               |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| MOOCs                                                                                                                                                                                  |     | 1. <a href="https://nptel.ac.in/courses/106106248">https://nptel.ac.in/courses/106106248</a><br>2. <a href="https://skillbuilder.aws/learn/S2N5PM41ZK/aws-security-fundamentals/E71QQGTCRZ">https://skillbuilder.aws/learn/S2N5PM41ZK/aws-security-fundamentals/E71QQGTCRZ</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                  |           |           |                                             | 12 Weeks<br>15 hrs                                                     |       |
| Video Lectures                                                                                                                                                                         |     | 1. <a href="https://youtu.be/XsRBDJ5hedg">https://youtu.be/XsRBDJ5hedg</a><br>2. <a href="https://youtu.be/w2caA8ty36s">https://youtu.be/w2caA8ty36s</a><br>3. <a href="https://youtu.be/fpNmvxYhsN0">https://youtu.be/fpNmvxYhsN0</a><br>4. <a href="https://youtu.be/amCrXVFX1C4">https://youtu.be/amCrXVFX1C4</a><br>5. <a href="https://youtube.com/playlist?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J&amp;si=wLJBL0TKrcs8Jkmc">https://youtube.com/playlist?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J&amp;si=wLJBL0TKrcs8Jkmc</a><br>6. <a href="https://youtu.be/1ZKuwyATV3c">https://youtu.be/1ZKuwyATV3c</a><br>7. <a href="https://youtu.be/ZHCtVZ6cjdg?si=G0w6pE1v4dDNt2KV">https://youtu.be/ZHCtVZ6cjdg?si=G0w6pE1v4dDNt2KV</a> |                                                  |           |           |                                             | 26 Min<br>38 Min<br>27 Min<br>39 Min<br>13 hrs<br>1 hr 17 Min<br>8 Min |       |
| Web References                                                                                                                                                                         |     | 1. <a href="https://owasp.org">https://owasp.org</a><br>2. <a href="https://cloudsecurityalliance.org">https://cloudsecurityalliance.org</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                  |           |           |                                             |                                                                        |       |
| Mode of Evaluation                                                                                                                                                                     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             |                                                                        |       |
| CIE                                                                                                                                                                                    |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |           |           |                                             | ESE                                                                    | Total |
| ST1                                                                                                                                                                                    | ST2 | ST3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | TA1<br>10                                        | TA2<br>10 | TA3<br>10 | Attendance<br>10                            |                                                                        |       |
| 30                                                                                                                                                                                     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 20                                               |           |           |                                             | 100                                                                    | 150   |

|                                                                                   |                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p align="center"><b>NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY</b></p> <p align="center"><b>GREATER NOIDA-201306</b></p> <p align="center"><b>(An Autonomous Institute)</b></p> <p align="center"><b>School of Computer Science and Information Technology</b></p> |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                             |                                     |          |          |          |          |
|---------------------------------------------|-------------------------------------|----------|----------|----------|----------|
| <b>Course Code:</b> BMICSE0801              | <b>Course Name:</b> Computer Vision | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Offered in:</b> M.Tech Int. (CSE) |                                     | 3        | 0        | 0        | 3        |

**Pre-requisite:** Basic Knowledge of programming language Python/ Advanced Python features/ Libraries/

**Course Objectives:** To learn about key features of Computer Vision, design, implement and provide continuous improvement in the accuracy and outcomes of various datasets with more reliable and concise analysis results.

|                                                                                    |                                     |
|------------------------------------------------------------------------------------|-------------------------------------|
| <b>Course Outcome:</b> After completion of the course, the student will be able to | <b>Bloom's Knowledge Level (KL)</b> |
|------------------------------------------------------------------------------------|-------------------------------------|

|            |                                                                                                                                       |           |
|------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>CO1</b> | Classify knowledge of deep architectures used for solving various Vision and Pattern Association Tasks                                | <b>K2</b> |
| <b>CO2</b> | Develop appropriate learning rules for each of the architectures of perceptron and learn about different factors of back propagation. | <b>K3</b> |
| <b>CO3</b> | Deploy training algorithm for pattern association with the help of memory network.                                                    | <b>K5</b> |
| <b>CO4</b> | Design and deploy the models of deep learning with the help of use cases.                                                             | <b>K5</b> |
| <b>CO5</b> | Understand Analyse different theories of deep learning using neural networks.                                                         | <b>K4</b> |

**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 | PSO3 |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>CO1</b>    | 2   | 3   | 3   | 2   | 2   | 2   | -   | -   | 1   | -    | -    | -    | 1    | 2    | 2    |
| <b>CO2</b>    | 3   | 3   | 3   | 3   | 2   | 3   | -   | -   | 1   | -    | -    | 1    | 2    | 3    | 2    |
| <b>CO3</b>    | 3   | 3   | 3   | 2   | 3   | 2   | -   | -   | 1   | 1    | 1    | 1    | 2    | 3    | 3    |
| <b>CO4</b>    | 3   | 3   | 3   | 3   | 3   | 2   | -   | 2   | 2   | 1    | 1    | 1    | 3    | 3    | 3    |
| <b>CO5</b>    | 3   | 3   | 2   | 3   | 3   | 3   | 1   | 1   | 2   | 1    | -    | 1    | 3    | 3    | 3    |

**Course Contents/ Syllabus**

|                 |                                    |                |
|-----------------|------------------------------------|----------------|
| <b>Module 1</b> | <b>Computer Vision FOUNDATIONS</b> | <b>8 hours</b> |
|-----------------|------------------------------------|----------------|

Computer Vision, Research and Applications, Geometric primitives and transformations - Photometric image formation, The digital **Smart Cameras** camera - Point operators - Linear filtering, Digital Image fundamentals, Image Sensing and acquisition, Sampling and Quantization, Image formation models, OpenCV Basics, Edge Detection (Sobel, Canny) ,Most popular examples Categorization of Images, Retrieval of Images Based on Their Contents, Computer Vision Tasks classification.

|                 |                      |                 |
|-----------------|----------------------|-----------------|
| <b>Module 2</b> | <b>Architectures</b> | <b>10 hours</b> |
|-----------------|----------------------|-----------------|

Representation of a Three-Dimensional Moving Scene. Convolutional layers, pooling layers, and padding. Transfer learning and pre-trained models Architectures. Architectures Design: LeNet-5, AlexNet, VGGNet, GoogLeNet, ResNet, Efficient Net, Mobile Net, RNN Introduction.

|                 |                     |                |
|-----------------|---------------------|----------------|
| <b>Module 3</b> | <b>Segmentation</b> | <b>8 hours</b> |
|-----------------|---------------------|----------------|

Popular Image Segmentation Architectures, FCN Architecture, Upsampling Methods, Pixel Transformations, Geometric Operations, Spatial Operations in Image Processing, Instance Segmentation, Localisation, Object detection and image segmentation using CNNs, LSTM and GRU's. Vision Models, Vision Languages, Quality Analysis, Visual Dialogue, Active Contours & Application, Split & Merge, Mean Shift & Mode Finding, Normalized Cuts.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                    |                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| <b>Module 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Object Detection</b>                                                                                                                                                                            | <b>8 hours</b>                            |
| Object Detection and Sliding Windows, R-CNN, Fast R-CNN, Object Recognition, 3-D vision and Geometry, Digital Watermarking. Object Detection, face recognition instance Recognition, Category Recognition, Object classification. R-CNN, F-RCN, SSD, Retinanet, YOLO, CornerNet, Image Segmentation- U-Net, SegNet, Mask-RCNN, Attention Models- Vision Transformers.                                                                                                                                                                                                                                      |                                                                                                                                                                                                    |                                           |
| <b>Module 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Visualization and Generative Models</b>                                                                                                                                                         | <b>8 hours</b>                            |
| Benefits of Interpretability, Fashion MNIST, Class Activation, Map code walkthrough, GradCAM, ZFNet. Introduction about Deep Generative Models, Generative Adversarial Networks Combination VAE and GAN's, other VAE and GAN's deep generative models. GAN Improvements, Deep Generative Models across multiple domains, Deep Generative Models image and video applications.<br>Case Study: Computer Vision based Mouse, Computer Vision based Text Scanner, Computer Vision based Smart Selfie, Surveillance Robot, Sixth Sense Robot, IoT-enabled assistive devices, Surveillance Robots or Smart CCTV. |                                                                                                                                                                                                    |                                           |
| <b>Total Lecture Hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                    | <b>42 hours</b>                           |
| <b>Textbook:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                    |                                           |
| <b>S. No</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>“Introductory Techniques for 3D Computer Vision”, edition 2009</b>                                                                                                                              | <b>William Stallings and Lawrie Brown</b> |
| <b>1.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                    |                                           |
| <b>2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>“Computer Vision: Algorithms and Applications”, 2022, The University of Washington Edition, 2022</b>                                                                                            | <b>Szelisk Richard</b>                    |
| <b>3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>“Computer Vision - A Modern Approach”, Prentice Hall,, Edition 2015</b>                                                                                                                         | <b>Forsyth D. and Ponce J.,</b>           |
| <b>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>“Introductory Techniques for 3D Computer Vision”, Prentice Hall.</b>                                                                                                                            | <b>Trucco E. and Verri A.,</b>            |
| <b>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>“Computer &amp; Machine Vision”, Academic Press 4th Edition 2012</b>                                                                                                                            | <b>Davies E. R.,</b>                      |
| <b>6</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>“Computer Vision: Models, Learning, and Inference”, Cambridge University Press Edition, 2012</b>                                                                                                | <b>Simon J. D. Prince,</b>                |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |                                           |
| <b>S.No</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Book Title.</b>                                                                                                                                                                                 | <b>Author</b>                             |
| <b>1.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>“Computer Vision: A Modern Approach”, Prentice Hall, 2nd edition, 2015</b>                                                                                                                      | <b>Forsyth D. and Ponce J.,</b>           |
| <b>2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>“Computer Vision: Models, Learning, And Inference”. Cambridge University Press, 1st Edition, 2012.</b>                                                                                          | <b>“Prince, Simon J.D.</b>                |
| <b>3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>“Computer Vision”, Prentice-Hall, 2008.</b>                                                                                                                                                     | <b>Ballard D. H., Brown C. M</b>          |
| <b>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>“Understanding Augmented Reality, Concepts and Applications”, Morgan Kaufmann, Edition 2013</b>                                                                                                 | <b>Craig Alan B</b>                       |
| <b>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>“Computer Vision: Algorithms and Applications (CVAA)”, Springer edition, 2022</b>                                                                                                               | <b>Richard Szeliski</b>                   |
| <b>Self Study Content Link:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                    | <b>Hours</b>                              |
| <b>MOOCs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b><u>NPTEL Computer Vision Course <a href="https://nptel.ac.in/courses/106106224?">https://nptel.ac.in/courses/106106224?</a></u></b>                                                             | <b>80 Hrs</b>                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b><u>Coursera Deep Learning for Computer Vision <a href="https://www.coursera.org/learn/deep-learning-computer-vision?">https://www.coursera.org/learn/deep-learning-computer-vision?</a></u></b> | <b>20 Hrs</b>                             |
| <b>Video Lectures</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b><u>OpenCV Tutorial for Beginners <a href="https://www.youtube.com/watch?v=oXlwWbU8l2o">https://www.youtube.com/watch?v=oXlwWbU8l2o</a></u></b>                                                  | <b>3 Hrs</b>                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b><u>CNN and Object Detection Tutorial <a href="https://www.youtube.com/watch?v=pj9-rrlwDhM">https://www.youtube.com/watch?v=pj9-rrlwDhM</a></u></b>                                              | <b>3 Hrs</b>                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b><u>YOLO Object Detection Explained <a href="https://www.youtube.com/watch?v=MPU2HistivI">https://www.youtube.com/watch?v=MPU2HistivI</a></u></b>                                                | <b>2 Hrs</b>                              |
| <b>Web References</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b><u>TensorFlow Computer Vision Tutorials <a href="https://www.tensorflow.org/tutorials/images?">https://www.tensorflow.org/tutorials/images?</a></u></b>                                         |                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b><u>PyTorch Vision Tutorials</u></b>                                                                                                                                                             |                                           |

**Mode of Evaluation**

| CIE |     |     |           |           |           |                  | ESE | Total |
|-----|-----|-----|-----------|-----------|-----------|------------------|-----|-------|
| ST1 | ST2 | ST3 | TA1<br>10 | TA2<br>10 | TA3<br>10 | Attendance<br>10 |     |       |
| 30  |     |     | 20        |           |           |                  | 100 | 150   |



|                                                                                   |                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                             |                                         |          |          |          |          |
|---------------------------------------------|-----------------------------------------|----------|----------|----------|----------|
| <b>Course Code:</b> BMICSE0851              | <b>Course Name:</b> Computer Vision Lab | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Offered in:</b> M.Tech Int. (CSE) |                                         | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

**Pre-requisite:** Python , Machine Learning

**Course Objectives:**

The objective of this course is to provide practical knowledge of designing, training, and evaluating CNN models for image classification, object detection, and transfer learning applications. It aims to develop skills in digital image processing techniques such as enhancement, segmentation, compression, restoration, and color processing.

| <b>Course Outcome:</b> After completion of the course, the student will be able to |                                                                                                                                                                                                                                                  | <b>Bloom's Level</b> |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>CO1</b>                                                                         | Apply, implement, train, and evaluate deep learning models based on Artificial Neural Networks (ANNs) and Convolutional Neural Networks (CNNs) for classification, object detection, and transfer learning tasks.                                | K3                   |
| <b>CO2</b>                                                                         | Apply image processing techniques for image enhancement, segmentation, morphology, compression, restoration, and color image analysis using appropriate software tools and libraries.                                                            | K3                   |
| <b>CO3</b>                                                                         | Evaluate and analyze advanced deep learning architectures, including Autoencoders, Variational Autoencoders (VAEs), and Generative Adversarial Networks (GANs), for feature extraction, image transformation, and image generation applications. | K5                   |

**CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)**

| <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          | 2          | 1          | 3          | –          | –          | –          | –          | –           | –           | 1           | 3           | 1           | 3           |
| <b>CO2</b>           | 3          | 3          | 2          | 2          | 3          | –          | –          | –          | –          | –           | –           | –           | 3           | 1           | 2           |
| <b>CO3</b>           | 3          | 3          | 3          | 2          | 3          | –          | –          | –          | 2          | –           | –           | 1           | 3           | –           | 3           |

**Course Contents / Syllabus**

| <b>Lab No.</b> | <b>Title of Program</b>                                                                                 | <b>CO</b> |
|----------------|---------------------------------------------------------------------------------------------------------|-----------|
| 1.             | Building a simple convolutional neural network for spam classification.                                 | CO1       |
| 2.             | Building a simple convolutional neural network for image classification.                                | CO1       |
| 3.             | Implementing different types of pooling layers and comparing their effects on network performance.      | CO2       |
| 4.             | Training a CNN model on a large-scale image classification dataset using cloud- based GPU acceleration. | CO1       |
| 5.             | Building a simple convolutional neural network for Cats-v-dogs classification                           | CO1       |
| 6.             | Fine-tuning a pre-trained CNN for a specific image recognition task.                                    | CO1       |
| 7.             | Building a simple convolutional neural network for transfer learning using finetuning.                  | CO1       |
| 8.             | Building a simple convolutional neural network for transfer learning using feature extraction.          | CO1       |
| 9.             | Building a CNN model for object detection using a pre-trained architecture like YOLO.                   | CO1       |

|     |                                                                                                                                                     |     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 10. | Exploring different activation functions and comparing their effects on network performance.                                                        | CO1 |
| 11. | Write a program to Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets. | CO1 |
| 12. | Implement a program for basic image operations.                                                                                                     | CO2 |
| 13. | Implement a program for image enhancement                                                                                                           | CO2 |
| 14. | Building a simple convolutional neural network for spam classification.                                                                             | CO1 |
| 15. | Implement a program for image compression                                                                                                           | CO2 |
| 16. | Implement a program for color image processing                                                                                                      | CO2 |
| 17. | Implement a program for image segmentation                                                                                                          | CO2 |
| 18. | Design a program for image morphology                                                                                                               | CO2 |
| 19. | Implementing De-noising auto encoder.                                                                                                               | CO2 |
| 20. | Implementing Deep auto encoder.                                                                                                                     | CO2 |
| 21. | Implementing convolutional auto encoder.                                                                                                            | CO2 |
| 22. | Implementing feature extraction for classification using auto encoder.                                                                              | CO3 |
| 23. | Implementing feature extraction for regression using auto encoder.                                                                                  | CO3 |
| 24. | Perform scaling, rotation and shifting operations on an image using OpenCV ()                                                                       | CO3 |
| 25. | Perform image reflection on an image using OpenCV ().                                                                                               | CO3 |
| 26. | Implementing a basic Variational Autoencoder (VAE) for image generation                                                                             | CO3 |
| 27. | Training a Generative Adversarial Network (GAN) to generate synthetic images.                                                                       | CO3 |
| 28. | Implement and apply using Image Restoration                                                                                                         | CO3 |
| 29. | Implement and apply using Edge detection                                                                                                            | CO3 |
| 30. | Implement a program for color image processing                                                                                                      | CO2 |

**Total Hours:30 hrs.**

| M. Tech Int. (CSE)                                                                                                                                                                                                                                                                                 |                                                                                                                              |       |                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-------|----------------|
| Course code                                                                                                                                                                                                                                                                                        | BOE0766                                                                                                                      | L T P | Credits        |
| Course Title                                                                                                                                                                                                                                                                                       | Sensor Technologies                                                                                                          | 3 0 0 | 3              |
| Course Objectives: Student will learn about                                                                                                                                                                                                                                                        |                                                                                                                              |       |                |
| 1                                                                                                                                                                                                                                                                                                  | The concept of sensors and it's characteristics.                                                                             |       |                |
| 2                                                                                                                                                                                                                                                                                                  | Various sensor materials and technology used in designing sensors.                                                           |       |                |
| 3                                                                                                                                                                                                                                                                                                  | Commonly used sensors in industry for measurement of temperature, position, accelerometer, vibration sensor, flow and level. |       |                |
| 4                                                                                                                                                                                                                                                                                                  | The use of basic electronics circuits and intelligent sensors for industrial automation.                                     |       |                |
| 5                                                                                                                                                                                                                                                                                                  | The fundamentals of mechanical terms like pressure, position, force, strain and sensor application in different areas.       |       |                |
| Pre-requisites: Basic Electronics and Electrical Engineering                                                                                                                                                                                                                                       |                                                                                                                              |       |                |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                         |                                                                                                                              |       |                |
| UNIT-I                                                                                                                                                                                                                                                                                             | Sensors Fundamentals                                                                                                         |       | 8 hours        |
| Sensors & Transducers: Definition, Classification & selection of sensors, Sensor Characteristics, Measurement of displacement using Potentiometer, Measurement of position using Hall effect sensors                                                                                               |                                                                                                                              |       |                |
| UNIT-II                                                                                                                                                                                                                                                                                            | Sensor Materials and Technologies                                                                                            |       | 8 hours        |
| Materials: Passive Materials, Active Materials, Silicon, Polysilicon, semiconductors, Plastics, and Ceramics, Sensor Fabrication, Sensor Technologies: Surface Processing, Nano-Technology, IoT sensors. Pollution sensors, RFID sensors, image sensors, biometric sensors, MEMS and NEMS sensors. |                                                                                                                              |       |                |
| UNIT-III                                                                                                                                                                                                                                                                                           | Measurement of Physical parameters                                                                                           |       | 8 hours        |
| Measurement of temperature using Thermistors, Thermocouple & RTD, Concept of thermal imaging, Proximity sensors: Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.                              |                                                                                                                              |       |                |
| UNIT-IV                                                                                                                                                                                                                                                                                            | Interface Electronic Circuits & Intelligent Sensors                                                                          |       | 8 hours        |
| Input Characteristics of Interface Circuits, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission.                                                                                                                            |                                                                                                                              |       |                |
| Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control.                                                 |                                                                                                                              |       |                |
| UNIT-V                                                                                                                                                                                                                                                                                             | Sensor application in Different Areas                                                                                        |       | 8 hours        |
| Velocity and Acceleration; Force, Strain, Pressure Sensors. Batteries for Low Power Sensors, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement of pressure using LVDT based diaphragm & piezoelectric sensor.                                                           |                                                                                                                              |       |                |
| Course outcome: After successful completion of this course, students will be able to                                                                                                                                                                                                               |                                                                                                                              |       |                |
| CO1                                                                                                                                                                                                                                                                                                | Explain the concept of sensors and its characteristics.                                                                      |       | K <sub>1</sub> |

|                                                                                                                                |                                                                                                                                              |               |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>CO2</b>                                                                                                                     | Explain the different materials and technologies used in designing sensors.                                                                  | <b>K1, K2</b> |
| <b>CO3</b>                                                                                                                     | Explain and apply sensors in industry for measurement of temperature, position, accelerometer, vibration sensor, flow and level.             | <b>K2, K3</b> |
| <b>CO4</b>                                                                                                                     | Apply the basic electronics circuits and intelligent sensors for industrial automation.                                                      | <b>K2, K3</b> |
| <b>CO5</b>                                                                                                                     | Explain the basic fundamentals of mechanical terms like position, strain, and apply sensor for measurement of parameters in different areas. | <b>K2, K3</b> |
| <b>Text books:</b>                                                                                                             |                                                                                                                                              |               |
| 1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013                                                           |                                                                                                                                              |               |
| 2. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994. |                                                                                                                                              |               |
| 3. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press). |                                                                                                                                              |               |
| <b>Reference Books:</b>                                                                                                        |                                                                                                                                              |               |
| 1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.                                     |                                                                                                                                              |               |
| 2. D. Patranabis, Sensors and Transducers, PHI Publication, New Delhi                                                          |                                                                                                                                              |               |
| 3. Mechatronics- Ganesh S. Hegde, Published by University Science Press (An imprint of Laxmi Publication Private Limited).     |                                                                                                                                              |               |
| <b>NPTEL/ YouTube /Learning Source:</b>                                                                                        |                                                                                                                                              |               |
| <a href="https://youtu.be/1uPTyxZzyo">https://youtu.be/1uPTyxZzyo</a>                                                          |                                                                                                                                              |               |
| <a href="https://youtu.be/q8UuRkOQ9A0">https://youtu.be/q8UuRkOQ9A0</a>                                                        |                                                                                                                                              |               |
| <a href="http://www.nptel.ac.in">www.nptel.ac.in</a>                                                                           |                                                                                                                                              |               |

| M. Tech Int. (CSE)                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                          |                                  |   |   |        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---|---|--------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                               | BOE0765                                                                                                                                  | L                                | T | P | Credit |
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                              | Human Psychology and Organizational Behavior                                                                                             | 3                                | 0 | 0 | 3      |
| Course objective:                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                          | Duration: 40 Hours               |   |   |        |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                         | understand the various dimensions of Human psychology.                                                                                   |                                  |   |   |        |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                         | familiarize students with the concept of Organizational Behavior.                                                                        |                                  |   |   |        |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                         | To enable students to describe how people behave under different conditions and understand why people behave as they do.                 |                                  |   |   |        |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                         | To introduce students to the concepts of Team and Organization change.                                                                   |                                  |   |   |        |
| Prerequisites: Student must have basic understanding of General Management.                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                          |                                  |   |   |        |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                          |                                  |   |   |        |
| UNIT- I                                                                                                                                                                                                                                                                                                                                                                                                                   | roduction to Organizational Behavior                                                                                                     | Hours- 8                         |   |   |        |
| Introduction to OB , Definition, Nature and Scope – Environmental and organizational context – Impact of globalization, Diversity, Ethics, culture. Importance of OB in understanding Human Behavior. Cognitive Processes, I: Perception and Attribution: Nature and importance of Perception – Perceptual selectivity and organization , Social perception – Attribution Theories ,Locus of control –Attribution Errors. |                                                                                                                                          |                                  |   |   |        |
| UNIT-II                                                                                                                                                                                                                                                                                                                                                                                                                   | ensions of Human Behavior and Psychology                                                                                                 | Hours-8                          |   |   |        |
| Cognitive Processes, II: Personality and Attitudes, Personality as B continuum - Meaning of personality , Johari Window and Transactional Analysis , Nature and Dimension of Attitudes -Job satisfaction and organizational commitment, Motivational needs and processes, Theories of Motivation                                                                                                                          |                                                                                                                                          |                                  |   |   |        |
| UNIT- III                                                                                                                                                                                                                                                                                                                                                                                                                 | onflict and Stress Management                                                                                                            | Hours-8                          |   |   |        |
| Stress and Conflict: Meaning and types of stress, Stress Management, Meaning and types of conflict, Effect of stress and intra individual conflict, Conflict management.                                                                                                                                                                                                                                                  |                                                                                                                                          |                                  |   |   |        |
| UNIT-IV                                                                                                                                                                                                                                                                                                                                                                                                                   | roup Dynamics                                                                                                                            | Hours-8                          |   |   |        |
| Groups Vs. Teams – Nature of groups – dynamics of informal groups – dysfunctions of groups and teams – teams in modern work place. Power and Politics: Meaning and types of power – empowerment                                                                                                                                                                                                                           |                                                                                                                                          |                                  |   |   |        |
| UNIT-V                                                                                                                                                                                                                                                                                                                                                                                                                    | Leadership and Organizational Change.                                                                                                    | Hours-8                          |   |   |        |
| High performance work practices, Behavioral performance management: reinforcement and punishment as principles of Learning –Process of Behavioral modification, Leadership theories, Styles, Activities and skills of Great leaders. Organizational change , meaning, factors in Organizational change, process of planned Change, Resistance to change.                                                                  |                                                                                                                                          |                                  |   |   |        |
| Course outcome: At the end of course, the student will be able to                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                          |                                  |   |   |        |
| CO 1                                                                                                                                                                                                                                                                                                                                                                                                                      | Understand the concept of Organization Behavior and human psychology in terms of the key factors that influence organizational behavior. | Knowledge (K2), Remembering (K1) |   |   |        |
| CO 2                                                                                                                                                                                                                                                                                                                                                                                                                      | Analyze and evaluate the behavior for enhancing individual and group performance.                                                        | Comprehending (K 3)              |   |   |        |
| CO 3                                                                                                                                                                                                                                                                                                                                                                                                                      | Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.       | Knowledge (K2), Applying (K4)    |   |   |        |
| CO 4                                                                                                                                                                                                                                                                                                                                                                                                                      | Analyze the complexities associated with management of the group behavior in the organization.                                           | Knowledge (K2), Analyzing (K5)   |   |   |        |
| CO 5                                                                                                                                                                                                                                                                                                                                                                                                                      | Create the conducive work environment encompassing the theories of                                                                       | Applying (K4)                    |   |   |        |

|                                                                                                                                                                                                                                                                                                                                                                           |                                   |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--|
|                                                                                                                                                                                                                                                                                                                                                                           | leadership and change management. |  |
| <b>Text books</b>                                                                                                                                                                                                                                                                                                                                                         |                                   |  |
| 1. Robbins Stephen P& Judge Timothy B. —Organizational Behavior (2019, 9 <sup>th</sup> edition, Pearson)<br>2. Newstrom J. W., & Davis, K. (2011) Human behavior at work (12th ed.). Tata McGraw Hill                                                                                                                                                                     |                                   |  |
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                    |                                   |  |
| 1. Robbins &Coulter : Management (Pearson, 19th Edition, 2019)<br>2. Luthans Fred: Organizational Behavior, (McGraw Hill International Edition, 12th Edition, 2013)<br>3. Prasad L. M. : Principles and Practices of Management, (Sultan Chand& Sons, 9th edition,2016)<br>4. Pareek. U. (2010). Understanding Organizational Behavior (2nd ed.). Oxford University Press |                                   |  |

**M. Tech Int. (CSE)**

| M. Tech Int. (CSE)                                                                                                                                                                                                                                                                                                              |                                                                                                                    |         |         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------|---------|
| Course Code                                                                                                                                                                                                                                                                                                                     | BOE0873                                                                                                            | L T P   | Credits |
| Course Name                                                                                                                                                                                                                                                                                                                     | Wireless Communication                                                                                             | 3 0 0   | 3       |
| Course Objective: Student will learn about                                                                                                                                                                                                                                                                                      |                                                                                                                    |         |         |
| 1                                                                                                                                                                                                                                                                                                                               | The fundamentals of mobile communication systems.                                                                  |         |         |
| 2                                                                                                                                                                                                                                                                                                                               | The concept of cellular communication.                                                                             |         |         |
| 3                                                                                                                                                                                                                                                                                                                               | Propagation Models and channel fading                                                                              |         |         |
| 4                                                                                                                                                                                                                                                                                                                               | Contention free Multiple access technique (TDMA/FDMA/CDMA) and contention based (Pure ALOHA, Slotted ALOHA, CSMA). |         |         |
| 5                                                                                                                                                                                                                                                                                                                               | Various modern wireless technologies.                                                                              |         |         |
| Pre-requisites: Basic Knowledge of Digital Communication                                                                                                                                                                                                                                                                        |                                                                                                                    |         |         |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                      |                                                                                                                    |         |         |
| UNIT-I                                                                                                                                                                                                                                                                                                                          | Introduction of Wireless Communication                                                                             | 8 Hours |         |
| History and evolution of mobile radio systems. General Model of Wireless Communication Link Types of mobile wireless services/systems-Cellular, WLL, Paging, Satellite Systems, Future trends in personal wireless systems.                                                                                                     |                                                                                                                    |         |         |
| UNIT-II                                                                                                                                                                                                                                                                                                                         | Cellular Concepts and System Design Fundamentals                                                                   | 8 Hours |         |
| Cellular Infrastructure, Cellular System Components, Antennas for Cellular Systems, Operation of Cellular Systems, frequency reuse, channel assignment, handoff strategies, Interference and system capacity.                                                                                                                   |                                                                                                                    |         |         |
| UNIT-III                                                                                                                                                                                                                                                                                                                        | Mobile Radio Propagation Models                                                                                    | 8 Hours |         |
| Radio wave propagation issues in personal wireless systems, Propagation models, Channel Noise and Losses, Fading in Land Mobile Systems, Multipath Fading, Fading Effects on Signal and Frequency, Shadowing; Wireless Channel Modeling: AWGN Channel, Rayleigh Channel,                                                        |                                                                                                                    |         |         |
| UNIT- IV                                                                                                                                                                                                                                                                                                                        | Equalization, Diversity Techniques & Multiple Access Techniques                                                    | 8 Hours |         |
| Equalization, Rake receiver concepts, Diversity Techniques, Linear predictive coders and channel coding. Multiplexing and Multiple Access: FDMA, TDMA, CDMA, OFDMA, Multiple Access for Radio Packet Systems: Pure ALOHA, Slotted ALOHA, CSMA and their versions; Packet and Pooling Reservation Based Multiple Access Schemes. |                                                                                                                    |         |         |
| UNIT-V                                                                                                                                                                                                                                                                                                                          | Wireless Systems & Standards                                                                                       | 8 Hours |         |
| GSM system for mobile Telecommunication, General Packet Radio Service, Edge Technology; CDMA 2000, IMT 2000 and UMTS, Long Term Evolution (LTE), Introduction to Mobile Adhoc Networks, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Introduction to 4G, 5G and concept of NGN.                     |                                                                                                                    |         |         |
| Course Outcomes: After completion of this course students will be able to                                                                                                                                                                                                                                                       |                                                                                                                    |         |         |
| CO 1                                                                                                                                                                                                                                                                                                                            | Explain with various generations of mobile communications.                                                         |         | K1, K2  |
| CO 2                                                                                                                                                                                                                                                                                                                            | Explain concept of cellular communication.                                                                         |         | K2      |
| CO 3                                                                                                                                                                                                                                                                                                                            | Describe the basics of wireless communication.                                                                     |         | K2      |

|             |                                                                                            |       |
|-------------|--------------------------------------------------------------------------------------------|-------|
| <b>CO 4</b> | Explain and differentiate contention free and contention based multiple access techniques. | K2,K4 |
| <b>CO 5</b> | Explain Various modern wireless technologies.                                              | K2    |

**Text Books:**

1. T.S. Rappaport, “Wireless Communication-Principles and practice”, Pearson Publications, Second Edition.
2. Upena Dalal, “Wireless Communication and Networks”, Oxford Press Publications.
3. T L Singal ,“Wireless Communications ”, McGraw Hill Publications.

**Reference Books:**

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press.
2. S. Haykin & M. Moher, “Modern wireless communication”, Pearson, 2005.

**NPTEL/ YouTube/ Faculty Video Link:**

|               |                                                                                                                                                                                                                               |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Unit 1</b> | <a href="https://youtu.be/JCGMP37-2EA">https://youtu.be/JCGMP37-2EA</a>                                                                                                                                                       |
| <b>Unit 2</b> | <a href="https://youtu.be/f2wIHL1Sok8">https://youtu.be/f2wIHL1Sok8</a><br><a href="https://youtu.be/0PWILK-hqbQ">https://youtu.be/0PWILK-hqbQ</a>                                                                            |
| <b>Unit 3</b> | <a href="https://youtu.be/SFcRtZ30rqs">https://youtu.be/SFcRtZ30rqs</a><br><a href="https://youtu.be/BKf2mN9W6Nk">https://youtu.be/BKf2mN9W6Nk</a><br><a href="https://youtu.be/tePZhxRLsjE">https://youtu.be/tePZhxRLsjE</a> |
| <b>Unit 4</b> | <a href="https://youtu.be/GLmF3YB0pQU">https://youtu.be/GLmF3YB0pQU</a><br><a href="https://youtu.be/QHqZwBoTJRY">https://youtu.be/QHqZwBoTJRY</a>                                                                            |
| <b>Unit 5</b> | <a href="https://youtu.be/t3FVP5wuG4g">https://youtu.be/t3FVP5wuG4g</a><br><a href="https://youtu.be/ixY0Cau4mBM">https://youtu.be/ixY0Cau4mBM</a>                                                                            |

## M. Tech Int. (CSE)

| M. Tech Int. (CSE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                    |   |   |   |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|---|---|---|---------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | BOE0871                                            | L | T | P | Credit  |
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | INDUSTRY 4.0                                       | 3 | 0 | 0 | 3       |
| <b>Course objective:</b><br>The student develop concept related to Automation, familiarize students with the concepts and techniques of robot manipulator, its drive systems and end effectors, introduce the students with Cloud Computing, Bigdata, Cyber Security, understand various types of systems and models in simulation and familiarize students with the concepts rapid prototyping.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                    |   |   |   |         |
| <b>Pre-requisites:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |   |   |   |         |
| Course Contents / Syllabus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                    |   |   |   |         |
| UNIT-I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | INTRODUCTION TO AUTOMATION                         |   |   |   | 8 hours |
| Pneumatic system: production and distribution of compressed air, components of pneumatic system, Different types of valves, graphical symbols, graphical representation and design of pneumatic system, electro- pneumatics. Hydraulic system: Different types of valves such as flow, direction control valve, hydraulic pumps, Actuators and auxiliary elements in hydraulics, their applications and use of their graphical symbols, Synthesis and design of circuits (up to 2 cylinders), hydraulic system design, electro-hydraulics.                                                                                                                                                                                                                                                                                                                                                      |                                                    |   |   |   |         |
| UNIT-II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | FUNDAMENTALS OF ROBOT                              |   |   |   | 8 hours |
| Robotics – Introduction – Basic structure(manipulator) – classification of robot and Robotic systems – laws of robotics – work space, precision movement. Drive systems Hydraulic, pneumatic and electric systems– servo motors – stepper motors – servo-control. Robot Kinematics: forward and inverse kinematics – trajectory planning: interpolation and approximation. End Effectors: Types of robot end effectors – grippers: mechanical, magnetic, vacuum grippers – Tools as end effectors – Robot applications.                                                                                                                                                                                                                                                                                                                                                                         |                                                    |   |   |   |         |
| UNIT-III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | INTRODUCTION OF CLOUD, BIG DATA AND CYBER SECURITY |   |   |   | 8 hours |
| Introduction to Cloud Computing: Introduction to Cloud Computing, Definition of Cloud, Characteristics of Cloud Computing, Cloud Computing Layered Architecture and Deployment Models, Cloud Computing Service Models<br>Introduction to Big Data: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Introduction to Security, Security Threats and Vulnerabilities Need of security, CIA Triad, Introduction to security attacks, services and mechanism. Overview of Security threats and Vulnerability: Types of attacks on Confidentiality, Integrity and Availability.<br>Vulnerability and Threats, Malware: Virus, Worms, Trojan horse. Security Counter Measures:Intrusion Detection and its categories, Antivirus Software. |                                                    |   |   |   |         |
| UNIT-IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SIMULATION                                         |   |   |   | 8 hours |
| Introduction: Simulation: B tool, advantages and disadvantages of simulation, areas of application, systems and system environment, components of B system, discrete and continuous systems, discrete event system simulation.<br>General Principles: Concepts in discrete event simulation, time advance algorithm, manual simulation using event scheduling, basis properties and operations.<br>Models In Simulation: Terminology and concepts, statistical models: queuing systems; inventory systems; reliability and maintainability, limited data, discrete distributions: Bernoulli distribution; Bionomial distribution; Geometric distribution, continuous distribution: Uniform distribution; Exponential distribution; Gamma distribution; Normal distribution; Weibull distribution; Triangular Distribution; Lognormal distribution, poisson process.                             |                                                    |   |   |   |         |
| UNIT-V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Additive Manufacturing                             |   |   |   | 8 hours |
| Elementary Introduction & Understanding of 3D Printing and necessary skill set to pursue in Technology. Design Requirements and Analysis and Career Aspects. B Model Printing on FFF Material i.e. PLA or ABS. Deep Understanding of Composite FDM 3D Printing Technology. Introduction to LDM Technology, Mechanism for Clay Extrusion, Operations & Precautions. Slurry Preparation & Material Prospects & Explanation of slicing                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                    |   |   |   |         |

software (Preform) for SLA technology. Detailed Explanation of Reverse Engineering, Methods of Reverse Engineering, Advantages and Applications.

**Course outcome: After completion of course students will be able to**

|      |                                                                                 |                |
|------|---------------------------------------------------------------------------------|----------------|
| CO 1 | Understand the concept of self-driven vehicles.                                 | K <sub>3</sub> |
| CO 2 | Explain the basic concepts of hardware and software architectures.              | K <sub>3</sub> |
| CO 3 | Know on the safety assurance for Autonomous vehicles.                           | K <sub>3</sub> |
| CO 4 | Understand and explain latest trends and technology in vehicle dynamic modeling | K <sub>4</sub> |
| CO 5 | Understand the concept related to vehicle longitudinal control.                 | K <sub>3</sub> |

**Text books :**

1. The Handbook of Research on Integrating Industry 4.0 in Business and Manufacturing

**Reference Books:**

1) M. Gordan, "Industry 4.0 - Perspectives and Applications".

2) Routledge," Additive Manufacturing in Industry 4.0".

**nk:** NPTEL/ YouTube/ Faculty Video Link:

|               |                                                                                                                                                                                               |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Unit 1</b> | <a href="https://onlinecourses.nptel.ac.in/noc21_me83">https://onlinecourses.nptel.ac.in/noc21_me83</a>                                                                                       |
| <b>Unit 2</b> | <a href="https://www.youtube.com/watch?v=vSaGIzbw_kQ">https://www.youtube.com/watch?v=vSaGIzbw_kQ</a>                                                                                         |
| <b>Unit 3</b> | <a href="https://www.youtube.com/watch?v=PEI3RWFKOFk">https://www.youtube.com/watch?v=PEI3RWFKOFk</a>                                                                                         |
| <b>Unit 4</b> | <a href="https://www.youtube.com/watch?v=zmbS_TmNDP4&amp;list=PLSGws_74K01-4rcWuB5BEATHSsOrBd1ye">https://www.youtube.com/watch?v=zmbS_TmNDP4&amp;list=PLSGws_74K01-4rcWuB5BEATHSsOrBd1ye</a> |
| <b>Unit 5</b> | <a href="https://www.youtube.com/watch?v=t7yv4gSnNkE&amp;list=PLwdnzlV3ogoWI8QEu4hsT-n_r8UbWbquy">https://www.youtube.com/watch?v=t7yv4gSnNkE&amp;list=PLwdnzlV3ogoWI8QEu4hsT-n_r8UbWbquy</a> |

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| <b>Course Code: BOE0762</b>                                                                                                                                                                                                                                              |                                                                                                                                                     | <b>Course Name: Biology for Engineers</b> |  | <b>L</b> | <b>T</b> | <b>P</b>             | <b>C</b>   |
| <b>Course Offered in: Department of Biotechnology</b>                                                                                                                                                                                                                    |                                                                                                                                                     |                                           |  | <b>3</b> | <b>0</b> | <b>0</b>             | <b>3</b>   |
| <b>Pre-requisite: Students should know about the basic knowledge of biology.</b>                                                                                                                                                                                         |                                                                                                                                                     |                                           |  |          |          |                      |            |
| <b>Course Objectives:</b> To familiarize the students with basic biological concepts, structures and functions of the cells, bio molecules and their metabolism.                                                                                                         |                                                                                                                                                     |                                           |  |          |          |                      |            |
| <b>Course Outcome:</b> After completion of the course, the student will be able to                                                                                                                                                                                       |                                                                                                                                                     |                                           |  |          |          | <b>Bloom's Level</b> |            |
| <b>CO1</b>                                                                                                                                                                                                                                                               | Understand and explain the cells, different cell organelles and their function,                                                                     |                                           |  |          |          |                      | <b>K2</b>  |
| <b>CO2</b>                                                                                                                                                                                                                                                               | Understand and compare different biomolecules, its structure and function and understand their role in a living organism.                           |                                           |  |          |          |                      | <b>K2</b>  |
| <b>CO3</b>                                                                                                                                                                                                                                                               | Describe and explain the genes and genetic materials (DNA & RNA) and how they replicate, transfer & preserve vital information in living organisms. |                                           |  |          |          |                      | <b>K2</b>  |
| <b>CO4</b>                                                                                                                                                                                                                                                               | Defines and illustrate the basic knowledge of life processes like nutrition, respiration circulation etc.                                           |                                           |  |          |          |                      | <b>K2</b>  |
| <b>CO5</b>                                                                                                                                                                                                                                                               | Explain and recognize the different types of microbes, Sterilisation technique and its interaction with humans.                                     |                                           |  |          |          |                      | <b>K2</b>  |
| <b>Course Contents / Syllabus</b>                                                                                                                                                                                                                                        |                                                                                                                                                     |                                           |  |          |          |                      |            |
| <b>Unit 1</b>                                                                                                                                                                                                                                                            | <b>Cell; Structure and their functions</b>                                                                                                          |                                           |  |          |          |                      | <b>8 h</b> |
| The Cells, Cell theory, structure of a Cell, Cell cycle, cell organelles and their functions. Plant Cell and animal Cell, Prokaryotic and Eukaryotic cell. Brief introduction to five kingdoms of classification including monera, protists, fungi, plantae and animalia |                                                                                                                                                     |                                           |  |          |          |                      |            |
| <b>Unit 2</b>                                                                                                                                                                                                                                                            | <b>Introduction to biomolecules and metabolism</b>                                                                                                  |                                           |  |          |          |                      | <b>8 h</b> |
| Structure and functions of biomolecules like carbohydrates, proteins, nucleic acids, lipids and enzymes. Metabolic basis for Living—Anabolic and Catabolic Pathways, Photosynthesis, Respiration                                                                         |                                                                                                                                                     |                                           |  |          |          |                      |            |
| <b>Unit 3</b>                                                                                                                                                                                                                                                            | <b>Genetics</b>                                                                                                                                     |                                           |  |          |          |                      | <b>8 h</b> |
| Prokaryotic gene and Eukaryotic gene structure, Basics of gene replication, Transcription and Translation in Prokaryote and Eukaryotes. Recombinant DNA technology.                                                                                                      |                                                                                                                                                     |                                           |  |          |          |                      |            |
| <b>Unit 4</b>                                                                                                                                                                                                                                                            | <b>Human physiology</b>                                                                                                                             |                                           |  |          |          |                      | <b>8 h</b> |
| Basic knowledge of nutrition, Digestive systems, Respiratory system, Blood circulatory system and nervous system                                                                                                                                                         |                                                                                                                                                     |                                           |  |          |          |                      |            |

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| Unit 5                                                                                                                                                                                                         | Microbiology                                                                                                                                                                                                                           | 12 h              |
| Structure and function of microscope, Identification and classification of microorganisms, Sterilization and media compositions, Concept of species and strains. Ecological aspects of single celled organisms |                                                                                                                                                                                                                                        |                   |
| Total                                                                                                                                                                                                          |                                                                                                                                                                                                                                        | 40 h              |
| Textbook:                                                                                                                                                                                                      |                                                                                                                                                                                                                                        |                   |
| S.No                                                                                                                                                                                                           | Book Title with publication agency & year                                                                                                                                                                                              |                   |
| 1                                                                                                                                                                                                              | Cell and Molecular Biology-P.K.Gupta 2. Cell Biology-Verma and Agarwal                                                                                                                                                                 |                   |
| 2                                                                                                                                                                                                              | Biology for Engineers ,Wiley Editorial                                                                                                                                                                                                 |                   |
| 3                                                                                                                                                                                                              | NCERT Biology class XI and XII                                                                                                                                                                                                         |                   |
| Reference Books:                                                                                                                                                                                               |                                                                                                                                                                                                                                        |                   |
| S.No                                                                                                                                                                                                           | Book Title with publication agency & year                                                                                                                                                                                              |                   |
| 1                                                                                                                                                                                                              | Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company                                                                                                                                       |                   |
| 2                                                                                                                                                                                                              | “Molecular Genetics (Second edition), Stent, G. S.; and Calendar, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher                                                                                       |                   |
| 3                                                                                                                                                                                                              | Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers                                                                                                                                       |                   |
| Self-Study Content Links:                                                                                                                                                                                      |                                                                                                                                                                                                                                        | Duration (in Hrs) |
| MOOCs                                                                                                                                                                                                          |                                                                                                                                                                                                                                        |                   |
| Video Lectures                                                                                                                                                                                                 |                                                                                                                                                                                                                                        |                   |
| Web References                                                                                                                                                                                                 |                                                                                                                                                                                                                                        |                   |
| Unit 1                                                                                                                                                                                                         | <a href="https://www.youtube.com/watch?v=URUJD5NEXC8">https://www.youtube.com/watch?v=URUJD5NEXC8</a><br><a href="https://www.youtube.com/watch?v=t5DvF5OVr1Y">https://www.youtube.com/watch?v=t5DvF5OVr1Y</a>                         |                   |
| Unit 2                                                                                                                                                                                                         | <a href="https://www.youtube.com/watch?v=fE6shCFJepo">https://www.youtube.com/watch?v=fE6shCFJepo</a><br><a href="https://www.youtube.com/watch?v=XzCROUAoZh8&amp;t=1066s">https://www.youtube.com/watch?v=XzCROUAoZh8&amp;t=1066s</a> |                   |
| Unit 3                                                                                                                                                                                                         | <a href="https://www.youtube.com/watch?v=A0mFCUE9en4">https://www.youtube.com/watch?v=A0mFCUE9en4</a><br><a href="https://www.youtube.com/watch?v=-mdYzXl9hc4">https://www.youtube.com/watch?v=-mdYzXl9hc4</a>                         |                   |
| Unit 4                                                                                                                                                                                                         | <a href="https://www.youtube.com/watch?v=0-8CMmaSBg">https://www.youtube.com/watch?v=0-8CMmaSBg</a><br><a href="https://www.youtube.com/watch?v=AfPMpTeYuqI">https://www.youtube.com/watch?v=AfPMpTeYuqI</a>                           |                   |

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| Unit 5 | <a href="https://www.youtube.com/watch?v=ryhdkAJb49A&amp;list=PLGaz8McLWyIww2QAcESaCxM8WN7-vmFEj">https://www.youtube.com/watch?v=ryhdkAJb49A&amp;list=PLGaz8McLWyIww2QAcESaCxM8WN7-vmFEj</a><br><a href="https://www.youtube.com/watch?v=Lm8Z_wRE_cs&amp;list=PLFpCrsN3l3fB3TaFS8ll0zwlnXJi619DI">https://www.youtube.com/watch?v=Lm8Z_wRE_cs&amp;list=PLFpCrsN3l3fB3TaFS8ll0zwlnXJi619DI</a> |  |
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| <b>Course Code: BOE0872</b>                                                                                                                                                                                                                                                                                       |                                                                                                                                    | <b>Course Name: Nanotechnology</b> |  | <b>L</b> | <b>T</b> | <b>P</b>                 | <b>C</b>   |
| <b>Course Offered in: Department of Biotechnology</b>                                                                                                                                                                                                                                                             |                                                                                                                                    |                                    |  | <b>3</b> | <b>0</b> | <b>0</b>                 | <b>3</b>   |
| <b>Pre-requisite: Basic knowledge of chemistry, physics and basic engineering subjects</b>                                                                                                                                                                                                                        |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>Course Objectives:</b> This course is designed to make students understand the intersection of nanotechnology and other allied subjects.                                                                                                                                                                       |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>Course Outcome:</b> After completion of the course, the student will be able to                                                                                                                                                                                                                                |                                                                                                                                    |                                    |  |          |          | <b>Bloom's Level</b>     |            |
| <b>CO1</b>                                                                                                                                                                                                                                                                                                        | Explain and solve the basics of nano-science, nanobiotechnology, nanotechnology and its techniques.                                |                                    |  |          |          |                          | K1, K3     |
| <b>CO2</b>                                                                                                                                                                                                                                                                                                        | Devise and categorized the effective strategies of nanomaterials synthesis through physical, chemical and biological process.      |                                    |  |          |          |                          | K4         |
| <b>CO3</b>                                                                                                                                                                                                                                                                                                        | Compare and connect the potential tools and techniques used for characterization of nanomaterials and their applications           |                                    |  |          |          |                          | K2, K4     |
| <b>CO4</b>                                                                                                                                                                                                                                                                                                        | Classify, compare and differentiate the synthesis and application of different classes of biomaterials and polymers and their uses |                                    |  |          |          |                          | K1, K2     |
| <b>CO5</b>                                                                                                                                                                                                                                                                                                        | Understanding and conclude the concept of nanotechnology and their applications in sciences, engineering and technology            |                                    |  |          |          |                          | K2,K4      |
|                                                                                                                                                                                                                                                                                                                   |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>Course Contents / Syllabus</b>                                                                                                                                                                                                                                                                                 |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>Unit 1</b>                                                                                                                                                                                                                                                                                                     | <b>Introduction to Nanotechnology</b>                                                                                              |                                    |  |          |          |                          | <b>8 h</b> |
| Nanotechnology, History, Origin, Fundamental Concepts, Approaches, Current research, Moore's Law, Micro and Nanofabrication process with examples                                                                                                                                                                 |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>Unit 2</b>                                                                                                                                                                                                                                                                                                     | <b>Nanomaterials synthesis and applications</b>                                                                                    |                                    |  |          |          |                          | <b>8 h</b> |
| Nanomaterials synthesis and applications: Carbon based nanomaterials Inorganic nanomaterials, their classification, Synthesis process, properties and applications.                                                                                                                                               |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>Unit 3</b>                                                                                                                                                                                                                                                                                                     | <b>Nanotechnology tool and techniques</b>                                                                                          |                                    |  |          |          |                          | <b>8 h</b> |
| Surface Plasmon Resonance (SPR), Spectroscopy (UV and FTIR), Zeta potential, Dynamic Light Scattering (DLS), X-ray diffraction (XRD), Transmission Electron Microscopy (TEM), Scanning Electron Microscope (SEM), Scanning Probe Microscopy (STM and AFM), Improved diagnostic devices (Nanowires and Cantilever) |                                                                                                                                    |                                    |  |          |          |                          |            |
|                                                                                                                                                                                                                                                                                                                   | <b>Biomaterials and polymers</b>                                                                                                   |                                    |  |          |          |                          | <b>8 h</b> |
| Biomaterials, Properties of Biomaterials, Polymer as Biomaterial, Metals and Alloys, Hard Tissue Replacement, Application of Biomaterials and Polymers                                                                                                                                                            |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>Unit 5</b>                                                                                                                                                                                                                                                                                                     | <b>Application of Nanotechnology in Sciences and Technology</b>                                                                    |                                    |  |          |          |                          | <b>8 h</b> |
| Medical sciences, Food and Agriculture sciences, Information and communication (Memory storage, Novel semiconductor devices, Quantum computers) Aerospace technology, Vehicle manufacturing technology, Sports technology, Steel, glass and Coatings technology.                                                  |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>Total</b>                                                                                                                                                                                                                                                                                                      |                                                                                                                                    |                                    |  |          |          | <b>40 h</b>              |            |
| <b>Textbook:</b>                                                                                                                                                                                                                                                                                                  |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>S.No</b>                                                                                                                                                                                                                                                                                                       | <b>Book Title with publication agency &amp; year</b>                                                                               |                                    |  |          |          |                          |            |
| 1                                                                                                                                                                                                                                                                                                                 | Nanotechnology by Mark Ratner and Daniel Ratner, Pearson Education-2003                                                            |                                    |  |          |          |                          |            |
| 2                                                                                                                                                                                                                                                                                                                 | Guozhong Cao ,”Nanostructures and Nanomaterials , synthesis , properties and applications” , Imperial College Press ,2004.         |                                    |  |          |          |                          |            |
| 3                                                                                                                                                                                                                                                                                                                 | Hari Singh Nalwa, “Nanostructured Materials and Nanotechnology”, Academic Press, 2002                                              |                                    |  |          |          |                          |            |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                           |                                                                                                                                    |                                    |  |          |          |                          |            |
| <b>S.No</b>                                                                                                                                                                                                                                                                                                       | <b>Book Title with publication agency &amp; year</b>                                                                               |                                    |  |          |          |                          |            |
| 1                                                                                                                                                                                                                                                                                                                 | Microfabrication and Nanomanufacturing-Mark James Jackson-2018                                                                     |                                    |  |          |          |                          |            |
| 2                                                                                                                                                                                                                                                                                                                 | MEMS and Nanotechnology –Based sensors and devices communication, Medical and Aerospace applications -A.R.Jha-2008                 |                                    |  |          |          |                          |            |
| 3                                                                                                                                                                                                                                                                                                                 | Drug Delivery: Engineering Principles for Drug Therapy, M. Salzman-2001                                                            |                                    |  |          |          |                          |            |
| <b>Self-Study Content Links:</b>                                                                                                                                                                                                                                                                                  |                                                                                                                                    |                                    |  |          |          | <b>Duration (in Hrs)</b> |            |
| <b>MOOCs</b>                                                                                                                                                                                                                                                                                                      |                                                                                                                                    |                                    |  |          |          |                          |            |

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| <b>Video<br/>Lectures</b> |  |  |
| <b>Web<br/>References</b> |  |  |