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

Affiliated to

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

Evaluation Scheme & Syllabus

For

Bachelor of Technology

Electronics and Communication Engineering

Third Year

(Effective from the Session: 2022-23)

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

Bachelor of Technology
Electronics and Communication Engineering
EVALUATION SCHEME
SEMESTER-V

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
WEEKS COMPULSORY INDUCTION PROGRAM													
1	AEC0501	Control System	3	1	0	30	20	50		100		150	4
2	AEC0502	CMOS Digital Integrated Circuit	3	0	0	30	20	50		100		150	3
3	AEC0503	Electromagnetic Field Theory and Antenna	3	1	0	30	20	50		100		150	4
4	ACSE0503	Design Thinking-II	2	1	0	30	20	50		100		150	3
5		Departmental Elective -I	3	0	0	30	20	50		100		150	3
6		Departmental Elective -II	3	0	0	30	20	50		100		150	3
7	AEC0551	Control System Lab	0	0	2				25		25	50	1
8	AEC0552	CMOS Digital Integrated Circuit Lab	0	0	2				25		25	50	1
9		Departmental Elective Lab	0	0	2				25		25	50	1
10	AEC0559	Internship Assessment –II	0	0	2				50			50	1
11	ANC0501/ ANC0502	Constitution of India, Law and Engineering / Essence of Indian Traditional Knowledge	2	0	0	30	20	50		50		100	
12		MOOCs(For B.Tech. Hons. Degree)											
		GRAND TOTAL										**1100**	**24**

List of MOOCs (Coursera) Based Recommended Courses for Third Year (Semester-V) B. Tech Students

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	AMC0131	Industrial IoT Markets and Security	University of Colorado Boulder	21	1.5
2	AMC0091	IoT Cloud	University of Illinois at Urbana-Champaign	19	1.5

OR

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	AMC0128	Modern Robotics: Foundations of Robot Motion	Northwestern University	24	1.5
2	AMC0129	Robotics: Aerial Robotics	University of Pennsylvania	18	1

OR

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	AMC0076	Fundamentals of Digital Image and Video Processing	Northwestern University	36	3
2	AMC0093	Machine Learning with Python	IBM	23	1.5

PLEASE NOTE:-

- **Internship (3-4 weeks) shall be conducted during summer break after semester-IV and will be assessed during semester-V**
- **Compulsory Audit Courses (Non Credit - ANC0501/ANC0502)**
  - 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.

List of Departmental Electives

Sl. No.	Departmental Electives	Subject Codes	Subject Name	Bucket Name	Branch	Semester
1	Elective-I	AEC0511	Applied Industrial IoT	Internet of Things	ECE	5
2	Elective-II	AEC0514	IoT Architecture and Protocols		ECE	5
3	Elective Lab	AEC0511P	Applied IoT Lab		ECE	5
4	Elective-I	AEC0512	Embedded System Design	Embedded & Robotics	ECE	5
5	Elective-II	AEC0515	Introduction to Robotics and it's Applications		ECE	5
6	Elective Lab	AEC0512P	Embedded System Design Lab		ECE	5
1	Elective-I	AEC0513	Image Processing and Pattern Recognition	Artificial Intelligence	ECE	5
2	Elective-II	AEC0516	Machine Learning		ECE	5
3	Elective Lab	AEC0513P	Image Processing and Pattern Recognition Lab		ECE	5

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

Bachelor of Technology
Electronics and Communication Engineering
EVALUATION SCHEME
SEMESTER-VI

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	AEC0601	Digital Signal Processing	3	1	0	30	20	50		100		150	4
2	AEC0602	Wireless Communication Networks	3	0	0	30	20	50		100		150	3
3	AEC0603	5G Technology	3	0	0	30	20	50		100		150	3
4		Departmental Elective-III	3	0	0	30	20	50		100		150	3
5		Departmental Elective-IV	3	0	0	30	20	50		100		150	3
6		Open Elective I	3	0	0	30	20	50		100		150	3
7	AEC0651	Digital Signal Processing Lab	0	0	2				25		25	50	1
8	AEC0652	Wireless Communication Lab	0	0	2				25		25	50	1
9		Departmental Elective Lab	0	0	2				25		25	50	1
10	AEC0659	Mini Project	0	0	2				50			50	1
11	ANC0602 / ANC0601	Essence of Indian Traditional Knowledge / Constitution of India, Law and Engineering	2	0	0	30	20	50		50		100	
12		MOOCs (For B.Tech. Hons. Degree)											
		GRAND TOTAL										**1100**	**23**

List of MOOCs (Coursera) Based Recommended Courses for Third Year (Semester-VI) B. Tech Students

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	AMC0096	5G for Everyone	Qualcomm Wireless Academy	14	1
2	AMC0119	IoT Networking	University of Illinois at Urbana-Champaign	20	1.5

OR

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	AMC0096	5G for Everyone	Qualcomm Wireless Academy	14	1
2	AMC0130	Development of Real-Time Systems	eit Digital	19	1.5

OR

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	AMC0096	5G for Everyone	Qualcomm Wireless Academy	14	1
2	AMC0101	Convolution Neural Network	Deep learning.AI	23	1.5

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 - ANC0601/ANC0602)**
  - 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.

List of Departmental Electives

Sl. No.	Departmental Electives	Subject Codes	Subject Name	Bucket Name	Branch	Semester
1	Elective-III	AEC0611	Privacy and Security in IoT	Internet of Things	ECE	6
2	Elective-IV	AEC0614	IoT Networks		ECE	6
3	Elective Lab	AEC0614P	Advanced IoT and Mobile Applications Lab		ECE	6
4	Elective-III	AEC0612	Real Time Operating System	Embedded & Robotics	ECE	6
5	Elective-IV	AEC0615	Robotics Design Mechanism		ECE	6
6	Elective Lab	AEC0615P	Robotics Lab		ECE	6
7	Elective-III	AEC0613	ANN & Deep Learning	Artificial Intelligence	ECE	6
8	Elective-IV	AEC0616	Artificial Intelligence		ECE	6
9	Elective Lab	AEC0616P	AI & ML Lab		ECE	6

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

Bachelor of Technology
Electronics and Communication Engineering

AICTE Guidelines in Model Curriculum:

A student will be eligible to get Under Graduate degree with Honors only, if he/she completes the additional MOOCs courses such as Coursera 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 to18 =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 Coursera 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 Honors 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.

Bachelor of Technology Third Year			
Course Code	**AEC0501**	**L T P**	**Credits**
Course Title	**Control System**	**3 1 0**	**4**

Course Objectives: The student will learn about

1	The basics of control systems along with different types of feedback and its effect. Introduction to block diagram reduction techniques and signal flow graph
2	Analysis of time domain response for various types of inputs along with the time domain specifications.
3	Distinguish the concepts of absolute and relative stability for continuous data systems along with different methods and analyse the system stability.
4	The concept the state space analysis of a control system.
5	The digital control system and its analysis.

Course Contents / Syllabus

UNIT-I	**Introduction to Control Systems**	**8 hours**

Transfer function, Basic Components of a control system, types of Feedback and its effect, Introduction: open-loop control system, close-loop control system, Block diagram, Signal flow graph, Modelling a control system: Electrical network, Mechanical system, Servo motor

UNIT-II	**Time Domain Analysis of Control Systems**	**8 hours**

Transient and steady state response, Input test signal, Time response of a first order control system, Time response of a second order control system, steady state Error, Sensitivity, Design of Control system: PD, PI, PID controller

UNIT-III	**Stability of Control Systems**	**8 hours**

Stability in terms of characteristic equation, Routh Hurwitz criterion, Root-Locus Technique, Frequency domain analysis of control system, Nyquist stability criterion, stability analysis with the Bode plot, relative stability: gain margin and phase margin. Compensation of control system,

UNIT-IV	**State Variable Analysis**	**8 hours**

State space representation, The concept of state, Block diagram for a state equation, Transfer function decomposition: Direct decomposition, Cascade decomposition, Parallel decomposition, Solution of state equation, Transfer matrix, Controllability, and Observability.

UNIT-V	**Discrete Data Control System**	**8 hours**

Review of Z-transform and its relationship with Laplace-transform, transfer function of discrete data system, State equations of linear discrete data system, Time domain properties of discrete data system, Stability of discrete data system, Steady state error analysis of discrete data control system.

Course Outcomes: At the end of this course students will demonstrate the ability to

CO 1	Describe the basics of control systems along with different types of feedback and its effect.	K_1, K_2
CO 2	Interpret the time domain response analysis for various types of inputs along with the time domain specifications.	K_3, K_4
CO 3	Distinguish the concepts of absolute and relative stability for continuous data systems along with different methods and analyse the system stability.	K_3, K_4
CO 4	Analyse the nonlinear control system using the state space analysis.	K_1, K_2
CO 5	Identify the digital control system and its analysis using z-transform.	K_1, K_3

Text books

1. I. J. Nagrath& M. Gopal, "Control System Engineering", 6th Ed. New Age International Publishers, 2018.
2. B.C. Kuo& Farid Golnaraghi, "Automatic Control Systems", 9th Edition, John Wiley India, 2008.

Reference Books

1. Norman S. Nise, “Control Systems Engineering”, 7th Edition, John Wiley India.	
2. Richard C. Dorf, Robert H. Bishop, “Modern Control Systems”, 13th Edition, Pearson	
3. Karl J. Åström, “Adaptive Control”, Pearson Education India, 2006	
4. M. Gopal, “Digital control System, 6th Ed. New Age International Publishers	
NPTEL/ Youtube/ Faculty Video Link:	
Unit I	https://nptel.ac.in/courses/106/102/106102181/ https://nptel.ac.in/courses/117/105/117105080/ https://www.youtube.com/playlist?list=PLyqSpQzTE6M8-wda5vbgHkMQTmu-21hRK
Unit II	https://www.youtube.com/playlist?list=PLyqSpQzTE6M8-wda5vbgHkMQTmu-21hRK
Unit III	https://www.youtube.com/playlist?list=PLyqSpQzTE6M8-wda5vbgHkMQTmu-21hRK
Unit IV	https://www.youtube.com/playlist?list=PLyqSpQzTE6M8-wda5vbgHkMQTmu-21hRK
Unit V	https://www.youtube.com/playlist?list=PLyqSpQzTE6M8-wda5vbgHkMQTmu-21hRK

Bachelor of Technology Third Year			
Course Code	**AEC0502**	**L T P**	**Credits**
Course Title	**CMOS Digital Integrated Circuit**	**3 0 0**	**3**
Course Objectives: Students will learn about			
1	MOS and CMOS logic gate design.		
2	CMOS Combinational and Sequential logic circuit design		
3	Dynamic logic circuit Design		
4	VLSI design methodology		
5	Different ASIC Design Flow		
Pre-requisites: Basic knowledge of MOSFET and Digital Electronics			
Course Contents/Syllabus			
UNIT-I	**MOSFET and CMOS Theory**		**8 hours**
Evolution of VLSI, MOS threshold voltage, MOS device design equations, MOSFET scaling and small geometry effects, MOSFET capacitances. CMOS logic gate design: CMOS inverter, DC characteristics, rise time, fall time delays, noise margin, static & dynamic power dissipation, CMOS NAND, NOR, XOR and XNOR gates, Transistor sizing.			
UNIT-II	**CMOS Combinational and Sequential logic circuit design**		**8 hours**
CMOS Combinational Circuit: Design Half Adder, Full Adder, Multiplexers, Demultiplexers using CMOS. CMOS Sequential logic circuits: Design SR latch, Simpler Implementation of SR Latch, JK flip flop, D flip flop using CMOS. DAC: weighted resistor DAC, R-2R Ladder Type DAC. ADC: Flash Type ADC, Dual Slope ADC, Successive approximation ADC.			
UNIT-III	**Dynamic logic circuit Design**		**8 hours**
Logic Gate design using pass transistor, different Combinational Circuit design using transmission gate and Pseudo NMOS logic. **Dynamic logic circuits:** Basic principle, non-ideal effects, domino CMOS logic, high performance dynamic CMOS circuits, clocking issues, clock distribution.			
UNIT IV	**VLSI Design Methodology**		**8 hours**
VLSI design methodology, design Hierarchy, concept of regularity, modularity & locality, VLSI design style like Full Custom, Semi-Custom, Gate Array, Standard Cell and FPGA, design flow, Design quality Parameters, computer aided design technology, stick diagram and design rules, lambda-based design rules.			
UNIT-V	**ASIC Design Flow**		**8 hours**
Introduction of Application Specific Integrated Circuit (ASIC) Design Flow: An overview of Backend VLSI Design Flow – Libraries, Floor-planning, Placement, Routing, Verification, Testing. Specifications and Schematic cell Design, Spice simulation Analysis of analog and digital circuits, Circuit Extraction, Electrical rule check, Layout Vs. Schematic (LVS), Post-layout Simulation and Parasitic extraction, Design format, Timing analysis, Back notation and Post layout simulation, ASIC design implementation.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Express the concept of MOS design and CMOS logic gate design.		K1, K2
CO 2	Design CMOS Combinational and Sequential logic circuit.		K1, K2, K3
CO 3	Implement various logic gate using Dynamic logic		K1, K2, K3

	Technique.	
CO 4	Discuss the VLSI design methodology and its design flow.	K1, K2
CO 5	Describe ASIC Design Flow.	K1, K2, K3

Text Books:

1. Sung-Mo Kang &YosufLeblebici, "CMOS Digital Integrated Circuits: Analysis & Design",Mcgraw Hill, 4th Edition.
2. A.S. Sedra and K.C. Smith, "Microelectronic Circuits," Saunder's College11 Publishing, 4th edition.

Reference Books:

1. Introduction to VLSI, Eshraghian&Pucknell, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007
2. W.Wolf, Modern VLSI Design: System on Chip, Third Edition, Pearson, 2002.

Unit 1	https://www.youtube.com/watch?v=MuBiC9yz2fc
Unit 2	https://nptel.ac.in/courses/108/106/108106158, https://www.youtube.com/watch?v=UuafwIJAKhY
Unit 3	https://www.youtube.com/watch?v=tRakiNOYBxI&t=19s
Unit 4	https://www.youtube.com/watch?v=v2XywtRAHxM&t=2s, https://www.youtube.com/watch?v=N5vQIMyeA3M&t=1s
Unit 5	https://nptel.ac.in/courses/117/101/117101058/

Bachelor of Technology Third Year			
Course Code	**AEC0503**	**L T P**	**Credits**
Course Title	**Electromagnetic Field Theory and Antenna**	**3 1 0**	**4**
Course Objectives: The student will learn about			
1	Different coordinate systems, vector calculus, and their application in electromagnetic field theory.		
2	The concept of static Electric and Magnetic fields.		
3	Maxwell's equations for time-varying fields, wave propagation in a different medium, Poynting's Theorem and basic concepts of Electromagnetic radiation.		
4	Fundamental properties of Antenna.		
5	Practical Antennas and their applications.		
Pre-requisites: Basic fundamentals of vectors algebra.			
Course Contents / Syllabus			**Hours**
UNIT-I	**Coordinate Systems and Transformation**		**8 hours**
Coordinates transformation: Cartesian, Cylindrical and Spherical. Vector calculus: Differential length, area and volume, line, surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes's theorem, Laplacian of a scalar.			
UNIT-II	**Electrostatic fields and Magnetostatic fields**		**8 hours**
Electric field intensity, Electric field due to charge distribution, Electric flux density, Gauss's Law-Maxwell's equations, Continuity equation and relaxation time, boundary conditions, Magnetostatic fields, Ampere's circuit law, Maxwell's equation, magnetic scalar and vector potential, Magnetic boundary conditions.			
UNIT-III	**Electromagnetic waves**		**8 hours**
Maxwell's equations in final form, plane wave propagation in different medium: lossy dielectrics, lossless dielectrics, free space and good conductor, wave polarization, Poynting's theorem, radiation from small current element, power density and radiation resistance of short electric dipole and half wave dipole.			
UNIT-IV	**Antenna fundamental**		**8 hours**
Introduction, Basic antenna parameters, Patterns, Beam area, Radiation intensity, Beam efficiency, Directivity and Gain, Directivity and resolution, Antenna apertures, Effective height, The radio communication link.			
UNIT-V	**Practical Antennas**		**8 hours**
The Loop Antenna, Design and its Characteristic, Application of Loop Antennas. Horn Antennas, Helical Antennas, The Log-Periodic Antenna, Design of Microstrip Antenna, Parabolic Reflector Antennas, Feed Methods for Parabolic Reflectors.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Apply different coordinate systems and vector calculus to solve problems of electromagnetic fields.		K3, K4
CO 2	Explain and apply the concepts of static Electric and Magnetic fields.		K2, K3
CO 3	Explain Maxwell's equations and their applications.		K2, K3
CO 4	Explain and calculate the fundamental properties of Antenna.		K2, K4
CO 5	Analyze practical Antennas with applications.		K2, K3
Text Books:			
1. MNO Sadiku, "Elements of Electromagnetics', Oxford University Press, 2014.			

2. John D Kraus, Ronald J Marhefka and Ahmad S. Khan, “Antennas and Wave Propagation”, Fourth Edition, Tata McGraw Hill, 2011.
3. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley, 2016.

Reference Books:

1. W H Hayt and JA Buck, “Engineering Electromagnetics”, McGraw- Hill Education, 2013.
2. A. R. Harish, M. Sachidananda, “Antennas and Wave Propagation”, Oxford University Press, 2007.
3. R. L. Yadava, Electromagnetic Waves, Khanna Publishing House, Delhi, 2018.
4. A. Das, Sisir K. Das, “Microwave Engineering”, Tata McGraw Hill, 2001.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=3qd1JT7sRG8
Unit 2	https://www.youtube.com/watch?v=F5KFYBdjzuE&list=PLVFqK_9GOGXnV8fwd2YmUURVmECpCIShv
Unit 3	https://www.youtube.com/watch?v=7NZhmOIyYQM
Unit 4	https://www.youtube.com/watch?v=h51mFbIgZRI&list=PLbRMhDVUMngfytbQXzasPMHuWst4E-Ly8&index=2
Unit 5	https://www.youtube.com/watch?v=wx_tIvaajAI&list=PL3UZlxOnyu9CRoBFsG5x-VqYeC69FmMZT

Bachelor of Technology Third Year			
Course Code	**ACSE0503**	**L T P**	**Credits**
Course Title	**DESIGN THINKING II**	**2 1 0**	**3**

Course Objectives:

The objective of this course is to upgrade Design Thinking skills by learning & applying advanced and contextual Design Thinking Tools. It aims to solve a Real-Life Problem by applying Design Thinking to create an impact for all the stakeholders

Pre-requisites: Student must complete Design Thinking-I course

Course Contents / Syllabus

UNIT-I	**Introduction**	**10 HOURS**

Design thinking & Innovation, Design Thinking Mindset and Principles, recap of 5-Step Process of Design Thinking, Design Approaches, additional in-depth examples of each design approaches. Simon Sinek's – Start with Why, The Golden Circle , Asking the "Why" behind each example *(an in-class activity of asking 5-WHYS)* , The Higher Purpose, *in-class activity for LDO & sharing insights*

Visualization and it's importance in design thinking , reflections on wheel of life (*in-class activity for visualization & Wheel of Life*), Linking it with Balancing Priorities (*in class activity),* DBS Singapore and Bank of Americas' Keep the Change Campaign. Litter of Light & Arvind Eye Care Examples, understanding practical application of design thinking tools and concepts, case study on McDonald's Milkshake / Amazon India's Rural Ecommerce & Gillette

Working on 1-hour Design problem, Applying RCA and Brainstorm on innovative solutions.

Main project allocation and expectations from the project

UNIT-II	**Refinement and Prototyping**	**8 HOURS**

Refine and narrow down to the best idea, 10-100-1000gm, QBL, Design Tools for Convergence – SWOT Analysis for 1000gm discussion. *In-class activity for 10-100-1000gm & QBL*
Prototyping (Convergence): Prototyping mindset, tools for prototyping – Sketching, paper models, pseudo-codes, physical mockups, Interaction flows, storyboards, acting/role-playing etc, importance of garnering user feedback for revisiting Brainstormed ideas,
Napkin Pitch, Usability, Minimum Viable Prototype, Connecting Prototype with 3 Laws, A/B Testing, Learning Launch. Decision Making Tools and Approaches – Vroom Yetton Matrix, Shift-Left,Up,Right, Value Proposition, Case study: Careerbuddy,You-Me-Health Story & IBM Learning Launch.
In-class activities on prototyping- paper-pen / physical prototype/ digital prototype of project's 1000gm idea

UNIT-III	**Storytelling, Testing and Assessment**	**8 HOURS**

Storytelling: Elements of storytelling, Mapping personas with storytelling, Art of influencing, Elevator Pitch, Successful Campaigns of well-known examples, *in-class activity on storytelling.*
Testing of design with people, conducting usability test, testing as hypothesis, testing as empathy, observation and shadowing methods, Guerrilla Interviews, validation workshops, user feedback, record results, enhance, retest, and refine design, Software validation tools, design parameters, alpha&beta testing, Taguchi, defect classification, random sampling

Final Project Presentation and assessing the impact of using design thinking

UNIT-IV	**Innovation, Quality and Leadership**	**6 HOURS**

Innovation: Need & Importance, Principles of innovations, Asking the Right Questions for innovation, Rationale for innovation, Quality: Principles & Philosophies, Customer perception on quality, Kaizen, 6 Sigma. *FinTech case study of Design Thinking application – CANVAS*
Leadership, types, qualities and traits of leaders and leadership styles, Leaders vs Manager, Personas of Leaders & Managers, Connecting Leaders-Managers with 13 Musical Notes, Trait theory, LSM (Leadership Situational Model), Team Building Models: Tuckman's and Belbin's. Importance of Spatial elements for innovation

UNIT-V	**Understanding Human Desirability**	**8 HOURS**

Program needed to achieve the comprehensive human goal: the five dimensions of human endeavour(ManaviyaVyavstha) are: Education- Right living (Sikhsa- Sanskar), Health – Self-regulation (SwasthyaSanyam), Justice – Preservation (Nyaya- Suraksha), Production – Work (Utpadan – Karya), Exchange – Storage (Vinimya – Kosh), Darshan-Gyan-Charitra (Shifting the Thinking)
Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature, Thinking expansion for harmony: Self-exploration (Johari's window), group behaviour, interpersonal behaviour and skills, Myers-Briggs personality types (MBTI), FIRO-B test to repair relationships.

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

CO 1	Learn sophisticated design tools to sharpen their problem-solving skills	K2
CO 2	Generate innovate ideas using design thinking tools and converge to feasible idea for breakthrough solution	K3, K4
CO 3	Implement storytelling for persuasive articulation	K3
CO 4	Understanding the nature of leadership empowerment	K2
CO 5	Understand the role of a human being in ensuring harmony in society and nature.	K2

Textbooks

1. Arun Jain, UnMukt : Science & Art of Design Thinking, 2020, Polaris
2. Gavin Ambrose and Paul Harris, Basics Design 08: Design Thinking, 2010, AVA Publishing SA
3. R R Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, First Edition, 2009, Excel Books: New Delhi

Reference Books

1. Jeanne Liedta, Andrew King and Kevin Benett , Solving Problems with Design Thinking – Ten Stories of What Works, 2013, Columbia Business School Publishing
2. Dr RituSoryan, Universal Human Values and Professional Ethics, 2022, Katson Books
3. Vijay Kumar, 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, 2013, John Wiley and Sons Inc, New Jersey
4. Roger L. Martin, Design of Business: Why Design Thinking is the Next Competitive Advantage, 2009, Harvard Business Press, Boston MA
5. Tim Brown, Change by Design, 2009, Harper Collins
6. Pavan Soni, Design your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-Solving, 2020, Penguin Books

NPTEL/ YouTube/ Web Link
Unit I https://www.youtube.com/watch?v=6_mHCOAAEI8 https://nptel.ac.in/courses/110106124 https://designthinking.ideo.com/ https://blog.experiencepoint.com/how-mcdonalds-evolved-with-design-thinking
Unit II https://www.coursera.org/lecture/uva-darden-design-thinking-innovation/the-ibm-story-iq0kE https://www.coursera.org/lecture/uva-darden-design-thinking-innovation/the-meyouhealth-story-part-i-what-is-W6tTs https://onlinecourses.nptel.ac.in/noc19_mg60/preview
Unit III https://nptel.ac.in/courses/109/104/109104109/ https://www.d-thinking.com/2021/07/01/how-to-use-storytelling-in-design-thinking/
Unit IV https://www.worldofinsights.co/2020/10/infographic-8-design-thinking-skills-for-leadership-development/
Unit V https://www.youtube.com/watch?v=hFGVcx1Us5Y

Bachelor of Technology Third Year			
Course Code	**AEC0511**	**L T P**	**Credits**
Course Title	**Applied Industrial IoT**	**3 0 0**	**3**
Course Objectives: Student will learn about			
1	The basic introduction and layered architecture of IIoT.		
2	The technology used in various types of sensors and measurement.		
3	Different functionalities required for edge computing and gateway.		
4	The architecture, big data architecture and data configure architecture.		
5	The security threats and gaps and provide the security solution.		
Pre-requisites: Knowledge of basic fundamentals of IoT.			
Course Contents / Syllabus			
UNIT-I	**Introduction to Industrial IoT**		**8 hours**
Concept of Internet of Things, Drivers, Benefits and Challenges of IoT, Categories of IoT, Examples of IoT in Industry, Layers of IIoT Architecture, Functions of IIoT Architecture Layers, Components of IIoT Architecture, Review of Components in various layers of IoT, Components of M bed operating system and its functionalities.			
UNIT-II	**Data Acquisition and Measurement**		**8 hours**
Sensor Technologies, Thermal Sensors, Pressure, Shear and Photo Sensors, Electrical, Magnetic and Mechanical Sensors, Introduction to Measurements, Direct Measurement, Indirect Measurement, Derived Measurement, Measurement from Industrial Systems.			
UNIT-III	**Edge Computing and Gateway**		**8 hours**
Edge Computing, Gateway Overview, Types and Features of Gateway, Choice of Gateway, Configuring the Gateway, IoT Video Analytics and Quality Control at the Edge.			
UNIT-IV	**Platform Architecture**		**8 hours**
Types of Server Architecture, Data Architecture, Big Data Architecture and Stream Processing, Storage Devices, Storage Technologies, Analytics Overview, Types of Analytics.			
UNIT-V	**IIoT Security**		**8 hours**
IIoT Device Security, IIoT Connection Security, IIoT Application Platform and Cloud Security, Threat Modeling, Industrial Example – IoT Connected Workplace Solution.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Analyze the scope and impact of IoT in daily life, society and Industry and able to architect the layers of IIoT.		K_1, K_2
CO 2	Understand the different technologies in thermal, pressure, shear, photo, electrical, magnetic and mechanical sensor, and able to determine the right measurement.		K_1, K_2
CO 3	Identify the various functionalities that are required in edge computing and gateway.		K_1, K_2
CO 4	Explain platform architecture, big data architecture and to configure the data storage architecture.		K_1, K_2
CO 5	Foresee possible security threats including gaps and identify its solutions.		K_1, K_2
Text books			
1. Guang Zhou, China, Industrial IoT Technologies and Applications, 2016, Kindle Edition			
2. Timothy Chou Precision - Principles, Practices and Solutions for the Internet of Things, 2016 PHI			
Reference Books			
1. Mahmood, Marchenko, Wireless Networks and Industrial IoT: Applications, Challenges and Enablers 1st ed. 2021 Edition, Kindle Edition			

2. Ismail Butun, Industrial IoT: Challenges, Design Principles, Applications, and Security, Kindle Edition	
NPTEL/ Youtube/ Faculty Video Link:	
Unit 1	https://onlinecourses.nptel.ac.in/noc21_cs20/unit?unit=49&lesson=51
Unit 2	https://onlinecourses.nptel.ac.in/noc21_cs20/unit?unit=57&lesson=58
Unit 3	https://www.youtube.com/watch?v=QnK0rf3y69s
Unit 4	https://onlinecourses.nptel.ac.in/noc21_cs20/unit?unit=33&lesson=38
Unit 5	https://onlinecourses.nptel.ac.in/noc21_cs20/unit?unit=89&lesson=91

Bachelor of Technology Third Year			
Course Code	**AEC0512**	**L T P**	**Credits**
Course Title	**Embedded Systems Design**	**3 0 0**	**3**
Course Objectives: Student will learn about			
1	Understand the basic introduction to embedded system design requirements.		
2	Learn the STM32F401 board & its interfacing.		
3	Understand the Architecture of ARM CORTEX-M4 processor.		
4	Learn the programming techniques of ARM processor.		
5	Understand the concept of embedded Linux and Linux kernel architecture.		
Pre-requisites: Knowledge of Microprocessor and Microcontroller			
Course Contents / Syllabus			
UNIT-I	**Embedded System Concepts**		**8 hours**
Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Design Considerations of Embedded Systems.			
UNIT-II	**STM32F401 Board & Interfacing**		**8 hours**
STM32F401 Nucleo Board, Interfacing with Analog World, Output Devices, Sensors and Actuators, Interfacing with 7 segment LED and LCD Displays, Interfacing with Temperature Sensor and LDR Light Sensor, Speed Control of DC Motor.			
UNIT-III	**The ARM CORTEX-M4 Processor**		**8 hours**
Key features of Arm architectures and processors, Structure and purpose of specific registers in the Arm Cortex-M4 processor, Interrupts: Nested Vectored Interrupt Controller (NVIC), Wakeup Interrupt Controller (WIC), Memory Protection Unit (MPU), Bus Interconnect and Debug System and Low Power Features.			
UNIT-IV	**ARM CORTEX-M4 Programming**		**8 hours**
Introduction to Arm Cortex-M4 Programming, Compare the C and Assembly programming languages, C as Implemented in Assembly Language, Benefits and drawbacks of high-level and low-level programming, Introduction to the Mbed Platform and CMSIS, Mbed platform and its importance.			
UNIT-V	**Embedded Linux & Drivers**		**8 hours**
History of Embedded Linux, Embedded Linux versus Desktop Linux, Embedded Linux Distributions, Architecture of Embedded Linux, Linux Kernel Architecture, Linux Start-Up Sequence, GNU Cross-p\Platform Tool chain, Linux Serial Driver, Ethernet Driver.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Compute the design considerations of embedded systems.		K_1, K_2
CO 2	Apply the knowledge to learn STM32F401 for various application.		K_1, K_3, K_4
CO 3	Analyze the Architecture of ARM CORTEX-M4 processor.		K_3, K_4
CO 4	Implement the programming techniques for ARM processor.		K_3, K_4
CO 5	Evaluate the concept of embedded Linux and kernel architecture.		K_2, K_4, K_5
Text books			
1.ARM system developers guide, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier,Morgan Kaufman publishers, 2008.			
2. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition, Newnes, 2009			
3. Embedded Linux System Design and Development, P.Raghavan, Amol Lad, Sriram			

Neelakandan, 2006, Auerbach Publications.	
Reference Books	
1. Shibu K V, ―Introduction to Embedded Systems‖, Tata McGraw Hill Education Private Limited, 2009.	
2. Embedded Systems: Architecture, Programming and design, Raj Kamal, Second Edition, Tata McGraw Hill publisher, 2010.	
3. David E. Simon, "An Embedded Software Primer", Pearson Education.	
4. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015	
NPTEL Links	
Unit 1	https://www.youtube.com/watch?v=y9RAhEfLfJs
Unit 2	https://www.youtube.com/watch?v=C04ZthY8Yqk
Unit 3	https://nptel.ac.in/courses/106/105/106105193/
Unit 4	https://www.youtube.com/watch?v=csttt3VHxf8
Unit 5	https://www.youtube.com/watch?v=h-ZP98qhEM8

Bachelor of Technology Third Year			
Course Code	**AEC0513**	**L T P**	**Credits**
Course Title	**Image Processing and Pattern Recognition**	**3 0 0**	**3**

Course Objective: The student will learn about

1	Basics of digital image and various operations on it.
2	Image enhancement techniques in different domains.
3	The various noises in images and restoration methods.
4	Skills to segment a digital image with different methods.
5	The basics of colour image processing and various image compression techniques.

Pre-requisites: Basic fundamental of mathematics and signal processing

Course Contents / Syllabus		Hours
UNIT-I	**Introduction To Image Processing & Image Formation**	**8 Hours**

Basic image file formats,Geometric and photometric models, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationship between Pixels, Linear and Nonlinear Operations on digital images, Applications of DIP.

UNIT-II	**Image Enhancement**	**8 Hours**

Spatial Domain: Basic Gray Level Transformations, Histogram based Processing, Enhancement using Arithmetic/Logic Operations, Spatial Filtering, Smoothing and Sharpening by Spatial Filtering.
Frequency Domain: Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.

UNIT-III	**Image Restoration**	**8 Hours**

Image Degradation/Restoration process model, Noise Models, Restoration in the presence of noise only–spatial filtering, Periodic noise reduction by frequency domain filtering.

UNIT-IV	**Image Segmentation & Image/Object Features Extraction**	**8 Hours**

Edge Linking and Boundary Detection, Thresholding: Otsu and adaptive, Region-Based Segmentation, Segmentation: Morphological Watershed, K-means and Fuzzy C-means, Wavelet transform, Discrete wavelet transform, Hough transform, Textural features - grey level co-occurrence matrix; Moments; Connected component analysis; Convex hull; Distance transform, medial axis transform, skeletonization/thinning, shape properties.

UNIT-V	**Color Image Processing & Morphological Filtering Basics**	**8 Hours**

Fundamentals of different colour models - RGB, CMY, HSI, YCbCr, Lab; False colour; Pseudo colour; Enhancement; Segmentation, Dilation and Erosion Operators, Top Hat Filters.

Course Outcomes: After completion of this course, students will be able to

CO 1	Apply knowledge of mathematics for image understanding and analysis.	K1, K3
CO 2	Analyse various image enhancement techniques in different domains.	K3, K4
CO 3	Recognize various noises in images and apply restoration methods.	K3, K4
CO 4	Apply different segmentation techniques on image.	K3
CO 5	Perform different operations on colour images as well as different morphological filtering techniques on images to analyse them.	K2, K3

Text Books:

3. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing Pearson, Third Edition, 2010.", Prentice Hall of India.

4. Anil K. Jain, Fundamentals of Digital Image Processing Pearson, 2002.

Reference Books:

1. Milan Sonka, Vaclav Hlavav, Roger Boyle, ―Image Processing, Analysis and Machine Vision, 2nd ed., Thomson Learning, 2001.
2. Rangaraj M. Rangayyan, ―Biomedical Image Analysis‖, CRC Press, 2005
3. Pratt W.K, ―Digital Image Processing‖, 3rd ed., John Wiley & Sons, 2007
4. Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://youtu.be/T0bgf3V7u-E
Unit 2	https://youtu.be/bJjgyTQ-BT4 https://youtu.be/M7JxDHUW5cc https://youtu.be/JfrcMYBouJE
Unit 3	https://youtu.be/MrNafUqh860 https://youtu.be/gLTlQPYY_pw
Unit 4	https://youtu.be/j3_Ck5oP5oI https://youtu.be/q1J0VAYFkHg
Unit 5	https://youtu.be/kSzramCsHA4 https://youtu.be/nlwH07G9Efg

Bachelor of Technology Third Year			
Course Code	**AEC0514**	**L T P**	**Credits**
Course Title	**IoT Architecture and Protocols**	**3 0 0**	**3**
Course Objectives: Student will learn about			
1	The architectural overview and IoT reference architecture.		
2	The open source architecture and design principles.		
3	The various types of IoT connectivity protocols.		
4	Different types of IoT layered protocols.		
5	Differences between Web of things and Internet of things.		
Pre-requisites: Knowledge of basic fundamentals of IoT			
Course Contents / Syllabus			
UNIT-I	**Reference Architecture**		**8 hours**
IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints, Data representation and visualization, Interaction and remote control, Wireless Sensor Network.			
UNIT-II	**IoT Architecture**		**8 hours**
IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity: An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction. LoRaWAN architecture, Channel access mechanism specific to NB-IoT.			
UNIT-III	**IoT Connectivity Protocols**		**8 hours**
IoT Connectivity Overview, Wireless Long Range (WAN) Protocols, LAN Protocols, Serial Protocols, IoT transmission Protocols, Wired LAN Protocols, Features and security in Bluetooth			
UNIT-IV	**IoT Layered Protocols**		**8 hours**
Protocol Standardization for IoT, Efforts, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Unified Data Standards Protocols IEEE802.15.4, IEEE 802.11, BAC Net Protocol Modbus, KNX, architecture and Protocol stack used in Zig bee, Network layer, APS layer.			
UNIT-V	**Web of Things**		**8 hours**
Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Unified Multitier WoT Architecture, WoTPortals and Business Intelligence.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Explain the architectural overview and IoT reference model.		K1, K2
CO 2	Demonstrate the IoT reference architecture.		K2
CO 3	Analyze the various types of IoT connectivity protocols.		K1
CO 4	Explain the different types of IoT layered protocols.		K1, K2
CO 5	Describe the differences between Web of things and Internet of Things.		K1, K2
Text books			
1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012			
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011			
3. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a			

Highly Connected World", Cambridge University Press, 2010.	
Reference Books	
1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.	
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013	
3. Cuno P fister, Getting Started with the Internet of Things, O" Reilly Media, 2011, ISBN: 978-1	
NPTEL/ Youtube/ Faculty Video Link:	
Unit 1	https://onlinecourses.nptel.ac.in/noc21_cs20/unit?unit=49&lesson=53
Unit 2	https://www.youtube.com/watch?v=FRxRT0DjE7A
Unit 3	https://onlinecourses.nptel.ac.in/noc19_cs65/unit?unit=15&lesson=20
Unit 4	https://onlinecourses.nptel.ac.in/noc19_cs65/unit?unit=15&lesson=19
Unit 5	https://www.youtube.com/watch?v=R52OCMtFqNA

Bachelor of Technology Third Year			
Course Code	**AEC0515**	**L T P**	**Credits**
Course Title	**Introduction to Robotics & Its Applications**	**3 0 0**	**3**
Course Objectives: Student will learn about			
1	The concept of robotics.		
2	Mathematical relations for forward and inverse kinematic analysis.		
3	The various types of actuators and drive systems.		
4	Different types of sensors for a robot in a specific job task.		
5	The applications of robotics in industry.		
Pre-requisites: Engineering mechanics, Basic Electrical & Electronics, Sensor & Instrumentation			
Course Contents / Syllabus			
UNIT-I	**Introduction**		**8 hours**
Classification of Robots, Advantages and Disadvantages of Robots, Robot Components, Robot Degrees of Freedom, Robot Joints, Robot Coordinates, Robot Reference Frames, Programming Modes, Robot Characteristics, Robot Workspace, Robot Languages.			
UNIT-II	**Kinematics of Robots**		**8 hours**
Position Analysis – Introduction, Robots as Mechanisms, Conventions, Matrix Representation Homogeneous Transformation Matrices, Representation of Transformations Forward and Inverse Kinematics of Robots, Forward and Inverse Kinematics of Planar Parallel Robots			
UNIT-III	**Actuators and Drive Systems**		**8 hours**
Introduction, Characteristics of Actuating Systems, Comparison of Actuating Systems, Hydraulic Actuators, Pneumatic Devices, Electric Motors, Microprocessor Control of Electric Motors, Pulse Width Modulation, Direction Control of DC Motors with an H-Bridge, Speed Reduction			
UNIT-IV	**Sensors**		**8 hours**
Introduction, Sensor Characteristics, Sensor Utilization, Position Sensors, Velocity Sensors, Acceleration Sensors, Force and Pressure Sensors, Torque Sensors, Micro-switches, Visible Light and Infrared Sensors, Touch and Tactile Sensors, Proximity Sensors, Range Finders, Sniff Sensors			
UNIT-V	**Robotics Applications**		**8 hours**
Robotics applications in Manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation. Limitation of usage of robots in processing operation.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Explain the concept of robotics.		K1, K2
CO 2	Formulate the mathematical relations for forward and inverse kinematic analysis.		K2
CO 3	Interpret the various types of actuators and drive systems.		K4, K6
CO 4	Explain the different type's sensor for a robot in a specific job task.		K4, K5
CO 5	Describe the applications of robotics in industry.		K1, K3
Text books			
1. Saeed B. Niku, "Introduction to Robotics – Analysis, Systems and Application" : PHI 2006			
2. J.J. Craig, Robotics, Addison-Wesley, 1986.			

3. K.S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.	
Reference Books	
1. An Introduction to Robot Technology, by CoifetChirroza, Kogan Page.	
2. Robotic Engineering - An Integrated Approach: Richard D. Klafter Thomas A.	
3. Robotics for Engineers, by Y. Koren, McGraw Hill.	
NPTEL/ Youtube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/watch?v=P_PP76flZfw&list=PLyqSpQzTE6M_XM9cvjLLO_Azt1FkgPhpH&index=2
Unit 2	https://www.youtube.com/watch?v=XOg1KT6xD04&list=PLyqSpQzTE6M_XM9cvjLLO_Azt1FkgPhpH&index=4
Unit 3	https://youtu.be/ksOgvhYdqX8
Unit 4	https://youtu.be/Gc4BiUGiV-Q
Unit 5	https://youtu.be/pSEjWxqE3R0

Bachelor of Technology Third Year			
Course Code	**AEC0516**	**L T P**	**Credits**
Course Title	**Machine Learning**	**3 0 0**	**3**

Course Objectives: Student will learn about

1	The machine learning and basics of statistics and probability theory.
2	Neurons, neural networks, and multilayer perceptron.
3	Identification of the dimensionality of data and its reduction using various mathematical concepts as well as probabilistic learning.
4	Various search and optimization techniques to the raw data.
5	Various learning techniques and approaches.

Pre-requisites: Basics of mathematics and python programming

Course Contents / Syllabus

UNIT-I	**Introduction**	**8 Hours**

Brief Introduction to Machine Learning, Supervised Learning, Unsupervised Learning, Reinforcement Learning and hypothesis testing. Probability Basics, Linear Algebra, Statistical Decision Theory – Regression & Classification, Bias – Variance, Linear Regression, Multivariate Regression.

UNIT-II	**Artificial Neural Network**	**8 Hours**

Neural Networks: Hebb's Rule, McCulloch and Pitts Neurons, Limitation of McCulloch and Pitts Neurons, The Perceptron, Linear separability, Linear Regression, Back propagation algorithm.

The Multi-layer Perceptron (MLP): MLP algorithm, Sequential and Batch training, Amount of training data, number of hidden layers, when to stop training. The network output and errors, Requirements of activation function.

UNIT-III	**Dimensionality Reduction and Models**	**8 Hours**

Dimensionality Reduction: Linear discriminant analysis, Principal Component analysis, Factor analysis, Independent Component analysis, locally linear embedding, ISOMAP

Models: Gaussian Matrix Models, Nearest Neighbour methods. Support Vector Machine (SVM): Optimal separation, Kernels, SVM algorithm, Extensions of SVM.

UNIT-IV	**Optimization and Search Techniques**	**8 Hours**

Optimization and Search: Going Downhill, least square optimization, conjugate gradients, Exhaustive search, Greedy search, hill climbing.

Evolutionary Learning: The genetic algorithm, Genetic operators, punctuated equilibrium, The Knapsack Problems.

UNIT-V	**ML Classifiers**	**8 Hours**

Reinforcement Learning: State and action spaces, the reward function, Markov chain decision process, Uses of Reinforcement Learning.

Learning with tree: Decision Tree, Classification and regression tree, Random Forest.

Unsupervised Learning: The k-means algorithm, Vector quantization, The self-organization feature map, Simulated annealing.

Course Outcomes: After completion of this course, students will be able to

CO 1	Describe the basic concepts of machine learning, statistics, and probability theory.	K1
CO 2	Define and describe the Neurons, neural networks, and multilayer perceptron.	K3

CO 3	Identify the dimensionality of data and reduces it using various mathematical concepts as well as describe the probabilistic learning.	K3, K4
CO 4	Describe and apply various search and optimization techniques to the raw data.	K5
CO 5	Illustrate and apply various learning techniques.	K2

Text Books:

1. Stephen Marsland, "Machine Learing- An Algorithm Perspective", CRC Press, 2nd edition.
2. EthemAlpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. SimanHaykin, "Neural Netowrks", Prentice Hall of India
4. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley

Reference Books:

1. Kumar Satish, "Neural Networks", Tata Mc Graw Hill
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Wiley India.
3. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
4. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.

NPTEL/ Youtube/ Faculty Video Link:

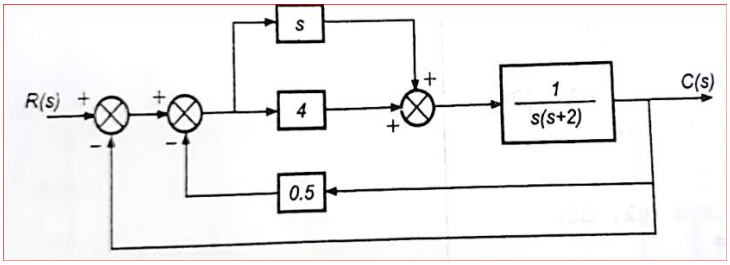
Unit 1	https://www.youtube.com/watch?v=T3PsRW6wZSY&list=PLJ5C_6qdAvBGaabKHmVbtryZW9KpICiHC
Unit 2	https://www.youtube.com/watch?v=T3PsRW6wZSY&list=PLJ5C_6qdAvBGaabKHmVbtryZW9KpICiHC
Unit 3	https://www.youtube.com/watch?v=T3PsRW6wZSY&list=PLJ5C_6qdAvBGaabKHmVbtryZW9KpICiHC
Unit 4	https://www.youtube.com/watch?v=T3PsRW6wZSY&list=PLJ5C_6qdAvBGaabKHmVbtryZW9KpICiHC
Unit 5	https://www.youtube.com/watch?v=T3PsRW6wZSY&list=PLJ5C_6qdAvBGaabKHmVbtryZW9KpICiHC

Bachelor of Technology Third Year			
Course Code	**AEC0551**	**L T P**	**Credit**
Course Title	**Control System Lab**	**0 0 2**	**1**

Course Objectives: The student will learn about

1.	Application of MATLAB in Control System.
2.	Analysis and plotting various pole-zero configuration in s-plane using MATLAB.
3.	The basics concept of time domain analysis and steady state error.
4.	The stability of a given transfer function using various methods such as Bode plot, Nyquist plot and root locus.
5.	The fundamental concept of steady state analysis and discrete control system

List of Experiments

Sr. No.	Name of Experiment	CO
1	Introduction to MATLAB and Control System Toolbox.	CO1
2	Plot the pole-zero configuration in s-plane for the given transfer function $$H(s) = \frac{2s+1}{s^2+5s+5}$$	CO1
3	Determine the transfer function for given closed loop system in block diagram representation. 	CO2
4	A unity feedback control system has forward path transfer function is given below, determine time response for unit step input, rise time, maximum overshoot. $$G(s) = \frac{s+2}{s(s+1)}$$	CO3
5	The open loop transfer function of unity feedback control system is given below find the position error coefficient, velocity error coefficient and acceleration error coefficient. $$G(s) = \frac{10}{(s^2+6s+10)}$$	CO3
6	Determine gain margin phase margin and closed loop stability by using Bode plot. Transfer function is given below $$G(s)H(s) = \frac{4}{s(0.5s+1)(0.08s+1)}$$	CO4
7	Draw the Nyquist plot for open loop transfer function given below and comment on its closed loop stability.	CO4

	$G(s)H(s) = \frac{2.2}{s(s+1)(s^2+2s+2)}$	
8	Plot the root locus plot for the system when the open loop transfer function is given by $G(s) = \frac{K}{s(s+4)(s^2+4s+13)}$	CO4
9	Obtain the state model for the transfer function given below $\frac{C(s)}{R(s)} = \frac{s+2}{(s+3)(s+1)}$	CO5
10	The forward-path transfer function of a unity-feedback discrete-data control system with sample-and-hold is $G_{ho}G(z) = \frac{0.0952z}{(z-1)(z-0.905)}$ The sampling period is T = 0.1 s. (a) Plot the plot of $G_{ho}G(z)$ and determine the stability of the closed-loop system. (b) Apply the w-transformation to $G_{ho}G(z)$ and plot the Bode plot of $G_{ho}G(w)$. Find the gain and phase margins of the system.	CO5
Course Outcomes: After successful completion of this Lab students will be able to		**Blooms Level**
CO 1	Classify different tools in MATLAB.	K1, K2, K3
CO 2	Evaluate the poles and zeros on s-plane along with transfer function of a given system.	K2, K3, K4
CO 3	Evaluate the various specifications of time domain response of a given system.	K1, K3, K4
CO 4	Examine the stability of a given transfer function using various methods such as Bode plot, Nyquist plot and root locus.	K1, K2, K3
CO 5	Examine the concept of state variable analysis and discrete control system	K2, K3, K4

Bachelor of Technology Third Year			
Course Code	**AEC0552**	**L T P**	**Credit**
Course Title	**CMOS Digital Integrated Circuit Lab**	**0 0 2**	**1**

Course Objectives: The student will learn	
1.	VLSI EDA Tool.
2.	Designing of various Logic gates.
3.	Analyze CMOS Inverter and Voltage Follower.
4.	Analysis and verification of CMOS Combinational Circuits.
5.	Analysis and verification of CMOS Sequential Circuits.

List of Experiments

Sr. No.	**Name of Experiment**	**CO**
1	Introduction to VLSI Basic and EDA Tools such as Microwind and or Siemens.	CO1
2	To design a 2-input NAND logic gate using 0.18 µm technology and study its DC, AC and Transient characteristics.	CO1
3	To design a 2-input NAND logic gate using 0.18 µm technology and study its DC, AC and Transient characteristics.	CO2
4	To design a 2-input NOR logic gate using 0.18 µm technology and study its Transient characteristics.	CO2
5	To design a NMOS source amplifier using 0.18 µm technology and study its DC and AC response. characteristics.	CO2
6	To design a voltage follower using 0.18 µm technology and study its DC and AC response.	CO2
7	To design a CMOS inverter using 0.18 µm technology and study its DC, AC and Transient characteristics.	CO3
8	To design and study the characteristic of CMOS XOR gate using 0.18 µm technology.	CO4
9	To design and study the characteristic of CMOS D flipflop using 0.18 µm technology.	CO3
10	To design and study the characteristic of CMOS T flipflop using 0.18 µm technology.	CO5

Course Outcome: After successful completion of this Lab students will be able to		**Blooms Level**
CO 1	Demonstrate VLSI EDA Tool.	K_3
CO 2	Design various Logic gates.	K_3, K_4
CO 3	Analyze CMOS Inverter and Voltage Follower.	K_3, K_4
CO 4	Analyze and verify CMOS Combinational Circuits.	K_2
CO5	Analyze and verify CMOS Sequential Circuits.	K_1, K_2, K_3

Bachelor of Technology Third Year			
Course Code	**AEC0511P**	**L T P**	**Credits**
Course Title	**Applied IoT Lab**	**0 0 2**	**1**

Course Objectives: Student will learn about	
1	The interfacing of Bluetooth with Arduino and publishing data to the cloud.
2	The connection of Node MCU and Thing speak cloud.
3	The controlling of LED, Home appliances with Node MCU, Raspberry Pi and blink app.
4	The connection of temperature and humidity sensor with Node MCU and blink app.
5	The detection of virgular motion and observation of various parameters of agricultural land.

Pre-requisites: Basic Knowledge of computer

	Course Contents / Syllabus	**CO**
1	TointerfaceBluetoothwithArduinoandwriteaProgramto turnLEDON/OFFwhenmessageisreceivedfromSmartPhone usingBluetooth.	CO1
2	To publishArduinodatatothecloud.	CO1
3	To Connect Node MCU with wi-fi Hotspots and sending Data to Thing speak Server using Node MCU.	CO2, CO3
4	To Control the LED with Node MCU using Blink App.	CO3
5	To control home appliances using Node MCU using Blink App.	CO2
6	To control home appliances using Raspberry Pi 3 and MQTT.	CO2, CO5
7	To control the servo motor rotation using Node MCU and Blink App.	CO2, CO4
8	To read the temperature and humidity using DHT11using Node MCU and Blink App.	CO2, CO4, CO5
9	To detect the virgular motion for home security system using Node MCU and Blink App.	CO2, CO5
10	To monitor soil moisture and water level of agricultural land using Node MCU and Blink App.	CO1, CO2

Course Outcomes: After completion of this course students will be able to

CO 1	The interfacing of Bluetooth devices with Arduino and its applications, publication of data on cloud.	K1, K2
CO 2	Analyze Thing speak cloud and blink app.	K3
CO 3	Controlling the home appliances using Node MCU, Raspberry Pi and blink app.	K4
CO 4	Understand the function of DHT11 with Node MCU and blink app.	K5
CO 5	Apply the IoT techniques for various practical applications.	K5

Bachelor of Technology Third Year			
Course Code	**AEC0512P**	**L T P**	**Credit**
Course Title	**Embedded System Design Lab**	**0 0 2**	**1**

Course Objectives: Student will learn about

1	Writing different programs for Arm based microcontroller.
2	Freedom KL25Z board to build a system.
3	Arm-based embedded system, and program to satisfy given user specifications.
4	Commercial tools to develop Arm-based embedded systems.
5	Commercial API and tools to accelerate the development cycle of Arm-based embedded systems.

Pre-requisites: Microcontrollers & Basics of Embedded system

	Course Contents / Syllabus	CO
1	Write a C program to examine the assembly language program output of the compiler and the map file output of the linker.	**CO1**
2	Write the Thumb code to multiply the two 32-bit in memory at addresses 0x1234_5678 and 0x7894_5612, storing the result in address 0x2000_0010.	**CO1**
3	Write and compile assembly code and debug the program image on an mbed board (namely the Freedom KL25Z board) using the Keil MDK-ARM tool.	**CO2, CO3**
4	Write an assembly code subroutine to approximate the square root of an argument using the bisection method.	**CO3**
5	Write a program to configure a General Purpose Input Output (GPIO) peripheral in a low-level (register-level) in practice.	**CO2**
6	Write a program to implement an interrupt handler in a low-level. You are required to demonstrate the interrupt mechanism using switches and LEDs on the board.	**CO2, CO5**
7	Write a program to generate audio waves using the analogoutput, and use two potentiometers to tune the volume and pitch of the audio.	**CO2, CO4**
8	Write a program to design an audio player using the timer, PWM, and interrupts. The audio player will play a simple piece of music using the speaker, and display the melody of the music to the LEDs. Two potentiometers are used to adjust the music speed and the volume respectively.	**CO2, CO4, CO5**
9	Write a program to generate various signals using DAC which can be viewed on an oscilloscope or heard through a speaker.	**CO2, CO5**
10	Write a C program and examine the assembly language program output of the compiler and the map file output of the linker.	**CO1, CO2**

Course Outcomes: After completion of this course students will be able to

CO 1	Write a program for Arm based microcontroller.	K1
CO 2	Analyze Freedom KL25Z board to build a system.	K4
CO 3	Build an Arm-based embedded system, and program to satisfy given user specifications.	K3
CO 4	Use commercial tools to develop Arm-based embedded systems.	K3
CO 5	Use commercial API and tools to accelerate the development cycle of Arm-based embedded systems.	K3

Bachelor of Technology Third Year			
Course Code	**AEC0513P**	**L T P**	**Credit**
Course Title	**Image Processing and Pattern Recognition Lab**	**0 0 2**	**1**

Course Objectives: The student will learn about

1.	Basic skills for image sharpening and image enhancement.
2.	Basic concept of image restoration and compression techniques.
3.	Basic concept of image segmentation for image analysis.
4.	Analyze the spatial/ texture feature of image.
5.	The use of various enhancement and segmentation techniques for developing computer vision application.

List of Experiments

Sr. No.	Name of Experiment	CO
1	Write a program using MATLAB/Python to display grey scale/colour images.	CO1
2	Write a program using MATLAB/Python to extract different attributes (i.e., Geometrical and texture) of an Image.	CO2
3	Write a program using MATLAB/Python for Image Negation.	CO2
4	Write a program using MATLAB/Python for Power Law Transformation.	CO2
5	Write a program using MATLAB/Python for Histogram Mapping and Equalization.	CO2
6	Write a program using MATLAB/Python for Image Smoothening and Sharpening.	CO1
7	Write a program using MATLAB/Python for Edge Detection using Sobel, Prewitt and Roberts Operators.	CO1
8	Write a program using MATLAB/Python for Morphological Operations on Binary Images.	CO3
9	Write a program using MATLAB/Python for Pseudo Coloring.	CO5
10	Write a program using MATLAB/Python for the segmentation using watershed transform.	CO3
11	Write a program to eliminate the high frequency components of an image.	CO5
12	Write a program using MATLAB/Python to extract the image features for image segmentation using DWT Computation.	CO4

Course Outcomes: After successful completion of this course, students will be able to

CO 1	Implement image sharpening and image enhancement algorithm.	K3, K4
CO 2	Analyze the power of various image restoration and compression techniques.	K2, K3
CO 3	Learn basic skills for image segmentation and image analysis.	K1, K2
CO 4	Analyze the spatial/ texture features of image.	K2, K3, K4
CO 5	Implement and evaluate different enhancement and segmentation techniques for developing computer vision applications.	K3, K4

Bachelor of Technology Third Year			
Course code	**ANC0501**	**L T P**	**Credits**
Course title	**Constitution of India, Law and Engineering**	**2 0 0**	**NC**
Course Objectives: In this course, the student will:			
1	Learn the legacies of constitutional development in India and understand the most diversified legal document of India and philosophy behind it.		K_1, K_2
2	Aware of the theoretical and functional aspects of the Indian Parliamentary System.		K_1
3	Understand the legal concepts and its implications for engineers.		K2
4	Learn the law of intellectual property rights.		K_1
5	Learn the role of engineering in business organizations and e-governance.		K_1
Pre-requisites: Political science			
Course Contents / Syllabus			
UNIT-I	**Introduction and Basic Information about Indian Constitution**		**6 hours**
Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.			
UNIT-II	**Union Executive and State Executive**		**6 hours**
Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, **Powers and Functions of Vice-President**, Powers and Functions of the Prime Minister, Judiciary –The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.			
UNIT-III	**Introduction and Basic Information about Legal System:**		**4 hours**
The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.			
UNIT-IV	**Intellectual Property Laws and Regulation to Information**		**4 hours**
Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information-Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.			

UNIT-V	Business Organizations and E-Governance:	4 hours
Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.		
Course outcome: After completion of this course students will be able to		
CO 1	Identify and explore the basic features and modalities about Indian constitution.	K1
CO 2	Differentiate and relate the functioning of Indian parliamentary system at the center and state level.	K2, K3
CO 3	Differentiate different aspects of Indian Legal System and its related bodies.	K2
CO 4	Discover and apply different laws and regulations related to engineering practices.	K3
CO 5	Correlate role of engineers with different organizations and governance models	K4
Text books		
1. M Laxmikanth: Indian Polity for civil services and other State Examination,6th Edition, Mc Graw Hill.		
2. Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.		
3. Prabudh Ganguli: Gearing up for Patents: The Indian Scenario, Orient Longman.		
Reference Books		
1. BL Wadehra: Patents, Trademarks, Designs and Geological Indication Universal Law Publishing - LexisNexis.		
2. Executive programme study material Company Law, Module II, by ICSI (The Institute of Companies Secretaries of India) (Only relevant sections i.e., Study 1, 4 and https://www.icsi.edu/media/webmodules/publications/Company%20Law.pdf		
3. Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, https://www.meity.gov.in/writereaddata/files/eGovernance_Project_Lifecycle_Participant_Handbook-5Day_CourseV1_20412.pdf		
Links		
Unit 1	https://legalaffairs.nalsar.ac.in/students/student/course-details/1	
Unit 2	https://www.youtube.com/watch?v=lZ2tvimrLRQ&t=281s	
Unit 3	https://www.youtube.com/watch?v=H0_olSSX6D8&t=2s	
Unit 4	https://www.youtube.com/watch?v=WvduZOWoft0	
Unit 5	https://www.youtube.com/watch?v=7SmrFh88Cuk	

B. TECH. THIRD YEAR

Course code	ANC0502	L T P	Credits
Course Title	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2 0 0	2

Course objective: This course aims to provide basic knowledge about different theories of society, state and polity in India, Indian literature, culture, Indian religion, philosophy, science, management, cultural heritage and different arts in India.s

Pre-requisites: Computer Organization and Architecture

Course Contents / Syllabus

UNIT-I	SOCIETY STATE AND POLITY IN INDIA	8 Hours

State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women.

UNIT-II	INDIAN LITERATURE, CULTURE, TRADITION, AND PRACTICES	8 Hours

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Sikh Literature, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature

UNIT-III	INDIAN RELIGION, PHILOSOPHY, AND PRACTICES	8 Hours

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

UNIT-IV	SCIENCE, MANAGEMENT AND INDIAN KNOWLEDGE SYSTEM	8 Hours

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India , Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's Dominance up to Pre-colonial Times.

UNIT-V	CULTURAL HERITAGE AND PERFORMING ARTS	8 Hours

Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Pottery, Painting, Indian Handicraft, UNESCO'S List of World Heritage sites in India, Seals, coins, Puppetry, Dance, Music, Theatre, drama, Martial Arts Traditions, Fairs and Festivals, UNESCO'S List of Intangible Cultural Heritage, Calenders, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema.

COURSE OUTCOMES: After completion of this course students will be able to

CO 1	Understand the basics of past Indian politics and state polity.	K2
CO 2	Understand the Vedas, Upanishads, languages & literature of Indian society.	K2
CO 3	Know the different religions and religious movements in India.	K4

CO 4	Identify and explore the basic knowledge about the ancient history of Indian agriculture, science & technology, and ayurveda.	K4
CO 5	Identify Indian dances, fairs & festivals, and cinema.	K1

Text Books:

1. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
2. S. Baliyan, Indian Art and Culture, Oxford University Press, India
3. Nitin Singhania, Indian Art and Culture: for civil services and other competitive Examinations,3rd Edition,Mc Graw Hill

Reference Books:

1. Romila Thapar, Readings In Early Indian History Oxford University Press, India
2. Basham, A.L., The Wonder that was India (34th impression), New Delhi, Rupa & co.

Bachelor of Technology Third Year			
Course Code	**AEC0601**	**L T P**	**Credits**
Course Title	**Digital Signal Processing**	**3 1 0**	**4**

Course Objectives: The students will learn about

1	The concept of digital signal processing, DFT, FFT & filtering in the frequency domain.
2	The designing of Digital IIR filter from analog filter using different mapping techniques for processing of discrete time signals.
3	The designing of digital finite impulse response filters using various methods (windows, sampling etc.) & effect of finite word length in digital filter.
4	The different types of IIR & FIR filter structures and their implementations.
5	The concept of multirate digital signal processing for various practical applications.

Pre-requisites: Basic knowledge of signal & system

Course Contents / Syllabus

UNIT-I	**DFT and FFT**	**8 hours**

Basics of signal processing, classification of signal processing, Applications of Digital Signal Processing in real world.

Frequency Analysis of Discrete-Time Systems: Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Properties of the DFT, Relationship of DFT with DTFT & Z- transform. Linear Filtering usingCircular Convolution and Linear Convolution.

Fast Fourier Transform: Radix-2 DIT-FFT & DIF-FFT algorithm, inverse DFT using FFT algorithm.

UNIT-II	**Design of IIR Digital Filters**	**8 hours**

Introduction to Filters, Classification of filter, Characteristic of digital filters, Filter Design Specifications.

Filter Transformation Technique: Impulse Invariant Transformation, Bi-Linear Transformation, All-Pole Analog Filters: Butterworth and Chebyshev, Analog frequency transformation, Design of Digital Butterworth, and Chebyshev Filters, digital frequency transformation.

UNIT-III	**Design of FIR Digital Filter**	**8 hours**

Linear phase FIR filter, frequency response of linear phase FIR filter, FIR filter Design using Fourier series method: Gibb's phenomenon, FIR filter Design using various window methods, Comparison of FIR & IIR digital filter.

Finite Word length effects in digital filters: Coefficient quantization error, Quantization noise – truncation and rounding, Limit cycle oscillations-dead band effects.

UNIT-IV	**Realization of Digital Systems**	**8 hours**

Introduction- basic building blocks to represent a digital system, recursive and non-recursive systems, basic structures of a digital system: Canonical and Non-Canonical structures.

IIR Filter Realization: Direct form, Cascade, Parallel form realization, continued fraction expansion, Ladder structures.

FIR Filter Realization: Direct form, Cascade, FIR Linear Phase Realization.

UNIT-V	**Multirate Digital Signal Processing (MDSP)**	**8 hours**

Introduction, Decimation, Interpolation, Sampling rate conversion: Single and Multistage, applications of MDSP- Sub-band Coding of Speech signals, Quadrature mirror filters, Advantages of MDSP.

Adaptive Filter: Introduction & Example of adaptive Filter, The window LMS Algorithm, Recursive Least Square Algorithm. The Forward-Backward Lattice and Gradient Adaptive Lattice Method.

Course Outcomes: After successful completion of the course students will be able to

CO1	Explain the concept of DFT & FFT and linear filtering using circular and linear convolution.	K1, K2, K3, K5
CO2	Design the digital IIR filters using various transformation techniques.	KI, K2, K4, K5

CO3	Design and analyse the FIR Filters and the effect of finite word length in digital filter.	K1, K2, K4, K5
CO4	Realize the digital system through different methods of realization structures and their utilities.	K1, K2, K4
CO5	Explain the concept of multirate digital signal processing, adaptive signal processing & basics of digital signal processor.	K1, K2, K3, K4

Textbooks

1. John G Prokias, Dimitris G Manolakis, "Digital signal processing Principles Algorithms & Applications", 4th edition, Pearson education, 2007.
2. Oppenheim & Schafer, "Discrete Time Signal Processing", Pearson education, Prentice Hall, 2nd edition,2003
3. Johnny R. Johnson, "Digital Signal Processing", 3rd edition, PHI Learning pvtLtd., 2009

Reference Books

1. S.Salivahanan, "Digital signal processing", 6th edition, McGraw Hill Education pvt ltd.
2. Tarun K. Rawat, "Digital Signal Processing",1st edition, Oxford University Press, 2015.
3. S.K. Mitra, 'Digital Signal Processing–A Computer Based Approach, McGraw Hill, 4th Edition.

NPTEL/ YouTube/ Faculty Video Link:

Unit 1	• https://nptel.ac.in/courses/117105134/ • http://www.digimat.in/nptel/courses/video/117105134/L38.html
Unit 2	• https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/video-lectures/lecture-15-design-of-iir-digital-filters-part-2/ • https://youtu.be/9WkvA7JT2dw
Unit 3	• https://youtu.be/RJrEaTJuX_A • https://youtu.be/5ka_14DkoYQ
Unit 4	• https://youtu.be/4Q-R1E5B40Q • https://youtu.be/9iE29uDpr0g
Unit 5	• https://youtu.be/HVGW85eGPQQ • https://youtu.be/XVMTpDK3UTk

Bachelor of Technology Third Year			
Course Code	**AEC0602**	**L T P**	**Credits**
Course Title	**Wireless Communication Networks**	**3 0 0**	**3**
Course Objectives: The student will be able to learn about			
1	The basics of networking and various layers of models		
2	The in-depth study and functions of layers.		
3	The functioning of wireless communication systems and the evolution of different wireless communication systems and standards.		
4	The cell architecture and advanced modulation used for wireless communication.		
5	Multiple access techniques and design issues and security issues associated with Ad-hoc wireless networks.		
Pre-requisites: Basic knowledge of communication and computer.			
Course Contents / Syllabus			
UNIT-I	**Basics of Computer Network, Physical layer and Data Link Layer**		**8 hours**
OSI Model, TCP/IP reference model, Understanding of Delay, Loss and Throughput, Networking Devices **The Physical Layer**: guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system. **Data Link Layer-** Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols – HDLC, PPP			
UNIT-II	**Network Layer, Transport Layer and Application Layer**		**8hours**
Network Layer -Virtual and Datagram networks, IP protocol and addressing in the Internet the network layer in the internet (IPv4 and IPv6), Subnetting with IPs, Routing algorithms **Transport Layer** -Multiplexing and Demultiplexing, UDP, Principles of reliable data transfer, TCP, Congestion control, SIP protocol. **Application Layer-** Web and HTTP, E-mail, DNS, Socket programming with TCP and UDP. DNS, electronic mail, World Wide Web: architectural overview, dynamic web document and http. Application Layer Protocols, Network Security.			
UNI`T-III	**Introduction to Wireless Communication**		**8hours**
Introduction to 1G/2G/3G/4G Terminology. evolution of cellular systems requirements, goals, and vision of the next-generation wireless communication systems Fading, Requirements and Targets for Long Term Evolution (LTE) - Technologies for LTE- 4G Advanced Features and Roadmap Evolutions from LTE to LTEA - Wireless Standards.			
UNIT-IV	**Cell Architecture and Modulation Technique**		**8hours**
Small cells: Past, present, and future trends of cellular networks coverage and capacity of smallcell networks Interference management, D2D architecture Towards IoT Spectrum sharing. Multicarrier modulation, OFDM, diversity multiplexing trade-off, OFDM system, smart-antenna: beam forming, cognitive radio, software-defined radio, communication relays, spectrum sharing.			
UNIT-V	**Multiple Access Techniques and Wireless Networks**		**8hours**
Contention-free multiple access schemes (FDMA TDMA, CDMA, SDMA, and Hybrid), contention-based multiple access schemes (ALOHA and CSMA), Waveforms, Variable subcarrier spacing, supported transmission numerologies. Design Challenges in Ad-hoc wireless networks, the concept of cross-layer design, security in wireless networks, energy-constrained networks, MANET and WSN.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and OSI Model.		K1, K4
CO 2	Analyze and design the topological and routing strategies for an IP based networking infrastructure and explain the working knowledge of		K4, K6

	computer applications and Network Security.	
CO 3	Explain the functioning of wireless communication systems and the evolution of different wireless communication systems and standards.	K2
CO 4	Explain architecture and modulation technique used for wireless communication systems.	K2
CO 5	Analyze the multiple access techniques and evaluate the design challengesand security issues associated with Ad-hoc wireless networks.	K2 K5

Text Books:

1. Computer Networks- A Top-Down approach, Behrouz Forouzan, McGraw Hill
2. T. S. Rappaport, R. W. Heath Jr., R. C. Daniels, and J. M. Murdock, Millimeter Wave Wireless Communication., Pearson Education, 2015.
3. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.

Reference Books:

1. Computer Networks (4th edition), Andrew Tanenbaum, Prentice Hall
2. Vijay K Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint)
3. Computer Networking and the Internet (5th edition), Fred Halsall, Addison Wesley.
4. Computer Networking- A Top-Down approach, 5th edition, Kurose and Ross, Pearson.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://nptel.ac.in/courses/106/105/106105183/ https://nptel.ac.in/courses/106/105/106105081/
Unit 2	https://swayam.gov.in/nd1_noc20_cs23/preview https://nptel.ac.in/courses/106105031
Unit 3	https://www.youtube.com/watch?v=f2wlHL1Sok8&list=PLuv3GM6-gsE3ypUYh43pPuZsXxJVG1e7F
Unit 4	https://www.youtube.com/watch?v=AKXFwwcww_E
Unit 5	https://www.youtube.com/watch?v=ycaz99NogS4&list=PLJ5C_6qdAvBHroAfekCO

Bachelor of Technology Third Year			
Course Code	**AEC0603**	**L T P**	**Credits**
Course Title	**5G Technology**	**3 0 0**	**3**
Course Objectives: The student will learn about			
1	The basics of 5G architecture and protocols.		
2	The propagation scenarios and channel modelling.		
3	The 5G techniques i.e. massive MIMO and mm wave.		
4	The mobility and handoff management in 5G.		
5	The network slicing, Network Function Virtualization		
Pre-requisites: Wireless Communication			
Course Contents / Syllabus			
UNIT-I	**Introduction to 5G Architecture and Protocols**		**8 hours**
Introduction to 5G RAN (Radio Access Networks), 5G NR Logical architectures, 5G NR Protocol stack (Layer 2 and Layer 3) **Introduction to Physical Layer:** Physical layer techniques, 5G NR MAC layer Architecture, functions, Channel Mapping, Procedures, Headers and Subheaders.			
UNIT-II	**Propagation Scenarios and Channel Modelling**		**8 hours**
Channel modelling requirements, propagation scenarios and challenges in the 5G modelling, Channel Models for mm Wave MIMO Systems. 5G Requirements, Key Capabilities of 5G versus 4G, 5G operating scenario, mm wave technology, Propagation modelling of 5G			
UNIT-III	**Massive MIMO Techniques**		**8 hours**
Massive MIMO propagation channel models, Channel Estimation in Massive MIMO, Massive MIMO with Imperfect CSI, Multi-Cell Massive MIMO, beamforming.			
UNIT-IV	**Mobility and Handoff Management**		**8 hours**
Interference and mobility management in 5G, Handoff management in 5G, QoS improvement with 5G, QoS mechanisms offered by 5G, 5G QoS Flow Descriptions and Characteristics. **IP Routing:** Types of routing protocols, IPv6 addressing.			
UNIT-V	**Network Slicing and Function Virtualization**		**8 hours**
Network Slicing: Concept, architecture, the status of network slicing in 5G standards, network slicing in core networks, network slicing challenges for 5G Networks. **Network Functions Virtualization (NFV):** Functionality, architecture, advantages for 5G network.			
Course Outcomes: After successful completion of the course, the student will be able to:			**Bloom's Level**
CO 1	Demonstrate Radio access network and protocol stack.		K_3
CO 2	Analyze indoor and outdoor propagation models.		K_4
CO 3	Apply massive MIMO technique in wireless communication.		K_3
CO 4	Apply mobility management in heterogeneous and network-controlled handover.		K_3
CO 5	Demonstrate the fundamentals of network slicing core networks.		K_3
Text Books:			
1. Martin Sauter "From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband", Wiley-Blackwell.			
2. AfifOsseiran, Jose. F. Monserrat, Patrick Marsch, "Fundamentals of 5G Mobile Networks", Cambridge University Press. Radar Principles, Technology, Applications, Byron Edde, Pearson Education, 2004.			
3. Athanasios G.Kanatos, Konstantina S.Nikita, Panagiotis Mathiopoulos, "New Directions in Wireless			

Communication Systems from Mobile to 5G", CRC Press.

4. Saad Asif, "5G Mobile Communications Concepts and Technologies", first edition, CRC Press.

Reference Books

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley &Sons.WHHayt and JA Buck, "Engineering Electromagnetic", 7th Edition TMH, 2013.

2. Theodore S.Rappaport, Robert W.Heath, Robert C.Danials, James N.Murdock "Millimeter Wave Wireless Communications", Prentice Hall Communications.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=aYJncUscfmk
Unit 2	https://www.youtube.com/watch?v=khsqASfv2T4&list=PLxJYaXA6j4AbpWZmDztACJNA5vA3rvfM0&index=6
Unit 3	https://www.youtube.com/watch?v=am3Zs8QpLLY
Unit 4	https://www.youtube.com/watch?v=q9Pk68iAHVA
Unit 5	https://www.youtube.com/watch?v=pUlfcGyFCFo

Bachelor of Technology Third Year			
Course Code	**AEC0611**	**L T P**	**Credits**
Course Title	**Privacy and Security in IoT**	**3 0 0**	**3**
Course Objectives: Student will learn about			
1	The security requirements in IoT Architecture.		
2	The basic concepts of cloud security and services.		
3	The cryptographic primitives and its role in IoT.		
4	The privacy and trust models for IoT.		
5	The network security and its management.		
Pre-requisites: Basic fundamental of microprocessor, microcontroller & Embedded System			
Course Contents / Syllabus			
UNIT-I	**Securing the Internet of Things**		**8 hours**
Security Requirements in IoT Architecture - Security in Enabling Technologies - Security Concerns in IoT Applications. Security Architecture in the Internet of Things - Security Requirements in IoT, Insufficient Authentication/Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability, Attacks Specific to IoT. Vulnerabilities, Secrecy and Secret-Key Capacity Authentication/Authorization for Smart Devices, Transport Encryption, Attack & Fault trees			
UNIT-II	**Cloud Security for IoT**		**8 hours**
Cloud services and IoT, offerings related to IoT from cloud service providers, Cloud IoT security controls, An enterprise IoT cloud security architecture, New directions in cloud enabled IoT computing			
UNIT-III	**Cryptographic Fundamentals for IoT**		**8 hours**
Cryptographic primitives and its role in IoT, Encryption and Decryption, Hashes, Digital Signatures, Random number generation, Cipher suites, key management fundamentals, cryptographic controls built into IoT messaging and communication protocols, IoT Node Authentication			
UNIT-IV	**Privacy Preservation and Trust Models For IoT**		**8 hours**
Concerns in data dissemination – Lightweight and robust schemes for Privacy protection – Trust and Trust models for IoT – self-organizing Things - Preventing unauthorized access.			
UNIT-V	**Network Security and Management**		**8 hours**
Principles of cryptography, Authentication, integrity, key distribution and certification, Access control and Firewalls, attacks and counter measures, security in many layers. Infrastructure for network management, The internet standard management framework, SMI, MIB, SNMP, Security and administration.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Explain security requirements in IoT Architecture.		K1, K2
CO 2	Realize the basic concepts of cloud security for IoT.		K1, K3
CO 3	Explain the cryptographic primitives and its role in IoT.		K1, K2
CO 4	Implement the various trust models for IoT.		K1, K4
CO 5	Realize the various types of network security and its management.		K1, K3
Text books			
1. Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren			
2. Cryptography & Networks Security Stallings, William 3rd edition			
Reference Books			
1. Securing the Internet of Things Elsevier			

2. William Stallings, “High-Speed Networks and Internets, Performance and Quality of Service”, Pearson Education	
NPTEL/ Youtube/ Faculty Video Link:	
Unit 1	https://onlinecourses.nptel.ac.in/noc21_cs20/unit?unit=89&lesson=92
Unit 2	https://onlinecourses.nptel.ac.in/noc19_cs65/unit?unit=75&lesson=79
Unit 3	https://www.youtube.com/watch?v=jSsehESW37c
Unit 4	https://www.youtube.com/watch?v=sMquG8gxRh4
Unit 5	https://onlinecourses.nptel.ac.in/noc21_cs20/unit?unit=41&lesson=42

Bachelor of Technology Third Year			
Course Code	**AEC0612**	**L T P**	**Credits**
Course Title	**Real Time Operating System**	**3 0 0**	**3**
Course Objectives: Student will learn about			
1	Embedded OS internals.		
2	The basic concepts of Real Time Operating System.		
3	Concepts of Process and Task Scheduling.		
4	Strategies to interface memory and I/O with RTOS kernel.		
5	Architecture of CMSIS-RTOS & process of RTX task management.		
Pre-requisites: Basic fundamental of microprocessor, microcontroller & Embedded System			
Course Contents / Syllabus			
UNIT-I	**Embedded of Internals**		**8 hours**
Linux internals: Process Management, File Management, Memory Management, I/O Management. Overview of POSIX APIs, Threads – Creation, Cancellation, POSIX Threads Inter Process Communication – Semaphore, Pipes, FIFO, Shared Memory Kernel: Structure, Kernel Module Programming Schedulers and types of scheduling. Interfacing: Serial, Parallel Interrupt Handling Linux Device Drivers: Character, USB, Block & Network.			
UNIT-II	**Overview of RTOS**		**8 hours**
OS overview: OS components, OS structure, Types of Operating Systems, Basics of RTOS: Real-time concepts, Characteristics of RTOS, Architecture of RTOS, Classification of RTOS: Hard Real time and Soft Real-time, Firm real time system, Advantage and disadvantage of RTOS.			
UNIT-III	**Process and Scheduling**		**8 hours**
Process: Introduction, Memory lay out of an executing program, Process control block, Process creation, Process Termination, Context Switching and States, RTX and Linux Examples. **Scheduling:** Levels of scheduling of tasks, scheduling criteria, scheduling algorithms non-pre-emptive or pre-emptive. Quantum size of task, priority of task, Real Time Scheduling and aperiodic Real time scheduling.			
UNIT-IV	**Concurrency and Memory Management**		**8 hours**
Concurrency: Concurrency Scheduling, Multiprocessing environment, Read-write by multiple CPUs and consistency problem, Solutions with Mutual Exclusion, Hardware Mutex, Software Mutex, Example: Dekker's algorithm, Semaphore, Deadlock, Bankers algorithm. **Memory Management:** Processes Need Memory, Address Binding & its types, Memory Hierarchy, Virtual Memory, Memory Partitioning, Paging, Segmentation with Paging, File System, File Structure, Directory Structure, Disk, Interrupt & DMA.			
UNIT-V	**RTX**		**8 hours**
RTX structure, RTX files, RTX task and time management, Simple Time Management APIs, Task Priority Scheme in RTX, Inter-Task Communication, Event, Interrupt, Mutex, Semaphore, Mailboxes and Messages in RTX, RTX control functions, Architecture of CMSIS-RTOS.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Explain Arm processor architectures.		K1, K2
CO 2	Realize the basic concepts of RTOS.		K1, K4
CO 3	Apply the concepts of Process and Task Scheduling.		K3
CO 4	Implement strategies to interface memory and I/O with RTOS kernel.		K2
CO 5	Analyze the architecture of CMSIS-RTOS & process of RTX task management.		K2, K4

Text books	
1. VenkateswaranSreekrishnan," Essential Linux Device Drivers", Ist Kindle edition, Prentice Hall, 2008	
2. Jonathan W. Valvano, "Real-Time Operating Systems for ARM Cortex-M Microcontrollers" Jonathan Valvano; 4 edition.	
Reference Books	
1. Jerry Cooperstein, "Writing Linux Device Drivers: A Guide with Exercises", J. Cooperstein publishers ,2009	
2. Qing Li and Carolyn Yao, "Real Time Concepts for Embedded Systems" – Qing Li, Elsevier ISBN:1578201241 CMP Books © 2000	
NPTEL/ Youtube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/channel/UCiwfpGavlOTzATgDSZJ62vA
Unit 2	https://www.youtube.com/channel/UCiwfpGavlOTzATgDSZJ62vA
Unit 3	https://www.youtube.com/watch?v=Lwa7n0G5OHc
Unit 4	https://www.youtube.com/watch?v=Qske3yZRW5I
Unit 5	https://www.youtube.com/watch?v=Q4qu4ADTy9Q

Bachelor of Technology Third Year			
Course Code	**AEC0613**	**L T P**	**Credits**
Course Title	**ANN & Deep learning**	**3 0 0**	**3**

Course Objectives: Student will learn about

1	The basic principles and techniques of artificial neural network and deep learning.
2	PCA, auto encoders, and other type of encoders.
3	Choices and limitations of a model for a given setting.
4	How to apply deep learning techniques to practical applications.
5	RNN, GRU & LSTM and will also learn how to critically evaluate model performance and interpret results.

Pre-requisites: Working knowledge of Linear Algebra, Probability Theory. It would be beneficial if the participants have done a course on Machine Learning.

Course Contents / Syllabus

UNIT-I	**Introduction**	**8 Hours**

Introduction: History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Multilayer Perceptron's (MLPs), Representation Power of MLPs, Sigmoid Neurons, RELU activation, Gradient Descent, Feed Forward Neural Networks, Back propagation.

UNIT-II	**Optimization & Dimensionality Reduction**	**8 Hours**

Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders.

UNIT-III	**Deep Learning Fundamentals**	**8 Hours**

Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Greedy Layerwise Pre-training, Softmaxlaye, weight initialization methods, Batch Normalization, Learning Vectorial Representations of Words.

UNIT-IV	**Deep learning architectures**	**8 Hours**

Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, ResNet, DenseNet.

UNIT-V	**RNN and LSTM models**	**8 Hours**

Recurrent Neural Networks, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models.

Course Outcomes: After completion of this course, students will be able to

CO 1	Identify the different ANN techniques and their applications.	K1
CO 2	Apply neural networks using various learning techniques and formulate the artificial neural network with different layers.	K3, K5
CO 3	Describe deep neural networks (DNN) using various learning techniques and formulate DNN with different layers.	K3, K4
CO 4	Apply different architectures of deep learning and summarize the difference between them.	K5
CO 5	Apply different deep learning techniques to practical applications and evaluate their performance.	K2, K5

Text Books:

1. S. Rajsekaran& GA Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India.
2. SimanHaykin, "Neural Netowrks", Prentice Hall of India

3. Ian Goodfellow and YoshuaBengio and Aaron Courville, Deep learning, MIT Press, 2016
4. Charu, C. Agrawal,Neural Networks and Deep Learning, Kindle edition, 2018
Reference Books:
1. Kumar Satish, "Neural Networks", Tata Mc Graw Hill
2. Machine Intelligence: Demystifying Machine Learning, Neural Networks and Deep Learning, **3.** Notion Press, 2019
4. Bishop, Pattern Recognition and Machine Learning, Springer
NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=OBFZPivcdqg https://www.youtube.com/watch?v=4TC5s_xNKSs
Unit 2	https://www.youtube.com/watch?v=xbYgKoG4x2g
Unit 3	https://www.youtube.com/watch?v=aPfkYu_qiF4
Unit 4	https://www.youtube.com/watch?v=wPz3MPl5jvY
Unit 5	https://www.youtube.com/watch?v=9TFnjJkfqmA

Bachelor of Technology Third Year			
Course Code	**AEC0614**	**L T P**	**Credits**
Course Title	**IoT Networks**	**3 0 0**	**3**
Course Objectives: Student will learn about			
1	The different types of networks and its requirement.		
2	The principles behind the Modern Network approaches such as SDN NFV and IoT.		
3	The various components of IoT enabled things.		
4	The basic concept of virtual machines and functions.		
5	The various security requirements.		
Pre-requisites: Basics of IoT and its Protocols			
Course Contents / Syllabus			
UNIT-I	**Modern Networking**		**8 hours**
Cloud Computing, Internet of Things - Types of Networks and Internet Traffic, Demand: Big Data, Cloud Computing and Mobile Traffic Requirements: QoS and QoE Routing Congestion Control, SDN and NFV, Modern Networking Elements			
UNIT-II	**Software Defined Networks**		**8 hours**
Network Requirements, The SDN Approach, SDN and NFV Related Standards, SDN Data Plane, Open Flow Logical Network Device, Open Flow Protocol, SDN Control Plane Architecture, REST API, SDN Application Plane Architecture			
UNIT-III	**IoT Components**		**8 hours**
The IoT Era, Scope of the Internet of Things, Components of IoT-Enabled Things, IoT World Forum Reference Model, ITU-T IoT Reference Model, Cisco IoT System, Io Bridge, SDN and NFV over IoT Deployment			
UNIT-IV	**Virtualization**		**8 hours**
Background and Motivation for NFV, Virtual Machines, NFV Concepts, NFV Reference Architecture, NFV Infrastructure, Virtualized Network Functions, NFV Management and Orchestration, NFV Use Cases, SDN and NFV			
UNIT-V	**IoT Security**		**8 hours**
Security Requirements, SDN Security, NFV Security, ETSI Security Perspective, IoT Security, The Patching Vulnerability, IoT Security and Privacy Requirements Defined by ITU-T, An IoT Security Framework, The Impact of the New Networking on IT Careers			
Course Outcomes: After completion of this course students will be able to			
CO 1	Explain the concept of modern networking and their types.		K1, K2
CO 2	Analyze the SDN and NFV related networks.		K3
CO 3	Describe the various components of IoT Enabled Things.		K1, K3
CO 4	Explain the concept of virtual machines and their network functions.		K1, K3
CO 5	Describe the various requirements of security.		K2, K3
Text books			
1. "Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" William Stallings Publisher: Addison-Wesley 2015			
2. SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization 1st Edition by Jim Doherty			
Reference Books			
1. Software Defined Networks: A Comprehensive Approach, Ist Edition by Paul Goransson Chuck Black			
2. Network Function virtualization with a touch of SDN by Paresh Shah, Syed Farrukh			

Hassan, Rajendra Chayapathi	
NPTEL/ Youtube/ Faculty Video Link:	
Unit 1	https://onlinecourses.nptel.ac.in/noc19_cs65/unit?unit=15&lesson=16
Unit 2	https://onlinecourses.nptel.ac.in/noc19_cs65/unit?unit=75&lesson=76
Unit 3	https://onlinecourses.nptel.ac.in/noc21_cs20/unit?unit=49&lesson=53
Unit 4	https://www.youtube.com/watch?v=Vl5UJUR1uV4
Unit 5	https://www.business.att.com/learn/tech-advice/the-security-benefits-of-software-defined-networking--sdn-.html

Bachelor of Technology Third Year			
Course Code	**AEC0615**	**L T P**	**Credits**
Course Title	**Robotics Design Mechanism**	**3 0 0**	**3**
Course Objectives: Student will learn about			
1	Industrial robots and their operational workspace characteristics & the tools taking part in the manufacturing process.		
2	Dynamic analysis of drives.		
3	The feedback sensors its types & transporting devices.		
4	The feeding materials used according to application & orientation.		
5	Functional systems & prototypes of robots.		
Pre-requisites: Introduction to Robotics & its Applications			
Course Contents / Syllabus			
UNIT-I	**Introduction**		**8 hours**
Review and Definitions: Robots & its Kinds, Definition of Levels, Manipulators, Structure of Automatic Industrial Systems, Non-industrial Representatives of the Robot Family, Relationship between the Level of Robot "Intelligence" and the Product. **Concepts and Layouts**: Processing Layout, Concept of an Automatic Manufacturing Process, Productivity of a Manufacturing Process, The Kinematic Layout, Rapid Prototyping			
UNIT-II	**Dynamic Analysis of Drives**		**8 hours**
Electromagnetic Drive, Electric Drives, Hydraulic Drive, Pneumo-drive, Brakes, Drive with a Variable Moment of Inertia **Kinematics and Control of Automatic Machines**: Position Function, Camshafts, Master Controller, Amplifiers, Dynamic Accuracy, Damping of Harmful Vibrations, Automatic Vibration Damping, Electrically Controlled Vibration Dampers			
UNIT-III	**Feedback Sensors**		**8 hours**
Linear and Angular Displacement Sensors, Speed and Flow-Rate Sensors, Force Sensors Temperature Sensors, Item Presence Sensors. **Transporting Devices**: General Considerations, Linear Transportation, Rotational Transportation, Vibrational Transportation			
UNIT-IV	**Feeding and Orientation Devices**		**8 hours**
Introduction, Feeding of Liquid and Granular Materials, Feeding of Strips, Rods, Wires, Ribbons, Feeding of Oriented Parts from Magazines, Feeding of Parts from Bins, General Discussion of Orientation of Parts, Passive Orientation, Active Orientation, Logical Orientation, Orientation by Non-mechanical Means			
UNIT-V	**Functional Systems and Mechanisms**		**8 hours**
General Concepts, Automatic Assembling, Special Means of Assembly, Inspection Systems, Miscellaneous Mechanisms **Manipulators**: Dynamics of Manipulators, Grippers & Guides.			
Course Outcomes: After completion of this course students will be able to			
CO 1	Explain industrial robots and their operational workspace characteristics & Manipulators.		K1, K2
CO 2	Analyze drives & its control.		K2
CO 3	Describe the use of sensors & solve kinematics of robot manipulators.		K3
CO 4	Apply feed material & orientation.		K4, K5
CO 5	Create application based prototypes of robots.		K1, K3
Text books			
3. Ben-Zion Sandler: Robotics designing the mechanisms for automated machinery, Prentice-Hall			

4. Pessen, D. W.: Industrial Automation, John Wiley & Sons, New York	
Reference Books	
3. Schey, John A., Introduction to Manufacturing Processes: Second Edition, McGraw-Hill International	
4. Critchlow, Arthur J., Introduction to Robotics, Macmillan Publishing Company, New York,Collier Macmillan Publishers, Londo	
NPTEL/ Youtube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/watch?v=P_PP76flZfw&list=PLyqSpQzTE6M_XM9cvjLLO_Azt1FkgPhpH&index=2
Unit 2	https://www.youtube.com/watch?v=XOg1KT6xD04&list=PLyqSpQzTE6M_XM9cvjLLO_Azt1FkgPhpH&index=4
Unit 3	https://youtu.be/ksOgvhYdqX8
Unit 4	https://youtu.be/Gc4BiUGiV-Q
Unit 5	https://youtu.be/pSEjWxqE3R0

Bachelor of Technology Third Year			
CourseCode	**AEC0616**	**L TP**	**Credits**
CourseTitle	**ArtificialIntelligence**	**3 0 0**	**3**

Course Objectives: Student will learn about

1	HistoricalperspectiveofAIanditsfoundations.
2	Principlesof AI toward problem solving and drawing inference thereof.
3	Perception, knowledge representation, and different learning techniques.
4	Architecture of knowledge-Based System, Rule-based systems, and other expert systems.
5	Evolutionary computational algorithms and different search algorithms.

Pre-requisites: BasicknowledgeofAIandMachine LearningConcepts.

CourseContents/ Syllabus

UNIT-I	**Introduction**	**8 Hours**

Introduction to Artificial Intelligence, Historical developments of Artificial Intelligence, well defined learningproblems, Designing a Learning System, Basics of problem-solving: problem representation paradigms, statespace,satisfiabilityvs optimality, pattern classification problems, exampledomains.

UNIT-II	**SearchTechniques**	**8 Hours**

Searching for solutions, Uninformed Search Strategies: DFS, BFS, Informed Search Strategies: Local searchalgorithms and optimistic problems, adversarial Search, Search for games, minimax, Alpha - Beta pruning,Heuristic Searchtechniques, HillClimbing,Best-firstsearch,Problem reduction, Constraintsatisfaction,MeansEnds Analysis,IterativedeepeningHeuristicSearchand A*.

UNIT-III	**LogicandKnowledgeRepresentation**	**8 Hours**

IntroductionofLogic,PropositionalLogic Concepts,Semantic Tableauxand Resolutionin Propositionallogic, FOPL, Semantic Tableaux and Resolution in FOPL, Logic Programming in Prolog. Production systemsand rules for some AI problems: Water Jug Problem, Missionaries-Cannibals Problem, n-Queen problem,monkey banana problem, Travelling Salesman Problem. Knowledge representation, semantic nets, partitionednets,parallelimplementation ofsemantic nets.Frames,Common Sensereasoningandthematicroleframes.

UNIT-IV	**ExpertSystem**	**8 Hours**

Architecture of knowledge-Based System, Rule-based systems,Forward and Backward Chaining, FrameBased systems. Architecture of Expert System, Forward & Backward chaining, Resolution, Probabilisticreasoning,Utilitytheory,Hidden MarkovModels(HMM), BayesianNetworks.

UNIT-V	**PlanningandUncertainty**	**8 Hours**

PlanningwithstateSpaceSearch,ConditionalPlanning,Continuousplanning,Multi-AgentPlanning,Formsof learning, inductive learning, Reinforcement Learning, learning decision trees, Neural Net learning andGeneticlearning.ProbabilisticMethods, Bayesian Theory,Dempster ShaferTheory,BayesNetwork. Evolutionary computation: Swarm Intelligence, ant colony optimization Agents, Intelligent Agents, Structureof Intelligent Agents, Virtual Agents, Multi-agent systems.

CaseStudy: HealthCare,ECommerce,SmartCities.

Course Outcomes: After completion of this course, students will be able to

1	Elaborate historicalperspectiveofAIanditsfoundations.	K1
2	Apply principlesofAI toward problem solving and drawing inference thereof.	K1, K4
3	Describe perception, knowledge representation, and different learning techniques.	K2, K3

4	Implement architecture of knowledge-Based System, Rule-based systems, and other expert systems.	K3, K5
5	Apply evolutionary computational algorithms and different search algorithms.	K4, K5

Textbooks:

1. StuartRussell,PeterNorvig,"ArtificialIntelligence–AModernApproach",PearsonEducation. FourthEdition2021
2. ElaineRichandKevinKnight, "ArtificialIntelligence",McGraw-Hill3rdEdition2010.

ReferenceBooks:

1. PatrickHenryWinston, "ArtificialIntelligence",PearsonEducationInc.,Thirdedition.
2. PythonMachineLearning:LearnPythoninaWeekandMasterIt.AnHands-OnIntroductionto ArtificialIntelligenceCoding,aProject-BasedGuidewithPracticalExercises(7DaysCrashCourse,Book2)2020.
3. NilsJ.Nilsson,"ArtificialIntelligence- ANewSynthesis",HarcourtAsiaPvt. Ltd.
4. AIin theWild:Sustainabilityin theAge of ArtificialIntelligence2020.
5. Knowledge-BasedSystemsTechniquesandApplications(4-VolumeSet).

NPTEL/ Youtube/ Faculty Video Link:

Unit1	https://nptel.ac.in/courses/106/106/106106198/
Unit2	https://nptel.ac.in/courses/111/107/111107137/
Unit3	https://nptel.ac.in/courses/106/106/106106202/
Unit4	https://nptel.ac.in/courses/106/106/106106213/
Unit5	https://nptel.ac.in/courses/106/105/106105152/

Bachelor of Technology Third Year			
Course Code	**AEC0651**	**L T P**	**Credit**
Course Title	**Digital Signal Processing Lab**	**0 0 2**	**1**
Course Objectives: The student will learn about			
1	Various matrix operations, different types of signals and its properties used in signal processing.		
2	The linear filtering using linear &circular convolution.		
3	The concept of frequency domain analysis of discrete time system using N point DFT & FFT.		
4	Performance of FIR and IIR filters using window techniques and Butterworth approximation respectively		
5	Analysis of decimation and interpolation process for multi-rate signal processing.		
	List of Experiments		
Sr. No.	**Name of Experiment**		**CO**
1	Write a MATLAB program to perform the various matrix operations: addition, subtraction, multiplication, and inverse of the given sequences as a = $\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$ and b = $\begin{bmatrix}3 & 2\\3 & 5\end{bmatrix}$		CO1
2	To generate the different type of signals such as unit impulse, unit step, ramp, exponential, sinusoidal and cosine for both continuous and discrete time signal using MATLAB.		CO1
3	Write a MATLAB program to perform amplitude-scaling, time-scaling and time shifting on a given signal x(n)= u(2n-3).		CO1
4	Evaluate the DFT and IDFT of a given sequences x(n) = {0,1,2,3} and draw the magnitude and phase response of the output sequence using MATLAB.		CO3
5	Evaluate and verify the linear convolution of the given sequences x(n)= {0,1,0,1} & h(n) = {2,3,4} using MATLAB for linear filtering applications.		CO2
6	Evaluate and verify the circular convolution of the given sequences x(n) = {1,1,1,1} & h(n) = {0,1,0,1} using MATLAB for linear filtering applications.		CO2
7	Analysis of DIT-FFT algorithm for a given sequence x(n)= {n+1} for n= 0, 1, 2, 3 and draw the frequency spectrum of given signals.		CO3
8	Design and analysis of a 2^{nd} order analog Low Pass Butterworth IIR filter for a cut off frequency of 4 KHz also draw the pole-zero diagram, magnitude and phase response using FDA tool.		CO4
9	Design and analysis of a digital Low Pass and High Pass FIR filter using various rectangular and hamming windows for M=7.		CO4
10	Design and analysis of decimation and interpolation of a given sequence x(n) = {1, 2 ,2, 3, 2, 1} for decimation factor D=4 and interpolation factor I=3.		CO5
Course Outcomes: After completion of this course students will be able to			
CO 1	Perform various matrix operations, different types of signals and its properties used in signal processing		K1, K2
CO 2	Perform the linear filtering using linear &circular convolution.		K1, K2
CO 3	Perform frequency domain analysis of discrete time system using N point DFT & FFT.		K1, K2, K3
CO 4	Design and evaluate the performance of FIR and IIR filters using window techniques and Butterworth approximation respectively		K1, K2, K3
CO5	Design and analyse decimation and interpolation process for multi-rate signal processing.		K1, K2, K3

Bachelor of Technology Third Year			
Course Code	**AEC0652**	**L T P**	**Credits**
Course Title	**Wireless Communication Lab**	**0 0 2**	**1**

Course Objectives: Students will learn about

1	The performance of wireless network.
2	The analysis of 5G Handover procedure.
3	The relationship between beamforming, gain and antenna count
4	The analysis of different Physical layer parameters.
5	To investigate path losses.

Pre-requisites: Basic Knowledge Wireless Communication.

	Course Contents / Syllabus	**CO**
1	Understand Measures of Network Performance: Throughput and Delay	CO1
2	Simulate and study 5G Handover procedure	CO2
3	Simulate and analyze the relation between beamforming gain and antenna count	CO3
4	Investigate how throughput varies with antenna count	CO3
5	Investigate how a packet is transmitted over OFDM physical layer.	CO4
6	Analytically estimate (per 3GPP standards) the application throughput for a simple use-case.	CO4
7	Simulate and analyse throughput as different PHY parameters are varied.	CO4
8	Analytically estimate (per 3GPP standards) the application throughput for a simple use-case	CO4
9	Simulate path loss variation with the distance between the UE and the gNB	CO5
10	Investigate path loss variation with gNB height. What is the optimal height of a gNB?	CO5

Course Outcomes: After completion of this course students will be able to		**Bloom's Level**
CO1	Understand the network performance.	**K_2**
CO2	Understand 5G Handover procedure.	**K_2**
CO3	Analyze the relation between beamforming, gain and antenna count.	**K_4**
CO4	Understand and analyse different Physical layer parameters.	**K_4**
CO5	Investigate path losses.	**K_3**

Bachelor of Technology Third Year			
Course Code	**AEC0614P**	**LTP**	**Credit**
Course Title	**Advanced IoT and Mobile Applications Lab**	**0 0 2**	**1**
Course Objectives: Student will learn about			
1	The basic fundamentals of Mobile Application Development.		
2	The various programs of UI fundamentals, layout and applications.		
3	The implementation of multimedia and animation and connection of notification and services.		
4	The real time applications.		
Suggested List of Experiments			
Sr. No.	**Name of Experiment**		**CO**
1.	Implementing fundamentals of Mobile Application Development a. Case study on the architecture of personal smart phone, b. Install the Android Studio 4.2 or higher for Android SDK 11 c. Install developer tools and build a test project to confirm that those tools are properly installed and configured.		CO1
2.	Implementing UI fundamentals and layouts and develop a program for student's records, Implement followings: - a. Use UI Widgets: 2 TextViews, 2 EditTexts, and one Push Buttons, b. One Image button, One toggle button and One table 3x3, Use linear layout, Absolute layout and Relative layout.		CO1
3.	Implementing UI fundamentals and applications. Develop a program to get students information, Implement followings: - a. To implement checkbox (minimum three options, Ask hobbies) b. Radio button for gender (Male, Female) c. Radio group (minimum three options, Ask skills) d. Progress bar. (Ask Course coverage) e. Use Scroll and list view for checkbox f. Use Image and grid view for radio group. g. Use date and time picker.		CO2
4.	Implementing multimedia and animation. a. Interfacing Bluetooth connectivity and transmit and receive message using Bluetooth. b. Develop program to show human walking animation.		CO2
5.	Connecting Notifications and services a. Develop a program to send and receive SMS. b. Develop a program to send and receive email.		CO3
6.	Develop real-time applications with Android Studio a) Create a native calculator application. b) Develop an application that makes use of database. c) Develop a native application that uses GPS location information. d) Sending sensor data from IoT enabled smart device and publishing on mobile application.		CO3
Course Outcomes: After successful completion of the course students will able to			
CO 1	Understand configuration of Android environment and development tools.		K2

CO 2	Develop rich user interfaces by using layouts, controls, user interface components and animations.	K6
CO 3	Construct android applications using data bases and connect services.	K6
CO 4	Implement, test and publish real time Android Applications.	K3

Bachelor of Technology Third Year			
Course Code	**AEC0615P**	**LTP**	**Credit**
Course Title	**Robotics Lab**	**0 0 2**	**1**
Course Objectives: Student will learn about			
CO 1	The basic features of KUKA sim pro software.		
CO 2	The various programs on KUKA Sim Pro software.		
CO 3	Basics of the KUKA KR10 robotics arm.		
CO 4	Programming & Simulation of different task on KUKA KR10 robotics arm.		
Suggested List of Experiments			
Sr. No.	**Name of Experiment**		**CO**
1.	Study of KUKA sim pro software and its features		**CO1**
2.	To write a simulation program for welding task.		**CO1**
3.	To write a simulation program for pick & place task on KUKA sim pro software.		**CO2**
4.	Simulation of finger gripper in KUKA sim pro with the help of a "move tower" project.		**CO2**
5.	Sensing strategy and robot path creation for interrupted welding lines at car underbody.		**CO3**
6.	To study about robotics arm KR 10 and its features.		**CO3**
7.	To verify the simulation program for task of pick & place on robotic arm KR-10.		**CO4**
8.	To verify the simulation program for welding task on robotic arm KR-10.		**CO4**
Course Outcomes: After successful completion of the course students will able to			
CO 1	Understand the basic features of KUKA sim pro software		K2
CO 2	Understand and simulate the various programs on KUKA Sim Pro software.		K2, K5
CO 3	Learn about the KUKA KR10 robotics arm.		K1, K2
CO 4	Simulate various programs on KUKA KR10 robotics arm.		K5

Bachelor of Technology Third Year			
Course Code	**AEC0616P**	**L T P**	**Credit**
Course Title	**AI & ML Lab**	**0 0 2**	**1**

Course Objectives: Student will learn about

6.	Implementation procedures for the machine learning algorithms.
7.	Design MATLAB/Python programs for various Learning algorithms.
8.	How to apply appropriate data sets to the Machine Learning algorithms.
9.	Identify and apply Machine Learning algorithms to solve real world problems.

List of Experiments

Sr. No.	Name of Experiment	CO
1	Implement the S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .csv file.	CO1
2	For a given set of training data examples stored in a .csv file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	CO1
3	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	CO2
4	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	CO2
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .csv file. Compute the accuracy of the classifier, considering few test data sets.	CO2
6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	CO2
7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	CO3
8	Apply EM algorithm to cluster a set of data stored in a .csv file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.	CO4
9	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	CO4
10	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CO4

Course Outcomes: After successful completion of this course, students will be able to		**Blooms Level**
CO 1	Explain the implementation procedures for the machine learning algorithms.	K_3
CO 2	Design Python programs for various Learning algorithms.	K_3, K_4
CO 3	Apply appropriate data sets to the Machine Learning algorithms.	K_3, K_4
CO 4	Identify and apply Machine Learning algorithms to solve real world problems.	K_5

B. TECH. THIRD YEAR

Course code	ANC0601	L T P	Credits
Course Title	CONSTITUTION OF INDIA, LAW AND ENGINEERING	2 0 0	2

Course objective: To acquaint the students with legacies of constitutional development in India and help them to understand the most diversified legal document of India and philosophy behind it.

Pre-requisites: Computer Organization and Architecture

Course Contents / Syllabus

UNIT-I	INTRODUCTION AND BASIC INFORMATION ABOUT INDIAN CONSTITUTION	8 Hours

Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

UNIT-II	UNION EXECUTIVE AND STATE EXECUTIVE	8 Hours

Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of Vice-President, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

UNIT-III	INTRODUCTION AND BASIC INFORMATION ABOUT LEGAL SYSTEM	8 Hours

The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

UNIT-IV	INTELLECTUAL PROPERTY LAWS AND REGULATION TO INFORMATION	8 Hours

Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information, Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.

UNIT-V	BUSINESS ORGANIZATIONS AND E-GOVERNANCE	8 Hours

Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

COURSE OUTCOMES: After completion of this course students will be able to

CO 1	Identify and explore the basic features and modalities about Indian constitution.	K1
CO 2	Differentiate and relate the functioning of Indian parliamentary system at the center and state level.	K2
CO 3	Differentiate different aspects of Indian Legal System and its related bodies.	K4
CO 4	Discover and apply different laws and regulations related to engineering practices.	K4
CO 5	Correlate role of engineers with different organizations and governance models	K4

Text Books:

1. M Laxmikanth: Indian Polity for civil services and other State Examination,6th Edition, Mc Graw Hill
2. Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
3. Granville Austin: The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Oxford University Press.

Reference Books:

1. Madhav Khosla: The Indian Constitution, Oxford University Press.
2. PM Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.
3. V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)

Bachelor of Technology Third Year			
Course Code	**ANC0602**	**L T P**	**Credits**
Course Title	**Essence of Indian Traditional Knowledge**	**2 0 0**	**NC**
Course Objectives: In this course, the student will:			
1	Learn the basics of past Indian politics and state polity.		K_1, K_2
2	Aware of the Vedic system		K_1
3	Understand the different religions and religious movements in India.		K2
4	Learn the basic knowledge about the ancient history of Indian agriculture, science & technology, and ayurveda		K_1
5	Understand Indian dances, fairs & festivals, and cinema.		K_2
Pre-requisites: Political science			
Course Contents / Syllabus			
UNIT-I	**Society State and Polity in India**		**4 hours**
State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship, Council of Ministers Administration Political Ideals in Ancient India, Conditions of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women.			
UNIT-II	**Indian Literature, Culture, Tradition, and Practices**		**6 hours**
Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali, Prakrit And Sanskrit, Sikh Literature, Kautilya'sArthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature, Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature			
UNIT-III	**Indian Religion, Philosophy, and Practices**		**4 hours**
Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.			
UNIT-IV	**Science, Management and Indian Knowledge System**		**4 hours**
Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India, Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India, Writing Technology in India Pyrotechnics in India Trade in Ancient India/, India's Dominance up to Pre-colonial Times.			
UNIT-V	**Cultural Heritage and Performing Arts**		**6 hours**
Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Pottery, Painting, Indian Handicrafts, UNESCO'S List of World Heritage Sites in India, Seals, coins, Puppetry, Dance, Music, Theatre, Drama, Martial Arts Traditions, Fairs and Festivals, UNESCO'S List of Intangible Culture Heritage, Calendars, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World, Indian Cinema.			
Course outcome: After completion of this course students will be able to			
CO 1	Understand the basics of past Indian politics and state polity.		K2
CO 2	Understand the Vedas, Upanishads, languages & literature of Indian society.		K2
CO 3	Know the different religions and religious movements in India.		K4

CO 4	Identify and explore the basic knowledge about the ancient history of Indian agriculture, science & technology, and ayurveda.	K4
CO 5	Identify Indian dances, fairs & festivals, and cinema.	K1

Text books

4. S. Baliyan, Indian Art and Culture, Oxford University Press, India
5. Nitin Singhania, Indian Art and Culture: for civil services and other competitive Examinations,3rd Edition, Mc Graw Hill
6. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan

Reference Books

4. Romila Thapar, Readings In Early Indian History Oxford University Press, India
5. Basham, A.L., The Wonder that was India (34th impression), New Delhi, Rupa & co
6. Sharma, R.S., Aspects of Political Ideas and Institutions in Ancient India (fourth edition), Delhi, Motilal Banarsidass