KLE Technological University | Creating Value, Leveraging Knowledge

Curriculum Structure and Curriculum Content for the Batch – 2022-26
School /Department: Electronics & Communication Engineering
Program: Bachelor of Engineering

KLE Technological University | Creating Value, Leveraging Knowledge

Table of Contents

KLE Technological University | Creating Value, Leveraging Knowledge

Vision and Mission of KLE Technological University

Vision

KLE Technological University will be a national leader in Higher Education–recognised globally for innovative culture, outstanding student experience, research excellence and social impact.

Mission

KLE Technological University is dedicated to teaching that meets highest standards of excellence, generation and application of new knowledge through research and creative endeavours.

The three-fold mission of the University is:

- To offer undergraduate and post-graduate programs with engaged and experiential learning environment enriched by high quality instruction that prepares students to succeed in their lives and professional careers.

- To enable and grow disciplinary and inter-disciplinary areas of research that build on present strengths and future opportunities aligning with areas of national strategic importance and priority.

- To actively engage in the Socio-economic development of the region by contributing our expertise, experience and leadership, to enhance competitiveness and quality of life.

As a unified community of faculty, staff and students, we work together with the spirit of collaboration and partnership to accomplish our mission.

KLE Technological University | Creating Value, Leveraging Knowledge

Vision and Mission Statements of the School / Department

Vision

KLE Tech-School of Electronics and Communication will be well recognized nationally and internationally for excellence in its educational programs, pioneering research and impact on the industry and society.

Mission

1. To create a unique learning environment through rigorous curriculum of theory and practice that develops students' technical, scientific, and professional skills and qualities to succeed in wide range of electronics and computing businesses and occupations.
2. To nurture spirit of innovation and state-of-the-art research to advance the boundaries of disciplinary and interdisciplinary knowledge and its applications.
3. To collaborate within and beyond the discipline to create solutions that benefit humanity and society.

Program Educational Objectives/Program Outcomes and Program-Specific Objectives

Program Educational Objectives -PEO's
1. Graduates will demonstrate peer- recognized technical competency to solve contemporary problems in the analysis, design and development of electronic devices and systems.
2. Graduates will demonstrate leadership and initiative to advance professional and organizational goals with commitment to ethical standards of profession, teamwork and respect for diverse cultural background.
3. Graduates will be engaged in ongoing learning and professional development through pursuing higher education, and self-study.
4. Graduates will be committed to creative practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society.
Program Outcomes-PO's
PO1: Engineering knowledge: Apply the knowledge of mathematics, science, computing, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development using first principles of mathematics, natural sciences, and engineering sciences.
PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate

consideration for public health and safety, whole-life cost, net zero carbon, cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Conduct investigations of complex engineering problems Using research-based knowledge and research methods including design of experiments, modelling, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5: Engineering Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 6: Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, economy, health, safety, legal, and cultural and environmental issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Ethics Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice by adhering to national & international laws
PO 8: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse and/or multidisciplinary teams.
PO 9: Communication: Communicate effectively on complex engineering activities with the engineering community and with t h e society at large, such as, being able to

comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
PO 10: Project Management and Finance: Demonstrate knowledge and understanding of t h e engineering and management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO11: Life-long Learning: Recognize the need for, and possess the preparation and ability for: i) independent and life-long learning, ii) adaptability to new and emerging technologies, and iii) critical thinking, in the broadest context of continual technological advancement and change.
Program Specific Objectives -PSO's
PSO 1: An ability to apply design principles in the development of hardware and software systems of varying complexity.
PSO 2: Demonstrate the knowledge of the state of art tools and apply for the development of VLSI circuits/systems.
PSO 3: An ability to use appropriate modern techniques for analysis, design and development of Communication components/systems.

Curriculum structure 2022-26

Course with course code	I	II	III	IV	V	VI	VII	VIII
	Single Variable Calculus (4-1-0)	Multivariable Calculus (4-1-0)	Corporate Communication (0.5-0-0)	Problem Solving & Analysis (0.5-0-0)	Arithmetical Thinking & Analytical Reasoning (0-0-0) *Audit	Industry Readiness & Leadership Skills (0-0-0) * Audit	**Wireless and Mobile Networks (2-0-1)**	**Elective 6 (3-0-0) /Internship**
	Engineering Physics (3-0-0)	Engineering Chemistry (3-0-0)	Integral Transforms and Statistics (4-0-0)	Linear Algebra &Partial Differential Equations (4-0-0)	CMOS VLSI Circuits (4-0-0)	PC13:Automotive Electronics (3-0-1)		
	Engineering Mechanics (4-0-0)	Problem Solving with Data Structures (0-0-3)	Circuit Analysis (4-0-0)	Electromagnetic Fields and Waves (3-0-0)	Communication Systems (3-0-1)	PC14:Computer Communication Networks I (4-0-0)	**Elective 2** **Elective 3** **Elective 4** **Elective 5** **(3-0-0)** **4 new electives are included**	
	C Programming for Problem solving (0-0-3)	Engineering Exploration (0-0-3)	Analog Electronic Circuits (4-0-0)	Linear Integrated Circuits (4-0-0)	Digital Signal Processing (2-0-2)	Elective 1 (3-0-0)		
	Basic Electrical Engineering (3-0-0)	Basic Electronics (4-0-0)	Digital Circuits (4-0-0)	Control Systems (4-0-0)	Operating System & Embedded System Design(3-0-1)	Computer Communication Networks Lab (0-0-1)		
	Social Innovation (0-1-1)	Basic Mechanical Engg. (2-1-0)	Signals & Systems (4-0-0)	ARM Processor & Applications (3-0-0)	PC15: Machine Learning and Deep Learning (2-0-2)	P2: Minor Project (0-0-6)		
	Engineering Physics Lab (0-0-1)	Professional Communication (1-1-0)	Digital Circuits Lab (0-0-1)	Digital System Design using Verilog (0-0-2)	CMOS VLSI Circuits Lab (0-0-1)	Gen AI (2-0-1)		**Open Elective 1 (3-0-0) /Internship**
			Analog Electronic Circuits Lab (0-0-1)	Data acquisition and controls Lab (0-0-1)	Mini Project (0-0-3)	PALR (3-0-0)		
			Microcontroller Architecture & Programming (2-0-1)	ARM Microcontroller Lab (0-0-1)			**Senior Design Project (0-0-6)**	**Project Work- (0-0-11)**
				Data Structures Applications Lab (0-0-2)			**CIPE-Audit (2-0-0)**	
Credits	**21**	**23**	**25.5**	**24.5**	**24**	**24**	**21**	**17**

Curriculum Structure-Overall

Semester					Total Program Credits: 180			
Course with course code	I	II	III	IV	V	VI	VII	VIII
	Single Variable Calculus (18EMAB101)	Multivariable Calculus (4-1-0) (18EMAB102)	BS: Integral Transforms and Statistics (15EMAB203)	BS: Linear Algebra &Partial Differential Equations (15EMAB208)	PC10: CMOS VLSI Circuits (24EECC301)	H3: Professional Aptitude and Logical reasoning(16EHSC301)	Wireless and Mobile Networks (25EECC403)	PSE Elective 6 (25EECEXXX)/ Internship- Project (20EECW494)
	Engineering Physics (22EPHB101)	Engineering Chemistry (22ECHB102)	ES1: Corporate Communication (22EHSH201)	ES2: Problem Solving & Analysis (22EHSH202)	PC11: Communication System (23EECC302)	ES4: Industry Readiness & Leadership Skills (23EHSA304)	PSE Elective 2 (25EECEXXX)	Open Elective 1 (18EECOXXX)/ Internship- Project (20EECW494)
	Engineering Mechanics (4-0-0) (15ECVF101)	Problem Solving with Data Structures (18ECSP102)	PC1: Circuit Analysis (22EECC201)	ES4: Electromagnetic Fields and Waves (23EECC209)	PC12: Digital Signal Processing (23EECC303)	PC13: Automotive Electronics (24EECC305)	PSE Elective 3 (25EECEXXX)	Internship- Training (18EECI493)
	C Programming for Problem solving (0-0-3) (18ECSP101)	Engineering Exploration (22ECRP101)	PC2: Analog Electronic Circuits (22EECC202)	PC5: Linear Integrated Circuits (19EECC203)	PC13: Operating System & Embedded Systems Design (24EECC304)	PC14: Computer Communication Networks I (23EECC306)	PSE Elective 4 (25EECEXXX)	
	Basic Electrical Engineering (3-0-0) (18EEEF101)	Basic Electronics (18EECF101)	PC3: Digital Circuits (19EECC201)	PC6: Control Systems (23EECC206)	PCLx: CMOS VLSI Circuits Lab (24EECP301)	GEN AI (24EECC308)	PSE Elective 5 (25EECEXXX)	Capstone Project (20EECW402)
	Deign thinking for Social Innovation (0-1-1) (20EHSP101)	Basic Mechanical Engineering (22EMEF101)	PC4: Signals & Systems (19EECC202)	PC7: ARM Processor & Applications (22EECC207)	PC15: Machine Learning& Deep Learning (24EECC309)	PSE Elective 1 (17EECEXXX)	P3: Senior Design Project (20EECW401)	

	Applied Physics Lab (0-0-1) (21EPHP101)	Professional Communication (15EHSH101)	PCL1: Digital Circuits Lab (22EECP201)	PC8: Digital System Design using Verilog (22EECC208)	P1: Mini Project (23EECW301)	PCL7: Computer Communication Networks I Lab (23EECP303)	CIPE (15EHSC402)	
			PCL2: Analog Electronic Circuits Lab (22EECP202)	PCL3: Data acquisition and controls Lab (22EECP203)	ES3: Arithmetical Thinking & Analytical Reasoning (23EHSA303)	P2: Minor Project (24EECW302)		
			ES2: Microcontroller Architecture & Programming (22EECF202) C Programming (Diploma) (22EECF202)	PCL4: ARM Microcontroller Lab (22EECP204)				
				PCL3: Data Structure Applications Lab (21EECF201) PCL3: Data Structure Lab (Diploma) (21EECF203)				
Credits	**21**	**23**	**25.5**	**24.5**	**24**	**24**	**21**	**17**

Curriculum Structure-Semester wise

Semester - I

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	18EMAB101	Single Variable Calculus	BS	4-1-0	5	6	50	50	100	3 hrs
2	22EPHB101	Engineering Physics	BS	3-0-0	3	3	50	50	100	3 hrs
3	15ECVF101	Engineering Mechanics	ES	4-0-0	4	4	50	50	100	3 hrs
4	18ECSP101	C Programming for Problem solving	ES	0-0-3	3	6	80	20	100	3 hrs
5	18EEEF101	Basic Electrical Engineering	ES	3-0-0	3	3	50	50	100	3 hrs
6	20EHSP101	Design Thinking for Social Innovation	HSS	0-1-1	2	4	50	50	100	1.5hrs
7	21EPHP101	Applied Physics Lab	BS	0-0-1	1	2	80	20	100	3 hrs
TOTAL				**14-2-5**	**21**	**28**	**410**	**290**	**700**	

Semester - II

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	18EMAB102	Multivariable Calculus	BS	4-1-0	5	6	50	50	100	3 hrs
2	22ECHB102	Engineering Chemistry	BS	3-0-0	3	3	50	50	100	3 hrs
3	18ECSP102	Problem Solving with Data Structures	ES	0-0-3	3	6	80	20	100	3 hrs
4	22ECRP101	Engineering Exploration	ES	0-0-3	3	6	80	20	100	3 hrs
5	18EECF101	Basic Electronics	ES	4-0-0	4	4	50	50	100	3 hrs
6	22EMEF101	Basic Mechanical Engineering	ES	2-1-0	3	4	50	50	100	3 hrs
7	15EHSH101	Professional Communication	HSS	1-1-0	2	4	50	50	100	1.5 hrs
TOTAL				**15-2-6**	**23**	**33**	**410**	**290**	**700**	

Semester- III

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	15EMAB203	BS: Integral Transforms and Statistics	BS	4-0-0	4	4	50	50	100	3 hours
2	22EHSH201	ES1: Corporate Communication	ES	0.5-0-0	0.5	1	100	--	100	3 hours
3	22EECC201	PC1: Circuit Analysis	PC	4-0-0	4	4	50	50	100	3 hours
4	22EECC202	PC2: Analog Electronic Circuits	PC	4-0-0	4	4	50	50	100	3 hours
5	19EECC201	PC3: Digital Circuits	PC	4-0-0	4	4	50	50	100	3 hours
6	19EECC202	PC4: Signals & Systems	ES	4-0-0	4	4	50	50	100	2 hours
7	22EECP201	PCL1: Digital Circuits Lab	PC	0-0-1	1	2	80	20	100	2 hours
8	22EECP202	PCL2: Analog Electronic Circuits Lab	PC	0-0-1	1	2	80	20	100	2 hours
9	22EECF202 18EECF204	ES2: Microcontroller Architecture & Programming C Programming (Dip)	ES	2-0-1 0-0-2	3 2	4 4	80	20	100	2 hours
TOTAL				22.5-0-3	25.5	29	590	310	900	

Semester- IV

No	Code	Course	Categor	L-T-P	Credit	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	15EMAB208	BS: Linear Algebra & Partial Differential Equation	BS	4-0-0	4	4	50	50	100	3 hours
2	22EHSH202	ES2:Problem Solving & Analysis	ES	0.5-0-0	0.5	1	100	--	100	3 hours
3	23EECC209	ES4: Electromagnetic Fields and Waves	PC	3-0-0	3	3	50	50	100	3 hours
4	19EECC203	PC5: Linear Integrated Circuits	PC	4-0-0	4	4	50	50	100	3 hours
5	23EECC206	PC6: Control Systems	PC	4-0-0	4	4	50	50	100	3 hours
6	22EECC207	PC7: ARM Processor & Applications	PC	3-0-0	3	3	50	50	100	3 hours
7	22EECC208	PC8: Digital System Design using Verilog	PC	0-0-2	2	4	80	20	100	2 hours
8	22EECP203	PCL3: Data acquisition and controls Lab	PC	0-0-1	1	2	80	20	100	2 hours
9	22EECP204	PCL4: ARM Microcontroller Lab	PC	0-0-1	1	2	80	20	100	2 hours
10	21EECF201	PCL3: Data Structure Applications Lab	ES	0-0-2	2	4	80	20	100	2 hours
	21EECF203	PCL3: Data Structure Lab (Diploma)		0-0-3	3	6				
TOTAL				18.5-0-(	24.5	31	670	330	1000	

Semester- V

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	24EECC301	PC10:CMOS VLSI Circuits	PC	4-0-0	4	4	50	50	100	3 hours
2	23EECC302	PC11: Communication System	PC	3-0-1	4	5	50	50	100	3 hours
3	23EECC303	PC12: Digital Signal Processing	PC	2-0-2	4	6	80	20	100	3 hours
4	24EECC304	PC13: Operating System & Embedded Systems Design	PC	3-0-1	4	5	50	50	100	3 hours
5	24EECP301	PCLx: CMOS VLSI Circuits Lab	PC	0-0-1	1	2	80	20	100	2 hours
6	24EECC309	PC15: Machine Learning& Deep Learning	PC	2-0-2	4	6	50	50	100	3 hours
7	23EECW301	P1: Mini Project	PW	0-0-3	3	6	50	50	100	2 hours
8	23EHSA303	ES3:Arithmetical Thinking & Analytical Reasoning	Audit	0-0-0	--	1	50	50	100	3 hours
TOTAL				**14-0-10**	**24**	**35**	**540**	**260**	**800**	

Semester- VI

No	Code	Course	Category	L-T-P	Credits	Contact Hour	ISA	ESA	Total	Exam Duration (in hrs)
1	16EHSC301	H3: Professional Aptitude and Logical reasoning.	HC	3-0-0	3	3	50	50	100	3 hours
2	23EHSA304	ES4: Industry Readiness & Leadership Skills	ES	0-0-0	Audit	1	25	75	100	3 hours
3	24EECC305	PC13:Automotive Electronics	PC	3-0-1	4	5	63	37	100	3 hours
4	23EECC306	PC14:Computer Communication Networks I	PC	4-0-0	4	4	50	50	100	3 hours
	24EECC308	GEN AI	PC	2-0-1	3	4	66	34	100	2 hours
5	17EECEXXX	PSE Elective 1	PE	3-0-0	3	3	50	50	100	3 hours
6	23EECP303	PCL7: Computer Communication Networks I Lab	PC	0-0-1	1	2	80	20	100	2 hours
8	24EECW302	P2: Minor Project - I	PW	0-0-6	6	12	50	50	100	2 hours
TOTAL				**15-0-9**	**24**	**34**	**434**	**366**	**800**	

Semester- VII

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	25EECC403	Wireless and Mobile Networks	PSC	2-0-1	3	3	67	33	100	2 hours
2	25EECEXXX	PSE Elective 2	PSE	3-0-0	3	3	50	50	100	3 hours
3	25EECEXXX	PSE Elective 3	PSE	3-0-0	3	3	50	50	100	3 hours
4	25EECEXXX	PSE Elective 4	PSE	3-0-0	3	3	50	50	100	3 hours
5	25EECEXXX	PSE Elective 5	PSE	3-0-0	3	3	50	50	100	3 hours
6	20EECW401	P3: Senior Design Project	PW	0-0-6	6	12	50	50	100	3 hours
7	15EHSC402	CIPE & EVS	M	2-0-0	-	2	50	50	100	3 hours
TOTAL				**14-0-7**	**21**	**29**	**367**	**333**	**700**	

Semester- VIII

No	Code	Course	Category	L-T-P	Credits	Contact Hour	ISA	ESA	Total	Exam Duration (in hrs)
1	25EECEXXX	PSE Elective 6	PSE	3-0-0	3	3	50	50	100	3 hours
2	18EECEXXX	Open Elective 1	OE	3-0-0	3	3	50	50	100	3 hours
OR										
3	18EECI493	Internship- Training	PRJ	0-0-6	6	12	50	50	100	3 hours
And										
	20EECW494	Internship- Project	PRJ	0-0-11	11	22	50	50	100	3 hours
OR										
4	20EECW402	Capstone Project	PRJ	0-0-11	11	22	50	50	100	3 hours
TOTAL				**6-0-11**	**17**	**28**	**150**	**150**	**300**	

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	21	23	25.5	24.5	24	24	21	17	180

List of Open Electives

Sr. No	Name of the Course	Course Code
1	Automotive Electronics	18EECO403

List of Program Electives

Sr. No	Name of the Course	Course Code
1	Analog Integrated Circuit Design	24EECE301
2	Architectural Design of Integrated Circuits	24EECE302
3	Embedded Intelligent Systems	24EECE310
4	OOPS using C++	25EECE421
5	Multimodal Machine Learning	25EECE327
6	Dynamics of Linear Systems	24EECE341
7	System Verilog for Verification	25EECE418
8	Multimedia Communication	18EECE410
9	Physical Design-Analog	25EECE419
10	CMOS ASIC Design	25EECE420
11	AUTOSAR	25EECE406
12	Human Machine Interface	25EECE428
13	Microwave & Antennas	23EECE411
14	Wireless & Mobile Communication	24EECE432
15	Speech Processing	24EECE422
16	Product and Functional Safety	24EECE433
17	5G and Software Defined Networking	24EECE434

18	Advance IC Packaging	25EECE436
19	Design for Testability	25EECE447
20	Signal and Power Integrity	25EECE448
21	Advanced DFT	25EECE449
22	Multi sensor Data Fusion	25EECE453
23	Agentic AI	25EECE438

List of Swayam Courses

Sr. No	Name of the Course	Course Code
01	Cloud Computing	22EECE444
02	Fabrication Techniques for MEMs-based Sensors: Clinical Perspective	25EECE442
03	Cyber Security and Privacy	23EECE439
04	Phase-Locked Loops	22EECE432
05	VLSI Design Flow: RTL to GDS	23EECE435
06	Computer Vision	25EECE443
07	C-Based VLSI Design	23EECE436
08	Fundamentals of Micro and Nanofabrication	23EECE438
09	Software Testing	25EECE446
10	Applied Linear Algebra for Signal Processing, Data Analytics and Machine Learning	23EECE437
11	Introduction to Adaptive Signal Processing	25EECE448
12	Introduction to Algorithms and Analysis	23EECE440

13	Cryptography And Network Security	22EECE431
14	RFIC Design	25EECE449

Curriculum Content- Course wise

Program: Electronics & Communication Engineering		**Semester: I**
Course Title: Single Variable Calculus		**Course Code: 18EMAB101**
L-T-P: 4-1-0	**Credits: 5**	**Contact Hours: 06 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50Hrs	**Examination Duration: 3 Hrs**	

Unit I

1. Functions, Graphs and Models

Functions, types of functions, transformations and models (Linear, exponential, trigonometric).
MATLAB: Graphing functions, Domain-Range and Interpreting the models

2. Calculus of functions and models

Limit of a function, Infinite limits- graph, Continuity and discontinuity, Intermediate value theorem statement, Roots of the equation using Bisection Method and Newton- Raphson Method
Interpretation of derivative as a rate of change, All the rules of derivatives (List only), Maxima, Minima and optimization problems. Curvature and Radius of Curvature, Indeterminate forms, L- Hospital's Rule-Examples
MATLAB: optimization problems. Curvature problems

Unit II

3. Infinite Series

Definition, Convergence of series, Tests of convergence – p-series, Alternating series. Power series, radius of convergence, Taylor's and Maclaurin's series, Applications of Taylor's and Maclaurin's series
MATLAB: Convergence of series

4. Integral calculus

Tracing of standard curves in Cartesian form, Parametric form and Polar form; Beta and gamma function, relation between them, evaluation of integrals using Beta and gamma functions; Applications to find arc length, Area, Volume and surface area (Cartesian, parametric and polar curves). Approximate integration- Trapezoidal rule, Simpson's 1/3 rule
MATLAB: problems on arc length, area, volume and surface area

Unit III

5. Ordinary differential equations of first order

(a) Introduction to Initial Value problems. Linear and Bernoulli's equations, Exact equations and reducible to exact form, Numerical solution to Initial Value Problems-Euler's method, Modified Euler's method and Runge-Kutta method
(b) Applications of first order differential Equations-Orthogonal trajectories growth and decay problems, mixture problems, Electrical circuits, falling bodies.
MATLAB: Solve differential equations

Text Books

1. Early Transcendentals Calculus- James Stewart, Thomson Books, 7ed 2010.

Reference Books:

1. Calculus Single and Multivariable, Hughues-Hallett Gleason, Wiley India Ed, 4ed, 2009.
2. Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010

Back to Semester - I

Program: Electronics & Communication Engineering		**Semester: I**
Course Title: Engineering Physics		**Course Code: 22EPHB101**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50Hrs	**Examination Duration: 3 Hrs**	

Unit I

Chapter 1: Conduction in semiconductors

Atomic theory: The atom, electron orbits and energy levels, energy bands, Conduction in solids: Electron motion and hole transfer, conventional current and electron flow

Conductors, semiconductors and insulators: Bonding force between atoms, Energy bands in different materials.

n-type and p-type Semiconductors: Doping, n-Type material, p-Type material, Majority and minority charge carriers, Effects of heat and light, charge carrier density.

Semiconductor conductivity: Drift current, diffusion current, charge carrier velocity, conductivity, Hall Effect.

(Text 1 Page No 1-33)

Chapter 2: Junctions

The pn-Junctions: Junction of p-Type and n-Type, Barrier voltage, depletion region, Qualitative theory of p-n Junction

Biased junctions: Reverse biased junction, forward biased junction, junction temperature effects.

Junction currents and voltages: Shockley equation, junction currents, junction voltages.

p-n Junction Diode characteristics and parameters: Forward and reverse characteristics, diode parameters.

Diode approximations: Ideal diode and practical diodes, piecewise linear characteristics, DC equivalent circuits.

DC load line analysis: DC load line, Q-Point, calculating load resistance and supply voltage.

Temperature Effects: Diode power dissipation, forward voltage drops, dynamic resistance.

Diode AC models: Junction capacitance, AC-equivalent circuits (Reverse biased and forward biased), reverse recovery time.

Diode specifications: Diode data sheets, low power diodes, rectifier diodes

Diode testing: Ohmmeter tests, use of digital meter, plotting diode characteristics.

Zener diodes: Junction break down, circuit symbols and packages, characteristics and parameters, data sheet, equivalent circuits.

(Text 1 Page No 34-71)

Unit II

Chapter 3: Electrostatics

Review on vectors:

Coordinate Systems, Vector and Scalar Quantities, Properties of Vectors, Components of a Vector and Unit Vectors

(Text 2 Page No 59-77)

Electric Fields:

Properties of Electric Charges, Charging Objects by Induction, Coulomb's Law, Analysis Model: Particle in a Field (Electric), Electric Field of a Continuous Charge Distribution, Electric Field Lines Motion of a Charged Particle in a Uniform Electric Field

Gauss's Law:

Electric Flux, Gauss's Law, Application of Gauss's Law to Various Charge Distributions, Conductors in Electrostatic Equilibrium

Electric Potential:

Electric Potential and Potential Difference, Potential Difference in a Uniform Electric Field, Electric Potential and Potential Energy Due to Point Charges, Obtaining the Value of the Electric Field from the Electric Potential, Electric Potential Due to Continuous Charge Distributions Electric Potential Due to a Charged Conductor, Applications of Electrostatics

Capacitance and Dielectrics:

Definition of Capacitance, Calculating Capacitance, Combinations of Capacitors, Energy Stored in a Charged Capacitor, Capacitors with Dielectrics, Electric Dipole in an Electric Field, An Atomic Description of Dielectrics

(Text 2 Page No 690-807)

Unit III

Chapter 4: Electromagnetics

Magnetic Fields:

Analysis Model: Particle in a Field (Magnetic), Motion of a Charged Particle in a Uniform Magnetic Field, Applications Involving Charged Particles Moving in a Magnetic Field, Magnetic Force Acting on a Current-Carrying Conductor, Torque on a Current Loop in a Uniform Magnetic Field,

Sources of the Magnetic Field:

The Biot–Savart Law, The Magnetic Force Between Two Parallel Conductors, Ampere's Law, The Magnetic Field of a Solenoid, Gauss's Law in Magnetism, Magnetism in Matter

Faraday's Law:

Faraday's Law of Induction, Motional emf, Lenz's Law, Induced emf and Electric Fields Generators and Motors, Eddy Currents (Text 2 Page No 868-969)

Text Book:

1. David A Bell, “Electronics Devices and Circuits”, Fifth Edition, Oxford University Press.
2. Serway and Jewett, “Physics for Scientists and Engineers-with Modern Physics”, 9th Edition, CENGAGE learning. 2014

Reference Books:

1. Jacob Millman and Christos Halkias, “Electronic Devices and Circuits” TMH
2. R P Feynman, Robert B Leighton, Matthew Sands, The Feynman Lectures on Physics Vol-II, Norosa Publishing House (1998).
3. Ben G Streetman, Solid State Electronic Devices, Prentice Hall, 1995

Back to Semester - I

Program: Electronics & Communication Engineering		Semester: I
Course Title: Engineering Mechanics		Course Code: 15ECVF101
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter 1: Overview of Civil Engineering

Evolution of Civil Engineering
Specialization, scope and role.
Impact of Civil Engineering on
National economy, environment and social & cultural fabric.
Challenges and Opportunities for Civil Engineers
Civil Engineering Marvels, Future challenges, Higher education and Research.

Chapter 2: Coplanar concurrent force system

Introduction to Engineering Mechanics:
Basic idealizations – Particle, Continuum, Body, Rigid body, Deformable body, Definition of force and its elements; Laws of Mechanics – Parallelogram law of forces, Principle of transmissibility, Law of Superposition,

Newton's laws of motion. Classification of force systems Resultant of coplanar concurrent force system: Definitions – Resultant, composition & Resolution of a force, Equilibrium, Equilibrant, Formulae for resultant of forces and resolution of a force. Numerical problems on resultant of forces.

Equilibrium of coplanar concurrent force system:
Conditions of equilibrium, Action & Reaction, Free body diagram, Lamis' theorem. Numerical problems on equilibrium of forces.

Chapter3 : Coplanar non-concurrent force system

Resultant of a force system: Moment, moment of a force, couple, moment of a couple, Characteristics of couple, Equivalent force-couple system, Numerical problems on moment of forces and couples, on equivalent force-couple system. Varignons principle of moments, Resultant of coplanar- non-concurrent force systems and numerical problems.

Unit II

Chapter4 : Equilibrium of a force system (Chapter 3 contd.)
Conditions of equilibrium, types of support and loading for a statically determinate beam, Reactions at support connections, Numerical problems on equilibrium of force systems and support reactions for a statically determinate beam.

Chapter 5: Static Friction: Introduction, types of friction, definition, limiting friction, coefficient of friction, laws of Coulomb friction, angle of friction and angle of repose, cone of friction. Wedge and belt friction theory. Derivation of belt friction formula. Numerical problems on, impending motion on horizontal and inclined planes (including connected bodies); wedge friction; Ladder friction and Belt friction.

Chapter 6: Simple Stress and Strain
Introduction, Properties of Materials, Stress, Strain, Elasticity, Elastic limit, Hooke's law & Young's modulus, Stress – Strain Diagram for structural steel, working stress and Factor of safety. Deformation of a bar due to force acting on it. Law of super position. Stresses in bars of uniform & varying cross sections. Composite sections. Problems connected to above topics.

Unit III

Chapter 7: Centroid of Plane Figures
Introduction, Definition, Methods of determining the centroid, axis of reference, axis of symmetry, Locating the centroid of simple plane figures (triangle, semicircle, quarter of a circle and sector of a circle etc.,) using method of integration, Numerical problems on Centroid of simple built-up sections.

Chapter 8: Second moment of area (Plane figures)
Introduction, Definition, Method of determining the second moment of area, Section Modulus, Radius of gyration, perpendicular and Parallel axis theorems, Polar second moment of area, second moment of area of simple plane figures (triangle, rectangle, semicircle, circle etc,.) using method of integration, Numerical problems on MI of simple built up sections.

Text Books

1. Beer, F.P. and Johnston, R., *Mechanics for Engineers: Statics*, McGraw Hill Company, New York, 1988.
2. Bhavikatti, S.S., and Rajasshekarappa K.G., *Engineering Mechanics*, 3Ed., New Age International Pub. Pvt. Ltd., New Delhi, 2008.
3. Kumar, K.L., *Engineering Mechanics*, 3ed., Tata McGraw Hill Publishing Company, New Delhi, 2003.
4. Punmia, B.C., Jain, A. and Jain, A., *Mechanics of Materials*, Lakshmi Publications, New Delhi, 2006

Reference Books:

1. Jagadeesh, T.R. and Jayaram, *Elements of Civil Engineering*, Sapna Book House, Bangalore, 2006.
2. Ramamrutham, S., *Engineering Mechanics*, Dhanpat Rai Publishing Co., New Delhi, 1998.
3. Singer, F.L., *Engineering Mechanics*, 3rd edition Harper Collins, 1994.
4. Timoshenko, S.P. and Young, D.H., *Engineering Mechanics*, 4th edition, McGraw Hill Publishing Company, New Delhi, 1956.
5. Irving H Shames, *Engineering Mechanics*, 3rd edition, Prentice-Hall of India Pvt. Ltd,

Back to Semester - I

Program: Electronics & Communication Engineering		**Semester: I**
Course Title: C Programming for Problem solving		**Course Code: 18ECSP101**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 6 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: 78Hrs	**Examination Duration: 3 Hrs**	

Introduction to Problem solving: Introduction to algorithms / flowcharts and its notations, top down design, elementary problems.

Basics of C programming language: Characteristics and uses of C, Structure of C program, C Tokens: Keywords, Identifiers, Variables, Constants, Operators, Data-types, Input and Output statements.

Decision control statements: Conditional branching statements: if statement, if else statement, else if ladder, switch statement, unconditional branching statements: break, continue.
Introduction to Debugging Skills, Introduction to Test Driven Programming.

Iterative statements: while, do while, for, nested statements

Functions: Introduction, Function declaration, definition, call, returns statement, passing parameters to functions, introduction to macros. Introduction to Coding Standards

Arrays and Strings: Introduction, Declaration, accessing elements, Storing values in arrays, Operations on one dimensional array, Operations on two dimensional arrays, Introduction to Code Optimization and refactoring

Pointers: Introduction, declaring pointer, pointer variables, pointer expression and arithmetic, passing arguments to functions using pointers, pointers and arrays, passing an array to a function.

Structures and Unions: Introduction, passing structures to functions, Array of structures, Unions

Text Books

1. R.G. Dromey, how to Solve it by Computer, 1ed, PHI, 2008.
2. Yashvant Kanetkar, Let us C ,15th ed, BPS Publication, 2016.

Reference Books:

1. B W Kernighan, D M Ritchie, The Programming Language C, 2ed, PHI, 2004.
2. B S Gottfried, Programming with C, 2ed, TMH, 2006.
3. B.A. Forouzan, R.F. Gilberg, A Structured Program Approach Using C, 3ed, CENGAGE Learning, 2008.

Back to Semester - I

Program: Electronics & Communication Engineering		**Semester: I**
Course Title: Basic Electrical Engineering		**Course Code: 18EEEF101**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40Hrs	**Examination Duration: 3 Hrs**	

Unit I

Overview of Electrical Engineering

Specialization, scope & role, impact of Electrical Engineering on national economy, environment, Sources of generation, sustainability, challenges and opportunities for electrical engineers, electrical engineering marvels, future challenges.

DC Circuits

Voltage and current sources, Kirchoff's current and voltage laws, loop and nodal analysis of simple circuits with dc excitation. Time-domain analysis of first-order RL and RC circuits.

AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase series and parallel R-L-C ac circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections. power measurement using two watt meters

Unit II

Electrical Actuators

Electromagnetic principles, Solenoid, Relays, classification of Electric motors, DC motors-shunt, series, compound, separately excited, PMDC motors – Speed Control, Stepper Motors, BLDC motors, three phase induction motor, Characteristics and applications, selection of motors for various applications.

Power Electronics (Text1, chapter 45)

Introductory, Thyristor, some thyristor circuits, Limitations to thyristor operation, the thyristor in practice, the fully controlled AC/DC converter, AC/DC inversion, switching devices in inverters, Three-phase rectifier networks, the three-phase fully controlled converter, Inverter-fed induction motors, Soft-starting induction motors, DC to DC conversion switched-mode power

Unit III

Electrical Wiring, Safety and protection (Ref: Text3-page 1 to 10)

Types of wires and cables for internal wiring, Types of switches and Circuits, Types of wiring, Safety precautions and rules in handling electrical appliances, Electric shock, first aid for electrical shocks, Importance of grounding and earthing, Methods for earthing, Fuses, MCB, ELCB and Relays, Lockout and Tagout, Electrical Codes and Standards.

Batteries:

Basics of lead acid batteries, Lithium Ion Battery, Battery storage capacity, Coulomb efficiency, Numerical of high and low charging rates, Battery sizing. Numericals.

Text Books

1. Hughes, Electrical & Electronic Technology, 8th, Pearson Education, 2001
2. P C Sen, Principals of Electrical Machines and Power Electronics, 2nd, Wiley Publications
3. Gilbert M Masters, Renewable and efficient Electrical Power systems, Published by John Wiley & Sons 2004 edition
4. Frank D. Petronella, Electric Motors and Control Systems, McGraw Hill Education Private Limited 2009 Edition

Reference Books:

1. D C Kulshreshtha, Basic Electrical Engineering, Mc Graw Hill Publications
2. David G Alciatore and Michel B Histand, Introduction to Mechatronics and Measurement Systems, 3rd, Tata McGraw Hill Education Private Limited, New Delhi., 2005
3. Vincent Del Toro, Electrical Engineering Fundamentals, 2nd edition Prentice Hall India

Back to Semester - I

Program: Electronics & Communication Engineering			Semester: I
Course Title: Design Thinking for Social Innovation			Course Code: 20EHSP101
L-T-P: 0-1-1	Credits: 2		Contact Hours: 4 hrs/week
ISA Marks: 80	ESA Marks: 20		Total Marks: 100
Teaching Hours: 28Hrs	Examination Duration: 3 Hrs		

Module		Topics	Assignments	Support activities / Tools
KNOWLEDGE, TOOLS & DEVELOPMENT	Course sensitization	1. Introduction to Social Innovation: • Awakening social consciousness **(www.yourstory.com)** • Social Innovation and Leadership • Engineering& Social innovation (EPICS) **(Connecting SI Course to Mini Project, Capstone Project, Campus Placements)** • Course Overview • **Students' Self Introduction Activity** • Group formation **Activity**	**Reading assignments** • Read the handout on "The Process of Social Innovation" by Geoff Mulgan • Design thinking for Social Innovation **Written Assignments** • **Writing about Akshaya Patra in class.** **(Background information about Akshaya patra and the Social Cause it is addressing)** • **Brainstorming Session on Social**	• Class activity on Behavioural Blocks to Innovation **Discussion on the behavioural blocks.** • **Introducing oneself with three Adjectives- Appreciating diversities and discovering self** • **Group Formation Activity (Forming square)** **(Making four equilateral triangles out of popsicle sticks to enhance group cohesiveness amongst the group mates)**

			Innovators in Class	
	Create Mindsets	**Seven Mindsets:** 1. Empathy **(Example of The Boy and the Puppies)** 2. Optimism **(Person Paralyzed waist down / Glass Half Full Half Empty)** 3. Iteration **(Thomas Alva Edison)** 4. Creative Confidence **(Origami – Josef Albers)** 5. Making it 6. Embracing Ambiguity **(Confusion is the Welcome doormat at the door of Creativity)** 7. Learning from Failure **(Designing Website first and then asking the stakeholders about the website)**	**<u>Reading assignments</u>** • Handout on "Create Mindsets"	• **(How to train the Dragon? Common Video for all the mindsets)** • **Watching in Class TED Talk on "How to build your Creative Confidence by David Kelley – IDEO Founder)**

		(Spending one lakh for the business which is never launched)		
	Process of Social Innovation	**Engage** Community study and Issue Identification	**<u>Reading assignments</u>** • Handout on Community Study and Issue Identification • Case Study on "EGramSeva" • Case Study on "Janani Agri Serve" **<u>Class Presentations</u>** • Initial observations being made by the group **(Literature Survey of Places of Hubli-Dharwad)** **www.readwhere.com** • Detailed interaction / engagements with	• Activity on Observation skills To know how to use one's observation skills in understanding the social conditions • Experience sharing by senior students • Brainstorming Deliberations on the initial observations and arrive at the "Social Issue" • Familiarization of the respective templates with the help of sample case study

			the society and finalize the social issue for intervention **Use template 1: Frame your Design Challenge**	
		PEER REVIEW		
		2. Inspiration • Plan for the Research • Development of Interview guide • Capture your Learnings	**Reading assignments** • Handout on Overview of Inspiration **Class Presentations** • Entirety of the Social Issue • Identification of the Stake Holders **(Examples on Fluorescent Curtain and Students' Punctuality for Class)** • Interview Questions **(Role Play on Interview with Stakeholders)** • Category wise Learnings capture **Use template 2: Plan your Research**	• Familiarization of the respective templates with the help of sample case study

			Template 3. Development of Interview Guide **Template 4. Capture your Learning**	
		3. Ideation **3.1 Synthesis** • Search for meaning • Create "How might we" question	**<u>Reading assignments</u>** • Handout on Overview of Ideation-Synthesis **<u>Class Presentations</u>** • Create insights • "How might we" questions **Use template 5: Create Insights** **Template 6: Create "How Might We' Questions**	• Familiarization of the respective templates with the help of sample case study
		3.0 Ideation **3.2 Prototyping** • Generate Ideas • Select Promising Ideas • Determine what to prototype • Make your prototype	**<u>Reading assignments</u>** • Handout on Overview of Ideation-Prototyping **<u>Class Presentations</u>** • Story board- demonstrating the possible solutions **Use template 7: Select your best ideas**	• Brain storming • Familiarization of the respective templates with the help of sample case study • Activity on Risk management • Activity on Resource management Structure building games

		• Test and get feedback	**Template 8 : Determine what to prototype**	
		PEER REVIEW		
		4.0 Implementation • Create an action plan • Community Partners (if any) • Budgeting & Fundraising 1. **Peer to Peer** 2. **Crowd Funding** 3. **Giving Kiosks** 4. **Donation** 5. **Envelop Funding** 6. **Marathons/ Walkathons** 7. **Conducting Yoga Classes** **(www.causevox.com / www.blog.fundly.com)**	**Reading assignments** • Handout on Overview of Implementation **Class Presentations** • Pilot implementation plan with required resources and Budget indicating stake holders & their engagement	• Familiarization of the respective templates with the help of sample case study

		• Duration • Ethical concerns • Launch your solution • Feedback (Impact)		
		5.0 Reflect Reflection of the overall learning by the students	**Reading assignments** • Handout on Overview of students Reflection **Use template 9: Reflection on the Process** **Class Presentations** Final Presentation- After Implementation	• Familiarization of the respective templates with the help of sample case study

Back to Semester - I

Program: Electronics & Communication Engineering		Semester: I
Course Title: Applied Physics lab		Course Code: 21EPHP101
L-T-P: 0-0-1	Credits: 1	Contact Hours: 2 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: 24Hrs	Examination Duration: 3 Hrs	

List of Experiments

1. Four probe method
2. V-I characteristics of p-n junction diode
3. Zener diode characteristics
4. Hysteresis loss
5. Transistor characteristics
6. Measurement of dielectric constant
7. Resonance frequency of LCR circuits
8. Study of frequency response of passive components
9. Calibration of thermocouple
10. Calibration of electrical meters

Back to Semester - I

Program: Electronics & Communication Engineering		Semester: II
Course Title: Multivariable calculus		Course Code: 18EMAB102
L-T-P: 4-1-0	Credits: 5	Contact Hours: 6 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

1. **Partial differentiation**
   Function of several variables, Partial derivatives, Level curves, Chain rule, Errors and Approximations. Extreme value problems. Lagrange's multipliers.
2. **Double integrals**
   Double integrals- Rectangular and polar coordinates, Change the order of integration. Change of variables, Jacobian. Application of double integrals

MATLAB: optimization problems, application of double integrals

Unit II

3. **Triple integrals**
   Triple integrals, Cartesian, change to Cylindrical and Spherical Coordinates Application of Triple integrals
4. **Calculus of Vector Fields**
   Vector fields, Gradient and directional derivatives. Line and Surface integrals. Independence of path and potential functions. Green's theorem, Divergence of vector field, Divergence theorem, Curl of vector field. Stokes theorem.

MATLAB: application of Triple integrals, Vector calculus problems

Unit III

5. **Differential equations of higher orders**
   (a) Linear differential equations of second and higher order with constant coeffiISAntsThe The method of Variation of parameters. Initial and boundary value problems. (b) Applications of second order differential Equations-Newton's 2nd law, electrical circuits, Simple Harmonic motion. Series solution of differential equations. Validity of Series solution of Differential equations.

MATLAB: application of differential equations

Text Books

1. Early Transcendentals Calculus- James Stewart, Thomson Books, 7ed 2010.

Reference Books:

1. Calculus Single and Multivariable, Hughues-Hallett Gleason, Wiley India Ed, 4ed, 2009.
2. Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010

Back to Semester - II

Program: Electronics & Communication Engineering		Semester: II
Course Title: Engineering Chemistry		Course Code: 22ECHB102
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

1. **Chemical Bonding**

   Introduction, Ionic bond, factors influencing the formation of Ionic bond: Ionization energy. Electron affinity & electro negativity and properties of Ionic compounds. Covalent bond: Valence Bond theory & Molecular Orbital theory – formation of hydrogen molecule, factors influencing the formation of covalent bond, polar and non-polar covalent bond, dipole moment, problems on calculation of percentage of Ionic character and properties of covalent compounds, Co-ordinate bond: formation of hydronium ion and ammonium ion.

2. **Electrochemical Energy Systems**

   Electrode potential, Nernst equation, formation of a cell; Reference electrodes – Calomel electrode, Determination of electrode potential, numerical problems on E, E_{cell}& E^0_{cell}.

   Batteries: Classification, Characteristics, Lead - acid, Lithium ion battery. Fuel cells - Methonol-O_2 fuel cell.

3. **Polymers**

   Introduction, polymerization; mechanism of polymerization taking ethylene as an example. Determination of molecular weight of a polymer – numerical problems. Commercial polymers - Plexi glass, PS, polyurethane.

   Polymer composites: Carbon fiber and Epoxy resin – synthesis, properties and applications. Introduction to conducting polymers, mechanism of conduction in poly acetylene and applications.

Unit II

4. **Plating Techniques:** Introduction, technological importance. Electroplating, Principles of electroplating. Factors affecting nature of electrodeposit, throwing power, Numerical problems on throwing power, Electroplating process of gold by acid cyanide bath. Electro less plating, advantages of electro less plating over electroplating. Electro less plating of Cu and its application in the manufacture of PCB.
5. **Wafer Technology:** Introduction, physical and chemical properties of silicon. Purification of silicon; chemical vapor deposition (CVD) process, zone refining process. Crystal growth; preparation of single crystal silicon by Czhochralski crystal pulling technique – numerical problems. Crystal slicing and wafer preparation. Fabrication process: thermal oxidation, diffusion, ion implantation – numerical problems, epitaxial growth, masking and photolithography, wet etching, dry etching.
6. **Material Chemistry:** Liquid Crystals – Types of liquid crystals, applications of Liquid Crystal in Display system. Fluorescence and Phosphorescence – Jablonski diagram, Thermoelectric and Piezoelectric materials – meaning, properties and applications.

Unit III

7. Instrumental methods of measurement

Advantages over conventional methods. Electro analytical methods: Potentiometer - principle, methodology and applications. Opt analytical methods: Colorimeter - Principle, methodology and applications.
Spectral methods of analysis: UV – Spectrophotometer - Instrumentation and applications.

8. Environmental Chemistry:

Water: Sources and ill effects of water pollutants – fluoride and nitrate; determination of total hardness of water by EDTA method – numerical problems., Sewage: Determination of Biological Oxygen Demand by Winkler's method – numerical problems and determination of Chemical Oxygen Demand – numerical problems.

Text Books

1. A text Book of Engineering Chemistry, 1st edition, Dara. S. S, S. Chand & Co. Ltd., 2009, New Delhi.
2. A text Book of Engineering Chemistry, 16th edition, Jain P.C and Jain M, Dhanpat Rai Publications, 2006, New Delhi.

Reference Books:

1. Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand, 1999, New Delhi.
2. Hand book of batteries, David Linden, Thomas B Reddy, 3rd edition Mc Graw Hill publications, 2001, New York.
3. Polymer Science, 6th Edition, Gowariker V.R., Viswanathan N.V., Sreedhar J., New Age International (P) Ltd, 2007, New Delhi.
4. Solid State Devices& Technology, 4thEdition, V. Suresh Babu, sanguine Technical Publishers, 2005, Bangalore.
5. Material Science & Engineering: An Introduction, 9th Edition, Calister William D, John Wiley and sons, 2007, New York.
6. Instrumental methods of Chemical analysis, 5th Edition, Gurudeep R Chatwal, Shan K Anand, Himalaya Publishing House Pvt. Ltd, 2010, Mumbai.
7. VLSI Technology, 2nd Edition, S.M.Sze, McGraw Hill Series in electrical and computer engineering, 1998, New York.

Back to Semester - II

Program: Electronics & Communication Engineering		Semester: II
Course Title: Problem Solving with Data Structures		Course Code: 18ECSP102
L-T-P: 0-0-3	Credits: 3	Contact Hours: 6 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: 78Hrs	Examination Duration: 3 Hrs	

Pointers, Structures and Files

Recap of basics: Pointers ,Structures; Self-referential structures, dynamic memory management Files – File manipulation programs

Stacks and Recursion

Stack: Definition, Operations, Stack ADT Implementation of stack operations. Applications of stack. Recursion-

Need for Recursion and problems on Recursion.

Queues

Queue: Definitions of Linear, Circular queues, Queue ADT Linear and circular queue operations Definition and working of Priority queue, Double ended queue; Applications of queues.

Lists

Concept of lists and dynamic memory management lists, definitions and representations: singly, doubly, circular lists. Dynamic Implementation of lists and its operations, Applications of linked lists

Binary trees

Binary Tree: Definition, Terminology and representation, Tree Traversals both recursive and iterative. Binary Search Tree and its applications.

Text Books

1. Data Structures with C -- Seymour Lipschutz, Schaum's Outline Series
2. Data Structures Using C and C++ -- Langsam and Tanenbaum, PHI Publication
3. Data Structures Through C -- Yashavant P Kanetkar, BPB Publication

Reference Books:

1. B W Kernighan, D M Ritchie, The Programming Language C, 2ed, PHI, 2004.
2. B S Gottfried, Programming with C, 2ed, TMH, 2006.
3. B.A. Forouzan, R.F. Gilberg, A Structured Program Approach Using C, 3ed, CENGAGE Learning, 2008.

Back to Semester - II

Program: Electronics & Communication Engineering		Semester: II
Course Title: Engineering Exploration		Course Code: 22ECRP101
L-T-P: 0-0-3	Credits: 3	Contact Hours: 6 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: 78Hrs	Examination Duration: 3 Hrs	

List of Experiments

1. Introduction to Engineering and Engineering Study
2. Role of Analysis in Engineering, Analysis Methodology
3. Data Analysis Graphing
4. Basics of Engineering Design, Multidisciplinary Nature of Engineering Design
5. Project Management
6. Sustainability in Engineering
7. Ethics
8. Modeling, Simulation and Data Acquisition using Software Tool
9. Platform based development : Arduino
10. Course Project

Reference Books:

1. Engineering Fundamentals & Problem Solving by Arvid Eide, Roland Jenison, Larry Northup, Steven, McGraw Hill Higher Education, 6th Edition (2011)
2. Engineering Exploration (Edited Book, 2008) by Pearson Publication

Back to Semester - II

Program: Electronics & Communication Engineering		Semester: II
Course Title: Basic Electronics		Course Code: 18EECF101
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter 1: Trends in Electronic Industries:

Introduction, Roadmap of electronic sector, scope and opportunities in various segments of electronics (i.e., Consumer, Telecom, IT, Defense, Industrial, Medical and Automobiles), Government and private sectors, Growth profile of Electronic industries, Standards and Polis's, Electronic System Components.

Chapter 2: Basic Components, Devices and Applications:

Diode: PN junction characteristics; modeling as a circuit element, ideal and practical diode. AC to DC converter: Half wave and full wave rectifier (centre tap and bridge), capacitor filter and its analysis, numerical examples. Zener diode and its applications (Voltage reference and voltage regulator). Realization of simple logic gates like AND OR gates.

Chapter 3: Transistor:

BJT, transistor voltages and currents, Signal amplifier (Fixed bias, Collector base bias, Voltage divider bias, CE configuration). DC load line. Voltage, current and power gains. Transistor as a switch: NOT Gate, Basic (DTL) NAND gate. Transistor as a Small Signal Amplifier (Single Stage and Two Stage RC-coupled Amplifiers).

Unit II

Chapter 4: Digital Logic:

Number systems: Decimal, Binary, Octal and Hexadecimal number systems, Conversions, Binary Operations-Addition and subtraction in binary number systems. Logic gates: Realization of simple logic functions using basic gates (AND, OR, NOT), Realization using universal gates (NAND, NOR). Boolean algebra: Theorems and postulates, DeMorgan'sTheorems, simplification of logical expressions, Karnaugh Maps, Use of Karnaugh Maps to Minimize Boolean Expressions (2 Variables, 3 Variables and 4 Variables), Design of Half Adder and Full Adder, Parallel Adder using full adders.

Chapter 5: Operational Amplifier:

OPAMP characteristics (ideal and practical), Linear and non-linear applications: Inverting amplifier, Non inverting amplifier, Voltage follower, Integration, Differentiation, Adder, Subtractor, ZCD and Comparator.

Unit III

Chapter 6: Communication Systems:

Basic block diagram of communication system, types of modulation. Amplitude modulation: Time-Domain description, Frequency-Domain description. Generation of AM wave: square law modulator. Detection of AM waves: envelope detector. Double side band suppressed carrier modulation (DSBSC), Generation of DSBSC wave: balanced modulator, Super heterodyne principle.

Chapter 7: Linear Power Supply, UPS & CRO:

Working principle of linear power supply, UPS and CRO. Measurement of amplitude, frequency and phase of a given signal.

Text Books

1. David A Bell, Electronic devices and Circuits, PHI New Delhi, 2004
2. K. A Krishnamurthy and M.R. Raghuveer, Electrical, Electronics and Computer Engineering for SISAntist and Engineers, 2, New Age International Publishers, 2001
3. A.P. Malvino, Electronic Principles, Tata McGraw Hill, 1999

Reference Books:

1. George Kennedy, Electronic Communication Systems, Tata McGraw Hill, 2000
2. Morris Mano, Digital logic and Computer design, 21st Indian print Prentice Hall India, 2000
3. Floyd, Digital fundamentals, 3, Prentice Hall India, 2001
4. Boylestead Nashelsky, Electronic devices & Circuit theory, Prentice Hall India, 2000
5. Ramakant Gaikawad, Operational Amplifiers & applications, PHI, 2000

Back to Semester - II

Program: Electronics & Communication Engineering		Semester: II
Course Title: Basic Mechanical Engineering		Course Code: 22EECF101
L-T-P: 0-0-3	Credits: 3	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter 1: Introduction to Mechanical Engineering:

Definition of engineering, Mechanical Engineering, Branches of Mechanical Engineering, who are Mechanical Engineers? Mechanical Engineers' top ten achievements. Visit to Workshop and Machine Shop, Tools, Safety Precautions Video presentations

Chapter 2: Manufacturing Engineering: Basics of Manufacturing

What is manufacturing? The main manufacturing sectors, The importance of the main manufacturing sectors to the Indian economy, Scales of production Classification of manufacturing Processes. Advances in Manufacturing: CNC machines, Mechatronics and applications Demonstration on working of Lathe, milling, drilling, grinding machines Demonstration on Welding (Electric Arc Welding, Gas Welding, Soldering) Demonstration and Exercises on Sheet metal work.

Visit to Learning Factory

Unit II

Chapter 3: Design Engineering: Power Transmission Elements

Overview

Design Application:

- Belt Drives. Types, Length of Belt. Velocity Ratio, Initial Tension. Ratio of Tensions. Power Transmitted, Numerical Problems.
- Gears. Spur Gear, Rack and Pinion, Worm Gear, Bevel Gear, Helical Gears. Speed, Torque, and Power in Gear pair. Simple and Compound Gear trains. Numerical Problems.
- Ball and Roller Bearings, Types, Applications.

Design Problems like a moving experience, aluminium can crusher Video presentations

Chapter 4: Thermal Engineering 1: Prime Movers.

Internal Combustion Engines: Classification, IC engine parts, 2 stroke SI and CI engine, 4 Stroke SI and CI Engine, PV diagrams of Otto and Diesel cycles, Comparison of 2 stroke and 4 stroke engine, comparison of CI and SI engine, Problems on Engine Performance, Future trends in IC engines. Case study on power requirement of a bike, car or any machine Video presentations.

Unit III

Chapter 5: Thermal Engineering 2: Thermal Systems' Applications

Refrigeration system, Air conditioning system, Pumps, Blowers and Compressors, Turbines, and their working principle and specifications.

Case study on selection of various thermal systems

Video presentations

Text Books

1. Jonathan Wickert and Kemper Lewis, An Introduction to Mechanical Engineering, Third Edition, 2013-Cengage Learning.
2. K.R. Gopalkrishna, Sudhir Gopalkrishna, S.C. Sharma. A Text Book of Elements of Mechanical Engineering, 30th Edition, Oct 2010,–Subhash Publishers, Bangalore.

Reference Books:

1. Course Material developed by the Department of Mechanical Engineering.
2. SKH Chowdhary, AKH Chowdhary, Nirjhar Roy, The Elements of Workshop Technology - Vol I & II, 11th edition 2001, Media Promoters and Publishers.
   Basic Manufacturing, Roger Timings, Third edition, Newnes, An imprint of Elsevier

Back to Semester - II

Program: Electronics & Communication Engineering		Semester: II
Course Title: Professional Communication		Course Code: 15EHSH101
L-T-P: 1-1-0	Credits: 2	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 42Hrs	Examination Duration: 3 Hrs	

List of Experiments

Chapter No. 1. Basics- English Communication

Course Introduction, Explanation of template mix-ups with correct usages & necessity of grammar in error detection, Usage of tenses

Chapter No. 2. Vocabulary and grammar

Vocabulary, Word Formation and Active and Passive Voice

Chapter No. 3. Bouncing Practice

Definition and types of bouncing and its practice with examples, reading skills, free style speech.Individual presentation.

Chapter No. 4. Rephrasing and Structures

Comprehension and Rephrasing, PNQ Paradigm and Structural practice.

Chapter No. 5. Dialogues

Introduction of dialogues, Situational Role plays.

Chapter No. 6. Business Communication

Covering letter, formal letters, Construction of paragraphs on any given general topic.

Reference Books:

1. Collins Cobuild Advanced Learner's English Dictionary
2. Raymond Murphy - Intermediate English Grammar, Cambridge University Press
3. Martin Hewings- Advanced English Grammar, Cambridge University Press.

Back to Semester - II

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: III Semester
Course Title: Integral transforms and Statistics		Course Code:15EMAB203
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration:3 Hrs	

Unit I

Chapter 1. Laplace Transforms

Definition, transforms of elementary functions- transforms of derivatives and integrals- Properties. Periodic functions, Unit step functions and Unit impulse functions.

Inverse Transforms- properties- Convolution Theorem. Initial and Final value theorems, examples; Applications to differential equations, Circuit equations

Chapter 2: Probability

Definition of probability, conditional probability, Baye's rule, Chebyshev's inequality, random variables- PDF-CDF- Probability Distributions: Binomial, Poisson, Exponential, Uniform, and Normal.

Unit II

Chapter 3: Regression

Introduction to method of least squares, fitting of curves=a+bx, $y = ab^x$, correlation and regression. Engineering problems.

Chapter 4: Fourier Series

Complex Sinusoids, Fourier series representations of four classes of signals, Periodic Signals: Fourier Series representations, Derivation of Complex Co-efficient of Exponential Fourier Series and Examples. Convergence of Fourier Series. Amplitude and phase spectra of a periodic signal. Properties of Fourier Series (with proof): Linearity, Symmetry Properties, Time shift, Frequency Shift, Scaling, Time differential differentiation coefficients, Time domain Convolution, Multiplication Theorem, Parseval's theorem and Examples on these properties.

Chapter 6: Fourier Transform

Fourier representation of non-periodic signals, Magnitude and phase spectra. Properties of Fourier Transform: Linearity, Symmetry Properties, Time shift, Frequency Shift, Scaling, Time differential differentiation coefficients, Time domain Convolution, Multiplication Theorem, Parseval's theorem and Examples on these properties.

Unit III

Chapter 6: Random Process:

Introduction to Joint Probability Distributions, marginal distribution, joint pdf and cdf, mean, variance, covariance, correlation.

Introduction to Random process, stationary process, mean, correlation and covariance function, autocorrelation function, cross correlation, Power spectral Density: properties of the spectral density; Gaussian Process: Properties of Gaussian process.

Text Books

1. Kreyszig E., Advanced Engineering Mathematics, 10th edition, Wiley, 2015
2. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons, 2018
3. Walpole and Myers, Probability and Statistics for Engineers and Scientists, 9th edition, Pearson Education India,2013.

Reference Books:

1. Simon Haykin, Barry Van Veen, Signals and Systems Wiley; Second edition ,2007
2. J. Susan Milton, Jesse C. Arnold, Introduction to Probability and Statistics: Principles and
3. Applications for Engineering and the Computing Sciences, 4th edition, TATA McGraw-Hill Edition, 2017
4. Ian Glover & Peter Grant, Digital Communications, 3rd edition, Pearson 2009.

Back to Semester- III

Program: Electronics & Communication Engineering		Semester: III
Course Title: Corporate Communication		Course Code: 22EHSH201
L-T-P: 0.5-0-0	Credits: 0.5	Contact Hours: 1 hrs/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hours: 16Hrs	Examination Duration: 3 Hrs	

Chapter No. 1. Communication Skills

Tools of Communication, Listening, Body Language, Common Postures and Gestures, Open and Closed Body Language, Body Language to be used in Corporate Scenarios, Voice: Pitch, Pace, and Pause, Verbal Language: Positive & Negative Vocabulary, Corporate Conversations

Chapter No. 2. Presentation Skills

Zero Presentation, Individual Presentations, and feedback, Making Presentations Interactive, Types of Questions, Taking off and Signing off differently, Captivating your Audience, Corporate Presentations

Chapter No. 3. Spoken English

Phonetic and Non-Phonetic Languages, Introduction to IPA, Sounds in English, Syllables, Word Stress, Rhythm, Pausing, and Intonation

Chapter No. 4. Written English

Vocabulary Enhancement Strategies, Root Words in English, Grammar Improvement Techniques, Dictionary Usage, Similar and Contradictory Words

Reference Books:

1. Diana Booher - Communicate with Confidence, Mc Graw Hill Publishers
2. Norman Lewis – Word Power Made Easy, Goyal Publishers
3. Cambridge Advanced Learner's Dictionary, Cambridge University Press.

Back to Semester- III

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: III Semester**
Course Title: Circuit Analysis		**Course Code: 22EECC201**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50Hrs	**Examination Duration:3 Hrs**	

Unit I

Chapter 1: Basics

Active and passive circuit elements, Voltage & current sources, Resistive networks, Nodal Analysis, Super node, Mesh Analysis, Super mesh, Star – Delta Transformation.
[Text 1: Chapter 4,5, 7]

Chapter 2: Network Theorems

Homogeneity, Superposition and Linearity, Thevenin's 's& Norton 's Theorems, Maximum Power Transfer Theorem, Miller 's theorem, Reciprocity principle.
[Text 1: Chapter 5]

Chapter 3: Network topologies

Graph of a network, Concept of tree and co-tree, incidence matrix, tie set and cut set schedules, Formulation of Equilibrium equations in matrix form, Solution of resistive networks.
[Text 1: Chapter 5]

Unit II

Chapter 4: Two Port Networks

Two port variables, Z, Y, H, G, A- Parameter representations, Input and output impedance calculation, Series, Parallel and Cascade network connections, and their (suitable) models.
[Text 2: Chapter 11]

Chapter 5: Time and Frequency Domain Representation of Circuits

Order of a system, Concept of Time constant, System Governing equation, System Characteristic equation, Initial conditions, Transfer Functions (Fourier and Laplace domain representation)
[Text 2: Chapter 4]

Chapter 6: First order circuits

Transient response of R-C and R-L networks (with Initial conditions) Concept of phasor, Phasor diagrams, Frequency response characteristics, Polar Plots-C, R-L circuits as differentiator and integrator models, time and frequency domain responses R-C, R-L circuits as Low pass and high pass filters[Text 2: Chapter 5, Text 1: Chapter 8,9,10]

Unit III

Chapter No. 7. Higher order circuits

Higher order R-C, R-L, and R-L-C networks, time domain and frequency domain representation, Series R-L-C circuit, Transient response, damping factor, Performance parameters, Quality factor, Frequency response curve, peaking of frequency curve and its relation to damping factor. Series and Parallel Resonance, Quality factor, Selectivity and Bandwidth

[Text 2: Chapter 7,8] [Text 1: Chapter 4,5, 7]

Text Books

1. W H Hayt, J E Kemmerly, S M Durban, "Engineering Circuit Analysis" McGraw Hill Education; Eighth edition ,2013
2. M E. Van Valkenburg, Network Analysis, Third edition Pearson Education, 2019

Reference Books:

1. Joseph Edminister, Mahmood Nahavi, Electric Circuits, 5th edition, McGraw Hill Education, 2017
2. V. K. Aatre, —Network Theory and Filter Design,3rd edition, New Age International Private Limited,2014

Back to Semester- III

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: III Semester
Course Title: Analog Electronic Circuits		Course Code:22EECC202
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration:3 Hrs	

Unit I

Chapter 1: Diode Models and Circuits

Recap of diode models: Exponential model, piece-wise linear model, constant voltage drop model, ideal diode model, small signal diode model and derivation of small signal diode resistance. Applications of diodes as a Clipping and clamping circuits with and without DC bias voltage; Voltage doublers Numericals on applications.
(T1: 2.2, 2.3.1 to 2.3.8, 2.6.1to 2.6.3.)

Chapter 2: Bipolar junction transistors

Recap of DC load line and bias point, small signal operation-the transfer characteristics, the amplifier gain, and operation as a switch. Biasing of BJT: voltage divider, small signal models of bipolar transistors, two port modelling of amplifiers, H-model, ac analysis of BJT circuits-coupling and bypass capacitor, Common emitter circuit analysis without RE resistance (Emitter resistor) Numericals on amplifiers and switch
(T1: 3.2.1,3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.3.2, 3.3.4)

Chapter 3: MOSFETs structure and physical operation

MOSFET Device structure, NMOS :Depletion type ; operation with no gate voltage, positive and negative gate voltage and Enhancement type ; operation with no gate voltage, positive and negative gate voltage creating a channel for current flow, applying small vds, operation as vds is increased, Derivation of threshold voltage of MOSFET, Operating the MOS transistor in the sub threshold region, Pinch off effect , channel length modulation effect , derivation of the ID-VDS relationship, with and without channel length modulation. Finite output resistance (rds on) in saturation, PMOS: Drain and Transfer characteristics, circuit symbol, the ID v/s VDS characteristics, and the role of the substrate-the body effect, temperature effects, breakdown and input protection. Threshold Voltage Derivation MOSFET circuits at DC.

Unit II

Chapter 4: Biasing of MOSFETs

MOSFET circuits at DC continued. Biasing in MOS amplifier circuits: By fixing VGS; By fixing VG; With drain to gate feedback resistor; Constant current source biasing, MOSFET as a switch Large – signal operation, operation as a linear amplifier and Numericals.
(T1:4.3)

Chapter 5: MOSFET amplifiers

Small signal operation and models, single stage MOS amplifiers, the MOSFET internal capacitance, Derivation of CS, CG and CD amplifiers parameters and its comparison, Implications on gain and Bandwidth. Source degenerated common source amplifier, cascode and cascaded circuits High frequency model of the MOSFET, revision of common-gate, common- source, common-drain circuits; poles and zeros in the transfer function (T1:4.4,4.5, 4.6.1 to 4.6.7, 4.7.1, 4.7.2, 4.7.3, 4.7.5, 4.7.6, 4.7.7;4.8.1,4.8.2, 4.8.3,4.8.4, 4.9.1 to 4.9.3)

Unit III

Chapter 6: Feedback Amplifiers

General feedback structure (Block schematic), Feedback desensitivity factor, positive and negative feedback Nyquist stability Criterion, RC phase shift oscillator, Wein bridge Oscar, merits of negative feedback, feedback topologies: series-shunt feedback amplifier, series-series feedback amplifier, and shunt-shunt and shunt-series feedback amplifier with examples

(T1:7.1 to 7.6)

Chapter 7: Large Signal Amplifiers

Classification of amplifiers: (A, B, AB and C); Transformer coupled amplifier, push-pull amplifier Transistor case and heat sink.

(T1:12.1 to 12.6;12.8.4)

Text Books

1. A.S. Sedra& K.C. Smith, "Microelectronic Circuits",7th edition, Oxford University Press, 2017

Reference Books:

1. Jacob Millman and Christos Halkias-Integrated Electronics "McGraw Hill Education, 2nd edition 2017
2. David A. Bell,-Electronic Devices and Circuits, Oxford Fifth edition 2008
3. Grey, Hurst, Lewis and Meyer,-Analysis and design of analog integrated circuits, Wiley,5th edition 2009
4. Thomas L. Floyd,-Electronic devices, Pearson, 10th edition, 2018
5. Richard R. Spencer & Mohammed S. Ghousi, — Introduction to Electronic Circuit Design‖, Pearson Education,2003
6. J. Millman& A. Grabel, "Microelectronics"-2nd edition, McGraw Hill,2017
7. Behzad Razavi,-Fundamentals of Microelectronics, 2nd edition Wiley;2013

Back to Semester- III

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: III Semester**
Course Title: Digital Circuits		**Course Code: 19EECC201**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50Hrs	**Examination Duration:3 Hrs**	

Unit I

Chapter 1: Logic Families

Logic levels, output switching times, fan-in and fan-out, comparison of logic families

Chapter 2: Principles of Combinational Logic

Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4 variables, incompletely specified functions (Don ‘t care terms), Simplifying Maxterm equations, Quine-McCluskey minimization technique- Quine-McCluskey using don ‘t care terms, Reduced Prime Implicant Tables.

Chapter 3: Analysis and design of combinational logic

General approach, Decoders-BCD decoders, Encoders, Digital multiplexers- Using multiplexers as Boolean function generators. Adders and subtractor-Cascading full adders, look ahead carry adders, Binary comparators.

Unit II

Chapter 4: Introduction to Sequential Circuits

Basic Bistable Element, Latches, A SR Latch, Application of SR Latch, A Switch De bouncer, The SR Latch, the gated SR Latch, the gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip-Flop, Edge Triggered Flip- Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop; Characteristic Equations

Chapter 5: Analysis of Sequential Circuits

Registers and Counters, Binary Ripple Counters, Synchronous Binary counters, Ring and Johnson Counters, Design of a Synchronous counters, Design of a Synchronous Mod-n Counter using clocked JK Flip-Flops Design of a Synchronous Mod-n Counter using clocked D, T or SR Flip-Flops.

Unit III

Chapter No. 6. Sequential Circuit Design

Introduction to Sequential Circuit Design, Mealy and Moore Models, State Machine notations, Synchronous Sequential Circuit Analysis, Construction of state Diagrams and counter design.

Chapter No. 7. Introduction to memories

Introduction and role of memory in a computer system, memory types and terminology, Read Only memory, MROM, PROM, EPROM, EEPROM, Random access memory, SRAM, DRAM, NVRAM.

Text Books

1. Donald D Givone, Digital Principles and Design, McGraw Hill Education ,2017
2. John M Yarbrough, Digital Logic Applications and Design,1st edition Cengage Learning,2006
3. A AnandKumar, Fundamentals of digital circuits 4th Revised edition, PHI ,2016

Reference Books:

1. Charles H Roth, Fundamentals of Logic Design,7th edition, Cengage Learning, 2015
2. ZviKohavi, Switching and Finite Automata Theory Cambridge University Press; 3 edition October 2009
3. R.D. Sudhaker Samuel, Logic Design, Pearson Education ,2010
4. R P Jain, Modern Digital Electronics ,4th edition, McGraw Hill Education,2009

Back to Semester- III

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: III Semester
Course Title: Signals and Systems		Course Code:19EECC202
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration:3 Hrs	

Unit I

Chapter 1: Signal Representation: Definition of a signals and systems, classification of signals, (analog and discrete signal, periodic and aperiodic, deterministic and random signals, even and odd signals, energy and power), basic operation on signals (independent variable, dependent variable, time scaling, multiplication, time reversal), elementary signals (Impulse, step, ramp, sinusoidal, complex exponential), Systems Interconnections (series, parallel and cascade), properties of linear systems. (homogeneity, superposition, linearity and time invariance, stability, memory, causality)

Chapter2: LTI System Representation: Impulse response representation and properties, Convolution, convolution sum and convolution integral. Differential and difference equation Representation, Block diagram representation.

Unit II

Chapter 3: Fourier representation for signals: Introduction, Discrete time Fourier series (derivation of series excluded) and their properties. Discrete Fourier transform (derivation of transform excluded) and properties Introduction, frequency response of LTI systems, Fourier transform representation of periodic signals

Chapter 4: Applications of Fourier transform, Fourier transform representation of discrete time signals. Sampling of continuous time signals.

Unit III

Chapter No. 05: Z-transform: Definition of z-transform, Properties of ROC, Properties of Z-transforms: Inverse z-transforms (Partial Fraction method, long division method), Unilateral Z-transform, Transform of LTI.

Text Books:

1. Simon Haykin and Barry Van Veen, Signals and Systems, 2nd edition Wiley,2007
2. Alan V Oppenheim, Alan S Willsky and S. Hamid Nawab, Signals and Systems, Second, PHI public,1997

Reference Books:

1. H. P Hsu, R. Ranjan, Signals and Systems, 2nd edition, McGraw Hill ,2017
2. Ganesh Rao and SatishTunga, SignalsandSystems1st edition, Cengage India, 2017
3. M.J.Roberts, Fundamentals of Signals and Systems 2nd edition, McGraw Hill Education, 2017

Back to Semester- III

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: III Semester
Course Title: Digital Circuits Lab		Course Code:22EECP201
L-T-P: 0-0-1	Credits: 1	Contact Hours: 2Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: --	Examination Duration:	

List of Experiments:

1. Characterization of TTL Gates– Propagation delay, Fan-in, Fan-out and Noise Margin.
2. To verify of Flipflops (a) JK Master Slave (b) T-type and (c)D-Type
3. Design and implement binary to gray, gray to binary, BCD to Ex-3 and Ex-3 to BCD code converters.
4. Design and implement BCD adder and Subtractor using 4 bitparalleladder.
5. Design and implement n bit magnitude comparator using 4- bit comparators.
6. Design and implement Ring and Johnson counter using shift register.
7. Design and implement 8:3 Priority Encoder
8. Design and implement frequency divider
9. Design and implement mod-6 synchronous and asynchronous counters using flip flops.
10. Design and implement given functionality using decoders and multiplexers.
11. Design and implement a digital system to display a 3-bit counter on a 7-segment display. Demonstrate the results on a general purposePCB.

****Note-All above experiments are to be conducted along with simulation.**

***Digital Circuits Lab:* Simulation of combinational and sequential circuits using netlist based Spice Simulators (Avoid using drag n drop), before implementing the circuits on breadboard**

Reference Books:

1. K.A. Krishnamurthy–Digital lab primer||, Pearson Education Asia Publications, 2003.
2. A.P. Malvino, -Electronic Principles 7th edition, McGraw Hill Education,2017

Back to Semester- III

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: III Semester
Course Title: Analog Electronic Circuits Lab		Course Code:22EECP202
L-T-P: 0-0-1	Credits: 1	Contact Hours:2Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: --	Examination Duration:	

List of Experiments:

1. Study of multi-meters, power supplies, function generators, Oscilloscopes; Identification of various components and devices, e.g. resistors, capacitors, diodes, transistors.
2. Design & analyze Diode Clipping circuits.
3. Design & analyze Positive and Negative Clamping circuits.
4. Study of BJT as a Switch.
5. Study the input and output characteristics of MOSFET.
6. To study the basic current mirror circuit.
7. MOSFET as a source follower (Buffer).
8. Study of transformer-less Class B push pull power amplifier and determination of its conversion efficiency
9. Design an amplifier using BJT and determine its gain, input, output impedance and frequency response of RC Coupled single stage BJT amplifier
10. Design an amplifier using MOSFET and determine its gain, input, output impedance and frequency response of a CS amplifier.
11. Design a regulated power supply for the given specifications

****Note: All above experiments are to be conducted along with simulation. *Analog Electronic Circuits Lab: Simulation of designed circuits using LTSpice Simulator, before implementing the circuits on breadboard.**

Reference Books:

1. “Integrated Electronics”, by Jacob Millman and Christos Halkias, McGraw Hill,
2. "Microelectronic Circuits", by A.S. Sedra & K.C. Smith, 7th Edition, Oxford Univ. Press, 2017.
3. “Electronic Devices and Circuits” by David A. Bell, 4thedition, PHI publication 2007.
4. “Analysis and design of analog integrated circuits,” by Grey, Hurst, Lewis and Meyer, 4thedition. Device data sheets.
5. KLETECH Electronics and Communication Engineering Department 2023-24 Analog Electronics Lab manual.

Back to Semester- III

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: III Semester**
Course Title: Microcontroller Architecture & Programming		**Course Code:22EECF202**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4 Hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: 40Hrs	**Examination Duration:Hrs**	

Unit I

Chapter 1: Microprocessors and microcontroller

Introduction, Microprocessors and Microcontrollers, A Microcontroller Survey, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture.

Chapter 2: The 8051 Architecture

8051 Microcontroller Hardware, Input / Output Pins, Ports and Circuits, semiconductor Memories, Interfacing external RAM & ROM memories.

Chapter 3: Addressing Modes and Arithmetic Operations

Addressing modes, External data Moves, Code Memory, Read Only Data Moves / Indexed Addressing mode, Data exchanges, stack concept and related instructions, example programs. Logical Operations: Introduction, Byte level, logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs, Arithmetic Operations: Introduction, Flags, Incrementing and Decrementing, Addition, Subtraction Multiplication and Division, Decimal Arithmetic, Example Programs.

Unit II

Chapter 4: Branch operations

Jump Operations: Introduction, The JUMP and CALL Program range, Jump calls and Subroutines Interrupts and Returns, Example Problems.

Chapter 5: 8051 Programming in 'C'

Data Types and Time delays in 8051C, I/O Programming, Logic operations, Data Conversion programs, Accessing code ROM space, Data serialization.

Chapter 6: Counter/Timer Programming in 8051

Programming 8051 Timers, Programming Timer0 and Timer1 in 8051C

Unit III

Chapter 7: Serial Communication

Basics of Serial Communication, 8051 connections to RS-232,8051 Serial Communication modes, Programming, Serial port programming in C.

Chapter 8: 8051 interfacing and applications

Interfacing 8051 to LCD, Keyboard, ADC, DAC, Stepper Motor, DC Motor.

Chapter 9: Interrupts

Introduction to interrupts, interrupts vs polling, classification of interrupts, interrupt priority, interrupt vector table, interrupt service routine

Text Books

1. "The 8051 Microcontroller Architecture, Programming & Applications" by ' Kenneth J. Ayala', Penram International, 1996
2. "The 8051 Microcontroller and Embedded systems", by ' Muhammad Ali Mazidi and Janice Gillispie Mazidi', Pearson Education, 2003

Reference Books:

1. "Programming and Customizing the 8051 Microcontroller ", by 'Predko', TMH.

Back to Semester- III

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: III Semester
Course Title: C Programming (Diploma)		Course Code:18EECF204
L-T-P: 0-0-2	Credits: 2	Contact Hours: 4 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: 52Hrs	Examination Duration:	

1. Write a C program to perform addition, subtraction, multiplication and division of two numbers.
2. Write a C program to
   i) Identify greater number between two numbers using C program.
   ii) To check a given number is Even or Odd.
3. Write a C program to
   i) To find the roots of a quadratic equation.
   ii) Find the factorial of given number.
4. Write a C program to
   i) To find the sum of n natural numbers.
   ii) Print the sum of 1 + 3 + 5 + 7 ++ n
5. Write a C program to
   i) Print the pattern.

```
*
* *
* * *
* * * *
* * * * *
```

   Ii) Print the pattern.

```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```

6. Write a C program to To test whether the given character is Vowel or not. (using switch case)
7. Write a C program to accept 10 numbers and make the average of the numbers using one dimensional array.
8. Write a C program to Find out square of a number using function.
9. Write a C program to find the summation of three numbers using function.
10. Write a C program to Find out addition of two matrices.

Text Books: Programming in ANSI C, E Balagurusamy.

Back to Semester- III

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: IV Semester**
Course Title: Linear Algebra and Partial Differential Equations		**Course Code:15EMAB208**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50Hrs	**Examination Duration:3 Hrs**	

Unit I

Chapter1: Partial differential equations

Introduction, classification of PDE, Formation of PDE, Solution of equation of the type Pp + Qq = R, Solution of partial differential equation by direct integration methods, method of separation of variables. Modeling: Vibration of string-wave equation, heat equation. Laplace equation. Solution by method of separation ofvariables.

Chapter2: Finite difference method

Finite difference approximations to derivatives, finite difference solution of parabolic PDE, explicit and implicit methods; Hyperbolic PDE-explicit method, Elliptic PDE-initial-boundary Value problems.

Unit II

Chapter 3: Fourier Series

Complex Sinusoids, Fourier series representations of four classes of signals, Periodic Signals: Fourier Series representations, Derivation of Complex Co-efficient of Exponential Fourier Series and Examples. Convergence of Fourier Series. Amplitude and phase spectra of a periodic signal. Properties of Fourier Series (with proof): Linearity, Symmetry Properties, Time shift, Frequency Shift, Scaling, Time differential differentiation coefficients, Time domain Convolution, Multiplication Theorem, Parseval 's theorem and Examples on these properties.

Chapter 4: Fourier Transform

Fourier representation of non-periodic signals, Magnitude and phase spectra. Properties of Fourier Transform: Linearity, Symmetry Properties, Time shift, Frequency Shift, Scaling, Time differential differentiation coefficients, Time domain Convolution, Multiplication Theorem, Parseval's theorem and Examples on these properties.

Unit III

Chapter5: Complex analysis

Function of complex variables. Limits, continuity and differentiability. Analytic functions, C-R equations in Cartesian and polar forms, construction of Analytic functions (Cartesian and polar forms).

Chapter 6: Complex Integration

Line integral, Cauchy's theorem- corollaries, Cauchy's integral formula. Taylor's and Laurent Series, Singularities, Poles, Residue theorem – problems.

Text Books

1. Simon Haykin, Barry Van Veen, Signals and Systems,2nd edition, Wiley,2007
2. Peter V. O'neil, Advanced Engineering Mathematics Cengage Learning Custom Publishing; 7th Revised edition2011
3. DennisGZillandMichaelRCullin," Advanced Engineering Mathematics",4th edition, Narosa Publishing House, NewDelhi,2012

Reference Books:

1. Kreyszig E., Advanced Engineering Mathematics,10th edition, Wiley,2015
2. Stanley J Farlow, Partial differential equations for Scientists and Engineers, Dover publications, INC, New York,1993

Back to Semester- IV

Program: Electronics & Communication Engineering		Semester: IV
Course Title: Problem Solving & Analysis		Course Code: 22EHSH202
L-T-P: 0.5-0-0	Credits: 0.5	Contact Hours: 1 hrs/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hours: 16Hrs	Examination Duration: 3 Hrs	

Chapter No. 1. Analytical Thinking

Analysis of Problems, Puzzles for practice, Human Relations, Direction Tests; Looking for Patterns: Number and Alphabet Series, Coding Decoding; Diagrammatic Solving: Sets and Venn diagram-based puzzles; Visual Reasoning, Clocks and Calendars

Chapter No. 2. Mathematical Thinking

Number System, Factors and Multiples, Using Simple Equations for Problem Solving, Ratio, Proportion, and Variation

Chapter No. 3. Verbal Ability: Problem Solving using Analogies, Sentence Completion

Chapter No. 4. Discussions & Debates

Team efforts in Problem Solving; A Zero Group Discussion, Mock Group Discussions, and Feedback; Discussion v/s Debate; Starting a Group Discussion: Recruitment and other Corporate Scenarios; Evaluation Parameters in a Recruitment Group Discussion, Types of Initiators: Verbal and Thought, Conclusion of a Discussion

Reference Books:

1. R. S. Aggarwal, “A Modern Approach to Verbal and Non – Verbal Reasoning”, Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, “Quantitative Aptitude”, Sultan Chand and Sons, New Delhi, 2018
3. Chopra, “Verbal and Non – Verbal Reasoning”, MacMillan India
4. M Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. Diana Booher - Communicate with Confidence, Mc Graw Hill Publishers
6. Norman Lewis–Word Power Made Easy, Goyal Publishers
7. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.
8. Kaplan’s GRE guide

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: IV Semester
Course Title: Electromagnetic Fields and Waves		Course Code:23EECC209
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40Hrs	Examination Duration:3 Hrs	

Unit I

Chapter 1: Electrostatic Fields

Introduction, Coulomb's Law and Field Intensity, Electric Fields Due to Continuous Charge Distribution, Electric Flux Density, Gauss's Law – Maxwell's Equation, Application of Gauss's Law, Electric Potential, Relationship between E and V – Maxwell's Equation, An Electric Dipole and Flux Lines, Energy Density in Electrostatic Fields.

Chapter 2: Electric Fields in Material Space

Introduction, Properties of materials, Convection and Conduction Currents, Conductors, Polarization in Dielectrics, Dielectric Constant and strength, Continuity Equation and Relaxation Time, Boundary Conditions.

Chapter 3: Electrostatic Boundary-Value Problems

Introduction, Poisson's and Laplace's Equations, Uniqueness Theorem, General Procedure for Solving Poisson's or Laplace's Equation, Resistance and Capacitance, Method of Images.

Unit II

Chapter 4: Magnetostatic Fields

Introduction, Biot-Savart's Law, Ampere's Circuit Law—Maxwell's Equation, Applications of Ampere's Law, Magnetic Flux Density—Maxwell's Equation, Maxwell's Equations for Static EM Fields, Magnetic Scalar and Vector Potentials, Derivation of Biot-Savart's Law and Ampere's Law.

Chapter 5: Magnetic Forces, Materials and Devices

Introduction, Forces due to Magnetic Fields, Magnetic Torque and Moment, A Magnetic Dipole, Magnetization in Materials, Classification of Magnetic Materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits, Force on

Magnetic Materials

Chapter 6: Maxwell's Equations

Introduction, Faraday's Law, Transformer and Motional Electromotive Forces, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields.

Unit III

Chapter 7: Electromagnetic Wave Propagation

Introduction, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector, Reflection of a Plane Wave at Normal Incidence, Reflection of a Plane Wave at Oblique Incidence.

Text Books

1. Mathew N. O. Sadiku, Elements of Electromagnetics, 4th Edition, Oxford University Press, 2007
2. William Hayt, Jr. John A. Buck, Engineering Electromagnetics, 8th edition, TMH, 2012
3. Kraus, John D. Electromagnetics. United Kingdom, McGraw-Hill, 1992.

Back to Semester- IV

Program: Electronics & Communication Engineering		Semester: IV
Course Title: Problem Solving & Analysis		Course Code: 22EHSH202
L-T-P: 0.5-0-0	Credits: 0.5	Contact Hours: 1 hrs/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hours: 16Hrs	Examination Duration: 3 Hrs	

Chapter No. 1. Analytical Thinking: Analysis of Problems, Puzzles for practice, Human Relations, Direction Tests; Looking for Patterns: Number and Alphabet Series, Coding Decoding; Diagrammatic Solving: Sets and Venn diagram-based puzzles; Visual Reasoning, Clocks and Calendars

Chapter No. 2. Mathematical Thinking: Number System, Factors and Multiples, Using Simple Equations for Problem Solving, Ratio, Proportion, and Variation

Chapter No. 3. Verbal Ability: Problem Solving using Analogies, Sentence Completion

Chapter No. 4. Discussions & Debates: Team efforts in Problem Solving; A Zero Group Discussion, Mock Group Discussions, and Feedback; Discussion v/s Debate; Starting a Group Discussion: Recruitment and other Corporate Scenarios; Evaluation Parameters in a Recruitment Group Discussion, Types of Initiators: Verbal and Thought, Conclusion of a Discussion

Reference Books:

1. R. S. Aggarwal, “A Modern Approach to Verbal and Non – Verbal Reasoning”, Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, “Quantitative Aptitude”, Sultan Chand and Sons, New Delhi, 2018
3. Chopra, “Verbal and Non – Verbal Reasoning”, MacMillan India
4. M Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. Diana Booher - Communicate with Confidence, Mc Graw Hill Publishers
6. Norman Lewis–Word Power Made Easy, Goyal Publishers
7. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.
8. Kaplan’s GRE guide

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: IV Semester
Course Title: Electromagnetic Fields and Waves		Course Code:23EECC209
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40Hrs	Examination Duration:3 Hrs	

Unit I

Chapter 1: Electrostatic Fields

Introduction, Coulomb's Law and Field Intensity, Electric Fields Due to Continuous Charge Distribution, Electric Flux Density, Gauss's Law – Maxwell's Equation, Application of Gauss's Law, Electric Potential, Relationship between E and V – Maxwell's Equation, An Electric Dipole and Flux Lines, Energy Density in Electrostatic Fields.

Chapter 2: Electric Fields in Material Space

Introduction, Properties of materials, Convection and Conduction Currents, Conductors, Polarization in Dielectrics, Dielectric Constant and strength, Continuity Equation and Relaxation Time, Boundary Conditions.

Chapter 3: Electrostatic Boundary-Value Problems

Introduction, Poisson's and Laplace's Equations, Uniqueness Theorem, General Procedure for Solving Poisson's or Laplace's Equation, Resistance and Capacitance, Method of Images.

Unit II

Chapter 4: Magnetostatic Fields

Introduction, Biot-Savart's Law, Ampere's Circuit Law—Maxwell's Equation, Applications of Ampere's Law, Magnetic Flux Density—Maxwell's Equation, Maxwell's Equations for Static EM Fields, Magnetic Scalar and Vector Potentials, Derivation of Biot-Savart's Law and Ampere's Law.

Chapter 5: Magnetic Forces, Materials and Devices

Introduction, Forces due to Magnetic Fields, Magnetic Torque and Moment, A Magnetic Dipole, Magnetization in Materials, Classification of Magnetic Materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits, Force on

Magnetic Materials

Chapter 6: Maxwell's Equations

Introduction, Faraday's Law, Transformer and Motional Electromotive Forces, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields.

Unit III

Chapter 7: Electromagnetic Wave Propagation

Introduction, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector, Reflection of a Plane Wave at Normal Incidence, Reflection of a Plane Wave at Oblique Incidence.

Text Books

1. Mathew N. O. Sadiku, Elements of Electromagnetics, 4th Edition, Oxford University Press, 2007
2. William Hayt, Jr. John A. Buck, Engineering Electromagnetics, 8th edition, TMH, 2012
3. Kraus, John D. Electromagnetics. United Kingdom, McGraw-Hill, 1992.

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: IV Semester
Course Title: Linear Integrated Circuits		Course Code:19EECC203
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40Hrs	Examination Duration:3 Hrs	

Unit I

Chapter 1: Current Mirrors

Current Mirror circuits and Modeling, Figures of merit (output impedance, voltage swing), Widlar, Cascode and Wilson current Mirrors, Current source and current sink.

Chapter 2: Basic Op-Amp architecture

Basic differential amplifier, Common mode and difference mode gain, CMRR, 5-pack differential amplifier with design, 7-pack operational amplifier.

Chapter 3: Op-Amp characteristics

Ideal and non-ideal Op-Amp terminal characteristics, Input and output impedance, output Offset voltage, Small signal and Large signal bandwidth

Unit II

Chapter 4: Op-Amp with Feedback

Op-Amp under Positive and Negative feedback, Impact Negative feedback on Bandwidth, Input and Output impedances, Offset voltage under negative feedback, Follower property & Inversion Property under linear mode operation.

Chapter 5: Linear applications of Op-Amp

DC and AC Amplifier, Summing, Scaling and Averaging amplifiers (Inverting, Non-inverting and Differential configuration), Instrumentation Amplifier, Integrator, Differentiator, Voltage sources, current sources and current sinks, Active Filters –First and second order Low pass & High pass filters. V to I and I to V converters.

Unit III

Chapter 6: Nonlinear applications of Op-Amp

Crossing detectors (ZCD. Comparator), Inverting Schmitt trigger circuits, Triangular/rectangular wave generators, Waveform generator, Voltage controlled Oscillator, sample and hold circuits, Phase shift oscillator, Wein bridge oscillator.

Data Converters: Digital to Analog Converters: Weighted resistor; R -2R, Current steering DAC, Pipeline. Analog to Digital Converters: Flash, Dual slope, Pipeline and SAR.

Text Books

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits McGraw-Hill, 2nd edition, 2016
2. Phillip E. Allen, Douglas R. Holberg, CMOS Analog Circuit Design, Oxford University Press, USA, 2010
3. Ramakant A. Gayakwad, Op - Amps and Linear Integrated Circuits, 4th Edition
4.

Reference Books:

1. A.S. Sedra & K.C. Smith, Microelectronic Circuits, 7th Edition, 2017
2. Design with Operational Amplifiers and Analog Integrated Circuits, Sergio Franco, 4th edition, Tata McGraw Hill 2014
3. David A. Bell, Operational Amplifiers and Linear IC's, 3rd ed., Oxford University Press, 2011
4. B. Razavi, Fundamentals of Microelectronics, 2nd edition.

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: IV Semester**
Course Title: Control Systems		**Course Code:23EECC206**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40Hrs	**Examination Duration:3 Hrs**	

Unit I

Chapter No. 1. Control System Representation

Concepts of Control Systems- Open Loop and Closed Loop Control Systems, Feedback characteristics, Examples, System representation: Differential Equations, Transfer function, Impulse response, System Modeling: Electrical Mechanical, Rotational Mechanical Systems.

Chapter No. 2. Block Diagram and Signal Flow Graphs

Transfer Functions, Block Diagram Algebra and Representation by Signal Flow Graph - Reduction Using Mason's Gain Formula.

Chapter No. 3. Time Response Analysis

Standard Test Signals (impulse, step, ramp, parabola)-Order and Type of System, Time Response of First Order Systems – Characteristic Equation of Feedback Control Systems, Transient Response of Second Order Systems - Time Domain Specifications – Steady State Response - Steady State Errors and Error Constants – Effects of Proportional Derivative, Proportional Integral Systems

Unit II

Chapter No. 4. Stability Analysis in S-Domain

The Concept of Stability (BIBO, all system poles on LHS, Impulse response is convergent, Marginal stability-necessary conditions) – Routh's Stability Criterion – Limitations of Routh's Stability Criterion (Applications only). Root Locus Technique: The Root Locus Concept - Construction of Root Loci.

Chapter No. 5. Frequency Response Analysis

Introduction, Bode Diagrams-Determination Of Frequency Domain Specifications And Transfer Function From The Bode Diagram-Phase Margin And Gain Margin-Stability Analysis From Bode Plots.

Unit III

Chapter No. 4. Stability Analysis in S-Domain

The Concept of Stability (BIBO, all system poles on LHS, Impulse response is convergent, Marginal stability-necessary conditions) – Routh's Stability Criterion – Limitations of Routh's Stability Criterion (Applications only). Root Locus Technique: The Root Locus Concept - Construction of Root Loci.

Chapter No. 5. Frequency Response Analysis

Introduction, Bode Diagrams-Determination of Frequency Domain Specifications and Transfer Function from The Bode Diagram-Phase Margin and Gain Margin-Stability Analysis from Bode Plots.

Text Books

1. J. Nagrath and M. Gopal, Control Systems Engineering; Sixth edition, New Age International PvtLtd 2018
2. B. C. Kuo, Automatic Control Systems, 9th edition, John wiley and Sons,2014

Reference Books:

1. Katsuhiko Ogata, Modern Control Engineering, 5th edition, Pearson education India Pvt. Ltd,2015,
2. Richord C Dorf and Robert H. Bishop, Modern Control Systems, 13th edition, Pearson; 2016

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester:IV Semester
Course Title: ARM Processor & Applications		Course Code:22EECC207
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40Hrs	Examination Duration:3 Hrs	

Unit I

Chapter No. 1 ARM Architecture

The Acorn RISC machine, Architectural inheritance, Architecture of ARM7TDMI, ARM programmers model, ARM development tools, 3 stage pipeline ARM organization, ARM instruction execution.

Chapter No. 2 Introduction to ARM instruction set

Data processing instruction, Branch instruction, Load store instruction, Software interrupt instruction, Program status register instruction, Conditional execution, Example programs, introduction to thumb instruction and implementation.

Chapter No. 3 Assembler rules and Directives

Introduction, structure of assembly language modules, Predefined register names, frequently used directives, Macros, Miscellaneous assembler features. Example programs.

Unit II

Chapter No. 4 Exception handling

Introduction, Interrupts, error conditions, processor exception sequence, the vector table, Exception handlers, Exception priorities, Procedures for handling exceptions.

Chapter No. 5 Introduction to Bus protocols:

I2C, SPI, AMBA (advanced memory bus architecture): AHB, APB

Chapter No. 6 LPC 2148 Controller Architectural overview and GPIO programming

LPC2148 architectural overview, Registers, GPIO Programming: LED, LCD, Seven segment, Stepper Motor, DC Motor, Buzzer, Switch, Keypad.

Unit III

Chapter No. 7 On-chip programming techniques using LPC 2148 Controller

ARM interfacing techniques and programming: Timers, RTC, UART, ADC, DAC, I2C and External Interrupt.

Chapter No. 8 Architectural support for high level languages

Abstraction in software design, data types, floating point data types, The ARM floating point architecture, use of memory, run time environment.

Text Books

1. The 8051 Microcontroller Architecture, Programming & Applications " By Kenneth J. Ayala, Cenage Learning; 3rd edition 2007
2. ARM System- On-Chip Architecture by 'Steve Furber', Second Edition, Pearson,2015
3. ARM Assembly Language fundamentals and Techniques by William Hohl, CRC press CRC Press; 2nd edition,2014

Reference Books:

1. ARM system Developer ‘s Guide- Hard bound, Publication date:2004 Imprint: MORGAN KAUFFMAN
2. User manual onLPC21XX.

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: IV Semester
Course Title: Digital System Design using Verilog		Course Code:22EECC208
L-T-P: 0-0-2	Credits: 2	Contact Hours: 4 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: --	Examination Duration:2 Hrs	

1. Chapter No. 1. Architecture of FPGA

Architecture of FPGAS: Spartan 6, What Is HDL, Verilog HDL Data Types and Operators.

2. Chapter No. 2. Data Flow Descriptions

Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type - Vectors, Testbench.

3. Chapter No. 3. Behavioural Descriptions

Behavioural Description highlights, structure of HDL behavioural Description, The VHDL variable –Assignment Statement, sequential statements, Tasks and Functions

4. Chapter No. 4. Structural Descriptions

Highlights of structural Description, Organization of the structural Descriptions, state Machines, Generate, Generic, and Parameter statements

5. Chapter No. 5. Finite State Machine:

Moore Machines, Mealy Machines

6. Chapter No. 6. Interfacing and applications

LCD, 7 Segment display, Keyboard, Traffic light controller, Stepper Motor, DC Motor.

Text Books

1. Nazeih M. Botros, HDL Programming –Verilog, Dreamtech Press,2006.
2. J.Bhaskar, "AVerilog Primer",; 3rd edition, Pearson Education India ,2015

Reference Books:

1. Samir Palnitkar,-Verilog HDL, Pearson Education,2nd Edition,2003.
2. Thomas and Moorby,-The Verilog Hardware Description Language, Kluwer academic publishers,5th edition, 2002.
3. Stephen Brown and Zvonko , Vranesic,-Fundamentals of Logic Design with Verilog; 2nd edition, McGraw Hill Education 2017.
4. Charles. H. Roth, Jr.,Lizy Kurian John-Digital System Design using VHDL, Thomson, 2ndEdition,2008.

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: IV Semester
Course Title: Data Acquisition and Control Lab		Course Code:22EECP203
L-T-P: 0-0-1	Credits: 1	Contact Hours:2 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: --	Examination Duration:2 Hrs	

List of Experiments:

1. Basic Signal Conditioning Techniques
   a) Inverting and Non-Inverting Amplifier using OPAMP.
   b) Comparator. (ZCD &Schmitttrigger)
   c) Precision rectifier
2. Realize and verify the performance of Instrumentation Amplifier usingop-amp
3. Feedback Concepts: Realize and verify the performance of WeinBridge Oscillator usingop-amp
4. To design and implement the filters for a givenspecification

   Obtain the phase and frequency responses of 2nd order, Low pass and High pass filter.
5. To implement and characterize the functional block of ADC and DAC.

   Realize the following data converters to determine their respective performance parameters.
   - 4-bit R-2R D-A Converter.
   - 2-Bit flash ADC/4-Bit ADC (Using0804IC
6. SystemModeling
   - Realize the system modeling for DC Motor using Quanser Qube
7. To determine System Response of RLCcircuits

   Time domain response of an RLC network and the response parameters of interest (Rise time, Peak overshoot, Overshoot and Settling time) for critical, over and under damped conditions using Labview.

   Time response using Quanser Qube
8. Stability Analysis To determine the stability of the system depending upon Pole - Zero location. To determine the stability of the system using Bode Plots.
9. Compensation Techniques To determine suitable compensator for the given system (PD, PI, PID Controller using Quanser Qube).

10. Structured Enquiry (16+16=32marks)

- MOS Amplifier Design andimplementation
- Design and implement a PD control system using Co-simulation.

Text Books:

1. Ramakant Gayakwad, Operational Amplifiers and Linear Integrated Circuits; Fourth edition Pearson Education, 2015
2. Sergio Franco Design with Op-amps and Analog Integrated circuits, MHE; third edition,2012

Reference Books:

1. Dan Sheingold Analog to Digital Conversion Hand Book, 3rd Revised edition PH,1986. Prentice Hall,1985
2. David A. Bell, Operational Amplifiers and LinearICs.; Third edition, Oxford University Press, 2011
3. Sedra and Smith — Microelectronics Circuits, Sixth edition, Oxford University, 2013

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: IV Semester
Course Title: ARM Microcontroller Lab		Course Code:22EECP204
L-T-P:0-0-1	Credits: 1	Contact Hours:2 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: --	Examination Duration:2 Hrs	

List of Experiments:

1. Write an ALP to achieve the following arithmetic operations:
   i) 32-bit addition
   ii) 64-bit addition
   iii) Subtraction
   iv) Multiplication
   v) 32-bit binary divide

Apply suitable machine dependent optimization technique and analyze for memory at time consumed

2. Write an ALP for the following using loops:
   i) Find the sum of 'N' 16 bit numbers
   ii) Find the maximum/minimum of N numbers
   iii) Find the factorial of a given number with and without look up table.

Apply suitable machine dependent optimization technique and analyze for memory and time consumed

3. Write an ALP to
   i) Find the length of the carriage return terminated string.
   ii) Compare two strings for equality.

Apply suitable machine dependent optimization technique and analyze for memory and time consumed

4. Write an ALP to pass parameters to a subroutine to find the factorial of a number or prime number generation.

Apply suitable machine dependent optimization technique and analyze for memory and time consumed

5. Write a C program to test working of LEDs and seven segment using LPC2148.

6. Write a C program & demonstrate an interfacing of Alphanumeric LCD 2X16 panel and 4X4 keypad to LPC2148 Microcontroller.

7. Write an ALP to generate the following waveforms of different frequencies
   i) Square wave
   ii) Triangular
   iii) Sine wave
8. Write a program that converts the data read from sensor to a data understandable for the ARM microcontroller.

9. Develop a C program to demonstrate the concept of serial communication with an example.

10. Develop an application code using embedded C to accept asynchronous inputs and control the connected device

11. Develop an application code using synchronous communication protocol to display the RTC value on a display device

.

Text Books

1. Steve Furber, ARM System- On-Chip Architecture, 2nd, LPE,2002
2. The8051 Microcontroller Architecture, Programming & Applications" By _Kenneth J. Ayala, Cenage Learning; 3rd edition 2007
3. William HohlARMAssembly Language fundamentals and Techniques by, CRC press CRC Press; 2nd edition ,2014

Reference Books:

1. -ARM system Developer 's Guide- Hardbound, Publication date:2004 Imprint: MORGAN KAUFFMAN
2. User manual onLPC21XX.

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: IV Semester
Course Title: Data Structures Application Laboratory		Course Code:21EECF201
L-T-P: 0-0-2	Credits: 2	Contact Hours: 4 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: --	Examination Duration:2 Hrs	

Chapter No 1. Analysis of algorithms: Introduction, Asymptotic notations and analysis, Analysis of recursive and non-recursive algorithms, master's theorem, complexity analysis of algorithms.

Chapter No 2. Analysis of linear data-structures and its applications: Complexity analysis of basic data structures (Stacks, Queues, Linked lists)

Chapter No 3. Analysis of non-linear data-structures and its applications

Trees and applications: Computer representation, Tree properties, Binary Tree properties, Binary search trees properties and implementation, Tree traversals, AVL tree.

Graphs and applications: Computer representation, Adjacency List, Adjacency Matrix, Graph properties, Graph traversals.

Hashing and applications: Hashing, Hash function, Hash Table, Collision resolution techniques, Hashing Applications

Text Books

1. Richard F. Gilberg & Behrouz A. Forouzan, Data Structures A Pseudocode Approach with C, Second Edition.
2. Aaron M. Tenenbaum, Data Structures Using C

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: IV Semester
Course Title: Data Structures using C Lab (Diploma)		Course Code:21EECF203
L-T-P: 0-0-3	Credits: 3	Contact Hours:6 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: 42Hrs	Examination Duration:2 Hrs	

Category: Demonstration		Total Weightage: 0.00		No. of lab sessions: 6.00
Expt./ Job No.	Experiment / Job Details	No. of Lab Session(s) per batch (estimate)	Marks / Experiment	Correlation of Experiment with the theory
1	Programs on Pointer concepts.	2.00	0.00	
	Learning Objectives: *The students should be able to* Perform basic programming structures on 1. Pointers concepts. 2. 1D and 2Darrays. 3. Pointers to functions. 4. Memory management functions			1
2	Programs on string handling functions, structures union and bit-files.	2.00	0.00	

	Learning Outcomes: *The students should be able to write programs to:* a) Perform string handling functions like 1. String length. 2. String concatenate. 3. Strings compare. 4. String copy. 5. Strings reverse. b) Implement Structures, union and bit-field			1
3	Programming on files.	2.00	0.00	
	Learning Outcomes: *The students should be able to write a modular program to:* 1. Open and Close the file. 2. Read and Write the file. 3. Append the file.			1
Category: Exercise		**Total Weightage: 20.00**		**No. of lab sessions: 12.00**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**

4	Programs on implementation of stacks and its applications.	2.00	3.00	
	Learning Outcomes: *The students should be able to:* 1. Write a program to Insert delete and display stack elements for an application. 2. Write a program using stack to convert from Infix to postfix & Infix to Prefix 3. Write a program using stack data structure for base conversion.			3
5	Programs on implementation of different queue data structures.	2.00	4.00	
	Learning Outcomes: *The students should be able to:* Write a program using queue data structure for an application.			3
6	Programs on implementation of different types of Linked lists	2.00	4.00	
	Learning Outcomes:			4

	The students should be able to write a modular program to use the linked lists for an application 1. Insert, delete and display a node in SLL. 2. Insert, delete and display a node in DLL. 3. Insert delete and display a node in CLL.			
7	Programs on Implementation of trees.	2.00	3.00	
	Learning Outcomes: *The students should be able to write modular programs to:* 1. Perform various operations on binary trees. 2. To find max, min value in a binary search trees. 3. To find the height of a tree, 4. To count nodes in a tree. 5. To delete a node in a tree			5
8	Programs to implement different sorting techniques.	2.00	3.00	
	Learning Outcomes: *The students should be able to:* Write modular program on perform the following sorting techniques			5

	1. Selection 2. Insertion 3. Bubble 4. Merge 5. Quick 6. Heap			
9	Programming on hash tables	2.00	3.00	
	Learning Outcomes: *The students should be able to* Write modular program on 1. Direct-address tables 2. Hash tables			6

Reference Books:

1. Aaron M. Tenenbaum, et al, "Data Structures using C", PHI, 2006
2. Cormen, Leiserson, Rivest "Introduction to Algorithms", PHI, 2001
3. E Balaguruswamy, "The ANSI C Programming Language", 2ed., PHI, 2010.
4. Yashavant Kanetkar, "Data Structures through C", BPB publications 2010
5. Horowitz, Sahani, Anderson-Feed, "Fundamentals of Data Structures in C", 2ed, Universities Press, 2008
6. Richard F. Gilberg, Behrouz A. Forouzan "Data Structures: A Pseudocode Approach with C", 2nd Edition, Course Technology, Oct 2009.
7. Kernighan and Ritchie, The ANSI C Programming Language, 2 ed., PHI.
8. Robert Kruse, Data Structures and Program Design in C, 2 ed., Pearson

Back to Semester- IV

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: V Semester
Course Title: CMOS VLSI Circuits		Course Code: 24EECC301
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration:3 Hrs	

Unit I

Chapter No. 1. Electronic Analysis of CMOS logic gates

DC transfer characteristics of CMOS inverter, Beta Ratio Effects, Noise Margin, MOS capacitance models. Transient Analysis of CMOS Inverter, NAND, NOR and Complex Logic Gates, Gate Design for Transient Performance, Switch-level RC Delay Models, Delay Estimation, Elmore Delay Model, Power Dissipation of CMOS Inverter, Transmission Gates & Pass Transistors, Tristate Inverter.

Chapter No. 2. Design of CMOS logic gates

Stick Diagrams, Euler Path, Semiconductor Technology - An Overview, Czochralski method of growing Silicon, Introduction to Unit Processes (Oxidation, Diffusion, Deposition, Ion-implantation), Layout design rules, DRC, Circuit extraction, Layout of AOI and OAI circuits, latch up – Triggering Prevention.

Unit II

Chapter No. 3. Designing Combinational Logic Networks

Gate Delays, Driving Large Capacitive Loads, Delay Minimization in an Inverter Cascade, Logical effort. Pseudo nMOS, Clocked CMOS, Dynamic CMOS Logic Circuits, Dual-rail Logic Networks: CVSL, CPL.

Chapter No.4.Standard Cell Layout

Digital Standard cell library development, Schematic (beta calculations, stage ratio) layout (architecture, height of cell, power rail calculations), RC extraction, abstract, and LEF file characterization.

Unit III

Chapter No. 5. Sequential CMOS Circuit Design

Sequencing static circuits, Circuit design of latches and flip-flops, Clocking- clock generation, clock distribution.

Chapter No. 6. Static Timing Analysis

Timing Paths, Time Borrowing, Basic Concepts of Setup and Hold time, Basic Concepts of Setup and Hold time violation, Practical examples for Setup and Hold time/violation

Text Books

1. John P. Uyemura, Introduction to VLSI Circuits and Systems, 1, Wiley, 2007

2. Neil Weste, David Harris & Ayan Banerjee, CMOS VLSI Design, 3, Pearson Ed, 2005
3. J. Bhasker and Rakesh Chadha, “Static Timing Analysis for Nanometre Designs A Practical Approach” Springer 2009
4. Keith Barr - ASIC Design in the Silicon Sandbox- A Complete Guide to Building Mixed-Signal Integrated Circuits-McGraw-Hill Professional (2006)

Reference Books:

1. Wayne, Wolf, Modern VLSI design: System on Silicon, 3, Pearson Ed, 2005
2. Douglas A Pucknell and Kamran Eshraghian, Basic VLSI Design, 3, PHI, 2005
3. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3, Tata McGraw, 2007

Back to Semester- V

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: V Semester**
Course Title: Communication Systems		**Course Code:23EECC302**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hours: 5 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40Hrs	**Examination Duration:3 Hrs**	

Unit I

Chapter 01. Introduction to Analog communication: Introduction, history of communication, need for modulation, Amplitude modulation, Time-Domain and Frequency domain description, Frequency-Domain description, DSBSC, SSB, VSB, Phase and frequency modulation, Phase and frequency Deviation, Narrow and Wide band frequency modulation. Spectrum and phase diagram of FM Transmission band width of FM waves, Effect of Modulation index on bandwidth, Comparison of all modulation techniques.

Chapter 02. Sampling Process: Sampling theorem, Quadrature sampling of Band pass signals, Reconstruction of a message from its samples. Time Division Multiplexing (TDM) Signal distortion in Sampling. Pulse Amplitude Modulation (PAM), Pulse Position Modulation (PPM), Pulse Width Modulation (PWM)

Unit II

Chapter 03. Waveform Coding Techniques: Pulse-Code Modulation, Channel noise and Error Probability, Quantization noise and Signal to noise ratio, Robust Quantization, Differential Pulse code modulation, Delta Modulation, Problems

Chapter 04. Baseband shaping for data transmission: Discrete PAM signals, Power spectra of discrete PAM signals, Inter symbol Interference, Nyquist's criterion for distortion less baseband binary transmission, correlative coding, eye pattern, baseband M-ary PAM systems, and adaptive equalization for data transmission, Problems

Unit III

Chapter 05. Digital Modulation Techniques: Digital Modulation formats, Coherent binary modulation techniques, Coherent quadrature modulation techniques, non-coherent binary modulation techniques, Comparison of Binary and Quaternary Modulation techniques, Problems

Text Books:

1. "Communication Systems" by 'Simon Haykin' John Wiley 2003. 5th edition, 2009
2. "Principles of communication Systems", by Taub & Schilling, 2nd edition, TMH.
3. "Digital communications", Simon Haykin, John Wiley, 2006

Reference Books:

1. Communication Systems, by B.P.Lathi ,
2. Ganesh Rao, K N Haribhat, Analog Communication, Sanguine, 2009
3. Communication Systems by Harold. P.E, Stern Samy. A. Mahmond, Pearson Education, 2004.
4. Electronic communication systems, Kennedy and Davis, TMH, Edn. 6, 2012

Back to Semester- V

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester:V Semester
Course Title: Digital Signal Processing		Course Code: 23EECC303
L-T-P: 2-0-2	Credits: 4	Contact Hours: 6 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: 30Hrs	Examination Duration:3 Hrs	

Unit I

Discrete Fourier Transforms

Brief review of signals and systems: Basic definitions, properties and applications. Discrete Fourier Transforms (DFT), DFT as a linear transformation, Properties of DFT, Use of DFT in linear filtering, Overlap-save and Overlap-add method.

Unit II

Fast-Fourier-Transform (FFT) algorithms

Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, Need for efficient computation of the DFT (i.e. FFT algorithms), Radix-2 FFT algorithm for the computation of DFT and IDFT: Decimation-in-time and Decimation-in-frequency algorithms.

Unit III

Design of digital IIR and FIR filters

Design of IIR filters: Butterworth and Chebyshev methods using impulse invariance technique, and bilinear transformation.

Design of linear phase FIR filters using windowing method - Rectangular, Hamming, Hanning, Bartlet and Kaiser windows.

Text Books:

1. Proakis & Manolakis, Digital signal processing Principles Algorithms & Applications, 4th edition, PHI, New Delhi, 2007
2. S.K. Mitra, Digital Signal Processing, 2nd edition, Tata Mc-Graw Hill, 2004

Reference Books:

1. Oppenheim & Schaffer, Discrete Time Signal Processing, 5th edition, PHI, New Delhi, 2000

Back to Semester- V

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester:V Semester**
Course Title: Operating System and Embedded System Design		**Course Code: 24EECC304**
L-T-P: 3-0-1	**Credits: 3**	**Contact Hours: 5 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40Hrs	**Examination Duration:3 Hrs**	

Unit I

Chapter No 1. Introduction to Operating System : What is an operating system? Goals of an operating system. Operation of an OS. Operating System Services. System Calls and Types. Operating system Structure – Simple, Monolithic and Microkernels, System Boot

Chapter No 2. Process Management : Process concept- operating on the process, inter-process communication, process scheduling- CPU scheduler-preemptive scheduling, scheduling criteria, scheduling algorithms- first come, first served scheduling, shortest job first scheduling, priority scheduling, round robin scheduling

Chapter No 3. Introduction : to Real-Time Operating Systems : Introduction to Real-Time Operating Systems, Introduction to the real-time embedded system and types. Key characteristics of RTOS, its kernel, components in RTOS kernel, and Scheduling types: Preemptive priority-based scheduling, Round-robin and preemptive scheduling

Unit II

Chapter No 5. Tasks, Task Synchronization and Programming: Task: Structure, Semaphore: Structure, Types: binary semaphore, mutual exclusion (mutex) semaphore, and Uses. Event Flags: Structure, uses, and program using RTX kernel. Priority Inversion problem and its solutions.

Chapter No 5. Intertask Communication and Programming: Message Queue: Structure, state diagram, operation, Uses and program using RTX kernel.

Unit III

Chapter No 6 Embedded System Design Concepts and Firmware Development: Classification and purposes of embedded system, Characteristics of embedded system, Operational and non-operational quality attributes of embedded system. Core and Supporting components of embedded system. Embedded firmware development.

Text Books

1. Silberschatz, Galvin and Gagne, Operating system concepts,9th edition, WILEYPublication,2018.
2. Qing Li with Caroline Yao, Real-Time Concepts for Embedded Systems, 1E, Published,2011
3. Shibu K V, Introduction to Embedded systems,2nd edition, McGraw Hill Education India Private Limited,2017
4. Raj Kamal, Embedded Systems, Paperback,3rdedition, McGraw-Hill Education, 2017

Reference Books:1. Dhananjay Dhamdhere, Operating Systems a Concept Based Approach,3rd edition, McGraw-HillEducation,2017

Back to Semester- V

Experiment Wise Plan

List of experiments/jobs planned to meet the requirements of the course.

Category: Exercise	
Exp No	**Experiment / Job Details**
1	Write an optimized C program to Create Tasks using RTX Kernel. Also, comment on the performance.
2	Write an optimized RTOS program & demonstrate the concept of Round Robin Task Scheduling, and comment on performance.
3	Write an optimized RTOS program to demonstrate the concept of a basic preemptive scheduling algorithm using RTX Kernel and comment on performance.
4	Write an optimized RTOS program & demonstrate the concept of Events and Flags for inter-task communication using RTX Kernel. Also, comment on performance.
5	Write an optimized RTOS program & demonstrate the concept of Mailbox, and comment on performance.
6	Write an optimized RTOS program & demonstrate the concept of Semaphore, and comment on performance.

Category: Open Ended	
Expt./ Job No.	**Experiment / Job Details**
1	Design and implement an application using a Real-Time Operating System (RTOS) to address the specific requirements outlined in the given problem statement.

Back to Semester- V

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester:V Semester**
Course Title: Machine Learning& Deep Learning		**Course Code: 24EECC309**
L-T-P: 2-0-2	**Credits: 4**	**Contact Hours: 6 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 30Hrs	**Examination Duration:3 Hrs**	

Unit I

Chapter No.1 Introduction

Motivation, History and Evolution, Definition (ETP, Examples), Types of Machine Learning: Supervised, Unsupervised and Reinforcement learning.

Chapter No. 2 Supervised Learning

Model Representation: Basic Terminologies (Variable/features, Input, Output, Model, Learning Algorithm, Hypothesis, Cost/Loss function) Linear Regression: Single Variable (Representation of hypothesis, cost function, Optimization: Sum of squared error (L1 and L2), parameters/weights, bias) without bias and with bias. Model Optimization: Introducing Iterative optimization (Sum of squares error function, Gradient descent algorithm) and non-iterative optimization. Linear Regression: Polynomial Regression and Multi-variable Regression (Representation of hypothesis, cost function, Optimization).Model Optimization: Gradient descent algorithm (Learning rate/ step size, Normalization/ Feature Scaling).Model Optimization: Non-iterative optimization (Normal Equation).Logistic Regression: Hypothesis Representation, Decision boundary, Cost function, Logistic Regression: Optimization (Gradient Descent), Multi-class classification (One-vs.-all classification using logistic regression), Classical supervised learning algorithm- Support Vector Machine (SVM).

Chapter No. 3 Performance Evaluation

Performance Evaluation of learning models: Metrics (Confusion matrix, Precision, Recall, F1 Score, RoC curves), Modeling data and validating learning, over fitting, Trade of Bias and Variance, Methods to overcome over fitting (Feature reduction, Regularization).

Unit II

Chapter No. 4 Unsupervised Learning

Clustering: Introduction, K-means Clustering, Algorithm, Cost function, Applications, Dimensionality Reduction: Motivation, Definition, Methods of Dimensionality reduction, Dimensionality Reduction: PCA- Principal Component Analysis.

Chapter No. 5 Introduction to Neural Network and deep learning

Introduction to Neural Networks (Motivation: non-linear model, Neurons and perception), Model representation: Neural Network Architecture (Activation units, Layers), Neural Network: Initialization, Forwards propagation, and Cost function, Back propagation algorithm, Multi-class classification, Steps to train a neural network, Applications of Neural Networks, Introduction to Deep Learning (Motivation, Overview), Convolution Neural Networks (CNN) (Architecture, terminologies, Evolution and Modelling).

Unit III

Chapter No. 6 Deep learning algorithms

Recurrent Neural Networks (RNN), Self-supervised models (Auto encoders and variants), Generative Models (GAN, its variants and applications).

Chapter No. 7 Sequence to Sequence Learning:

Attention networks, Transformer based architecture, Transformer for Time-Series

Text Books

1. Tom Mitchell, Machine Learning, 1, McGraw-Hill, 1997
2. Christopher Bishop, Pattern Recognition and Machine Learning, 1, Springer, 2007

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining Inference and Prediction, 2, Springer, 2009

Back to Semester- V

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester:V Semester
Course Title: CMOS VLSI Circuits Lab		Course Code: 24EECP301
L-T-P: 0-0-1	Credits: 1	Contact Hours: 2 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: --	Examination Duration:2 Hrs	

List of Experiments:

1. Introduction to Cadence EDA tool.
2. Static and Dynamic Characteristic of CMOS inverter.
3. Layout of CMOS Inverter (DRC, LVS)
4. Static and Dynamic Characteristic of CMOS NAND2 andNOR2.
5. Layout of NAND2, NOR2, XOR2 gates (DRC, LVS).
6. Analysis of Transmission Gate

Structured Enquiry

1. AOI and OAI analysis and layout
2. Design of D-FF

Open Ended

1. Design complex combinational circuits and analyze the performance using Cadence tool.

Reference Books:

1. John P. Uyemura,-Introduction to VLSI Circuits and Systems, Wiley, 2006.
2. Neil Weste and K. Eshragian, Principles of CMOS VLSI Design: A System Perspective, 2nd edition, Pearson Education (Asia) Ptv. Ltd.,2000.

Back to Semester- V

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester:V Semester**
Course Title: Mini Project		**Course Code: 23EECW301**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 6 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 28Hrs	**Examination Duration:3 Hrs**	

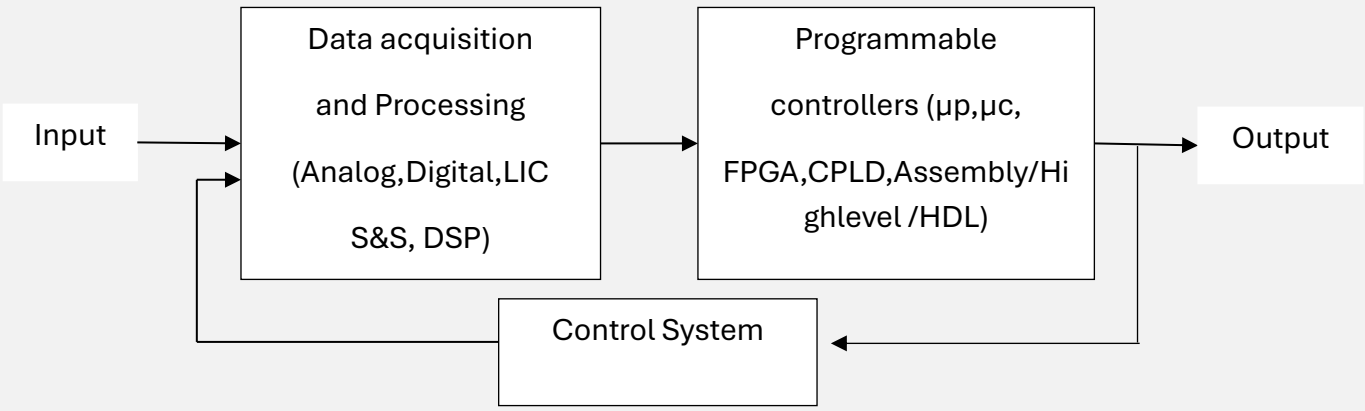
Guide lines for selection of a project:

The project needs to encompass the concepts leant in a subject/s studied in the previous four semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the identified need.

Project should be able to exhibit sensing, controlling and actuation sections.

The mini project essentially will comprise of two components:

- **The hardware design**
- **The graphical user interface (GUI) for application and data analysis with report generation.**



Student can select a project which leads to a product or model or prototype related to following areas (not limited to these areas).

- **Pulse and digital circuits: simulate the working of one or more circuits**
- **Signals and systems: simulate the behaviour of a system by considering different signals**
- **Analog Electronic: simulate working of different devices**
- **Control systems: simulate the behaviour of a control system**
- **Linear Integrated Circuits: simulate working of one or more circuits**
- **Micro-controllers: simulate the ALU/control unit of microcontroller**

Time plan: Effort to do the project should be between 120-150 Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).

Learning overhead should be 20-25% of total project development time.

Back to Semester- V

Program: Electronics & Communication Engineering		Semester: V
Course Title: Arithmetical Thinking and Analytical Reasoning		Course Code: 23EHSA303
L-T-P: 0-0-0	Credits: 0	Contact Hours: 1 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 16Hrs	Examination Duration: 3 Hrs	

Chapter No. 1. Analytical Thinking

Importance of Sense of Analysis for Engineers, Corporate Methodology of Testing Sense of Analysis, Puzzles for practice: Analytical, Mathematical, Classification Puzzles, Teamwork in Problem Solving

Chapter No. 2. Mathematical Thinking I

Problems on Finance: Percentages, Gain and Loss, Interest; Distribution and Efficiency Problems: Averages, Time Work, Permutations Combinations

Chapter No. 3. Mathematical Thinking II

Distribution Problems: Permutations Combinations

Chapter No. 4. Verbal Ability

Comprehension of Passages, Error Detection and Correction Exercises, Common Verbal Ability questions from Corporate Recruitment Tests

Reference Books:

1. George J Summers, “The Great Book of Puzzles & Teasers”, Jaico Publishing House, 1989
2. Shakuntala Devi, “Puzzles to Puzzle You”, Orient Paper Backs, New Delhi, 1976
3. R. S. Aggarwal, “A Modern Approach to Logical Reasoning”, Sultan Chand and Sons, New Delhi, 2018
4. M Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.
6. Kaplan’s GRE guide

Back to Semester- V

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester:VI Semester**
Course Title: Professional Aptitude and Logical reasoning		**Course Code: 23EHSA302**
L-T-P: 0-0-0	**Credits: Audit**	**Contact Hours:**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40Hrs	**Examination Duration:3 Hrs**	

Unit I

Chapter 1. – Arithmetical Reasoning

Chapter 2. – Analytical Thinking

Chapter 3. – Syllogistic Logic

Unit II

Chapter 1. – Verbal Logic

Chapter 2. – Non-Verbal Logic

Unit III

Chapter 1. - Lateral Thinking

Text Books

1. A Modern Approach to Verbal and Non – Verbal Reasoning – R. S. Aggarwal, Sultan Chand and Sons, New Delhi
2. Quantitative Aptitude – R. S. Aggarwal, Sultan Chand and Sons, New Delhi

Reference Books:

1. Verbal and Non – Verbal Reasoning – Dr. Ravi Chopra, MacMillan India
2. Lateral Thinking – Dr. Edward De Bono, Penguin Books, New Delhi

Back to Semester- VI

Program: Electronics & Communication Engineering		Semester: VI
Course Title: Industry Readiness & Leadership Skills		Course Code: 23EHSA304
L-T-P: 0-0-0	Credits: 0	Contact Hours: 1 hrs/week
ISA Marks: 25	ESA Marks: 75	Total Marks: 100
Teaching Hours: 16Hrs	Examination Duration: 3 Hrs	

Chapter No. 1. Written Communication

Successful Job Applications, Résumé Writing, Emails, Letters, Business Communication, Essay, and Paragraph Writing for Recruitment Tests

Chapter No. 2. Interview Handling Skills

Understanding Interviewer Psychology, Common Questions in HR Interviews, Grooming, Interview Etiquette

Chapter No. 3. Lateral & Creative Thinking

Lateral Thinking by Edward de Bono, Fractionation and Brain Storming, Mind Maps, Creativity Enhancement through Activities

Chapter No. 4. Team Building & Leadership Skills

Communication in a Team, Leadership Styles, Playing a Team member, Belbin's team roles, Ethics, Effective Leadership Strategies

Reference Books:

1. Diana Booher – E Writing, Laxmi Publications
2. Edward de Bono–Lateral Thinking – A Textbook of Creativity, Penguin UK
3. William Strunk, E B White – The Elements of Style, Pearson
4. John Maxwell – The 17 Essential Qualities of a Team Player, HarperCollins Leadership
5. Robin Ryan – 60 Seconds and You're Hired! – Penguin Books

Back to Semester- VI

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester:VI Semester**
Course Title: Automotive Electronics		**Course Code: 24EECC305**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hours: 5 Hrs/week**
ISA Marks: 63	**ESA Marks: 37**	**Total Marks: 100**
Teaching Hours: 30Hrs	**Examination Duration:3 Hrs**	

Unit I

Chapter No: 1. Automotive fundamentals and industry overview: Introduction to automotive electronics, Vehicle functional domains, ECU design cycle: Model Base Design (MBD), V and Agile.

Chapter No: 2. Automotive Control Systems Design: Vehicle safety and stability systems, sensors and actuators, powertrain control systems, vehicle dynamics control, brake control systems.

Chapter No: 3. Fundamentals of electric vehicle: Drive cycles, EV drive train, EV Batteries, battery management system

Unit II

Chapter No: 4. Automotive communication protocols: Overview of Automotive communication protocols, CAN, CAN FD, Automotive Ethernet, LIN, Flex Ray, MOST.

Chapter No: 5. Introduction to ADAS/AD: Advanced Driver Assistance Systems (ADAS), Autonomous driving: sensing, planning and control, connected vehicles.

Unit III

Chapter No: 6. Functional Safety Standards: Functional Safety: Need for safety standard-ISO 26262, safety concept, safety process for product life cycle.

Chapter No: 7. Vehicle Diagnostics: Introduction to vehicle diagnostics, onboard/off board Diagnostics, diagnostic tools, diagnostic fault codes, diagnostic protocols: KWP2000 and UDS.

Experiments List

- Modeling and simulation of Electrical/Mechanical subsystems
- Modeling and simulation of a vehicle motion
- Modeling and simulation of Control Algorithms and their realization on Target platform
  - Power train: Electronic Gas-pedal System (EGAS)
  - Fuel injection Control System
  - ABS/TCS/ESP
  - Seat-belt/Wiper Control
- Electric vehicle (EV) power train
- State of charge (SoC) of an electric vehicle (EV)
- Model Batteries and Develop BMS
- CAN bus communication for ECU networking
- Embedded C code for CAN cluster development. (Event based transmission)
- CAN node prioritization

- CAN bus acceptance filter
- CAN/CAN-FD bus Communication on start-up, event based, Periodic and Signal handling
    - Transmission on power up
    - Event Message Transmission
    - Periodic Message Transmission
    - Conditionally Periodic Message Transmission
    - CAN signal Handling during transmission
    - Working with timers
    - CAN signal accessing with and without Data Bus Code (DBC)
    - Signal interpretation by logic (eg., ignition on engine run)
    - DBC creation
- ECU simulation in CAN using Canoe (CAPL programming)
- Diagnostic data using UDS protocol
- Stored Data Transmission Services
- Diagnostics P-Code and Fault Codes

Text Books:

1. Ribbens, Understanding of Automotive electronics, 6th Edition, Elsevier, 2003

2. Denton, Automobile Electrical and Electronic Systems, Elsevier, 3rd Edition, 2004

3. Konrad Reif Ed, Brakes, Brake Control and Driver Assistance Systems, Professional Automotive Information, Springer, 2014

4. David Smith, Kenneth Simpson, The Safety Critical Systems Handbook, 5th Edition, 2020

Reference Books:

1. Ronald K Jurgen, Automotive Electronics Handbook, 2nd Edition, McGraw-Hill, 1999

2. James D Halderman, Automotive electricity and Electronics, PHI Publication, 2000

3. Allan Bonnick, Automotive Computer Controlled Systems Diagnostic Tools and Techniques, Elsevier Science, 2001

4. Nicholas Navet, Automotive Embedded System Handbook, 2009

Back to Semester- VI

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VI Semester
Course Title: Computer Communication Networks I		Course Code: 23EECC306
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration:3 Hrs	

Unit I

Chapter No.1. Computer Networks and the Internet What is Internet? The Network Edge, the network Core, delay-loss, throughput in packet switched networks. Protocol layers (OSI layers) and their service models, networks under attack

Chapter No. 2. Application Layer Principles of network applications, the web and HTTP, DHCP, electronic mail in the internet, DNS, peer-to-peer applications

Unit II

Chapter No. 3. Transport Layer Introduction and transport-layer services-relationship between transport and network layers - overview of the transport layer in the internet, multiplexing and de multiplexing, connectionless transport: UDP, principles of reliable data transfer, connection-oriented transport TCP, TCP congestion control.

Chapter No. 4. Network layer Introduction, virtual circuit and datagram networks, what's inside router? The Internet protocol (IP): forwarding and addressing in the internet.

Unit III

Chapter No. 5. Network layer: Routing algorithms: Link-State (LS), Distance-Vector (DV), Hierarchical Routing, Routing in the Internet, Intra-AS routing RIP, OSPF, Inter-AS routing BGP, broadcast routing algorithms and multi cast routing

Text Books:

1. Kurose & Ross, Computer Networking A Top-Down Approach, 6th edition, PEARSON, 2013.

Reference Books:

1. Behrouz A. Forouzan, 1. Data Communications and Networking, 4th Edition, Tata McGra, 2006
2. Larry L. Peterson and Bruce S. Davie, Computer Networks A Systems Approach, 4th Edition, Elsevier, 2007

Back to Semester- VI

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: VI Semester**
Course Title: GEN AI		**Course Code: 24EECC308**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4 Hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hours: 30Hrs	**Examination Duration:2 Hrs**	

Unit I

Chapter 1: Introduction to Generative AI

Definition, Overview of Generative AI, Importance and applications of Generative AI, Evolution of AI towards generative models, Key milestones and breakthroughs in Generative AI.

Chapter 2: Generative Models I:

Autoencoders (AE) and Variational Autoencoders (VAEs) Architecture: Encoder, Decoder, Latent Space, Training with ELBO (Evidence Lower Bound), Applications and limitations.

Generative Adversarial Networks (GANs): Architecture: Generator and Discriminator, Training process, loss functions, Common issues, Variants: DCGAN, CycleGAN, StyleGAN.

Diffusion Models: Forward process (encoders), reverse process (decoders), score matching, guided diffusion.

Chapter 3: Training and Evaluation of Generative AI Models:

Optimization Methods: Gradient Descent, Stochastic Gradient Descent (SGD), Adam Optimizer, Adam (Adaptive Moment Estimation), RMSProp (Root Mean Square Propagation), Adagrad (Adaptive Gradient Algorithm), AdaDelta.

Evaluation Metrics: Inception Score (IS), Frechet Inception Distance (FID), Perplexity, Reconstruction Error, Mode Score, Diversity Metrics, Wasserstein Distance, Earth Mover's Distance (EMD), BLEU Score

Challenges: Mode collapse, stability, and convergence.

Unit II

Chapter 4: Generative Models II: Autoregressive Models

Definition and Principle: Autoregressive Property, Conditional Dependence, Autoregressive Process

Examples of Autoregressive Models: AR Models in Time Series Analysis, Autoregressive Integrated Moving Average (ARIMA)

Autoregressive Models for Generative AI:

PixelCNN - Overview, Architecture, Training, Applications

WaveNet - Overview, Architecture, Training, Applications

Chapter 5: Generative Models II: Transformers

Introduction to Transformers, Origins and evolution from traditional sequence models (like RNNs and LSTMs) to transformers, self-attention mechanism, multi-head attention, position-wise feedforward networks.

Transformer Architecture: breakdown of encoder and decoder stacks, Layer normalization and residual connections, Masked self-attention in the decoder for auto-regressive generation, Pre-training and Fine-tuning.

Transformer-based Autoregressive Models: Overview, Architecture, Training, Applications, BERT (Bidirectional Encoder Representations from Transformers), T5 (Text-to-Text Transfer Transformer)

Chapter 6: Generative Models II: Large Language Models (LLMs)

Introduction to LLMs, Overview of Large Language Models (e.g., GPT-3, GPT-4), Training methodologies and scalability, Integration of LLMs in various generative tasks, Fine-tuning and transfer learning with LLMs, Building and deploying LLM-based applications.

Unit III

Chapter 7: Advanced Topics in Generative AI:

Flow-Based Models, Invertibility, Volume Preservation, Normalizing Flows, Invertible Convolution, Coupling Layers Sparse Attention Mechanisms, Multimodal Generative Models, Meta-Learning and Few-Shot Learning, Continual Learning and Transfer Learning, Privacy-Preserving Generative Models, Quantum Generative Models.

Chapter 8: Ethical Considerations and Responsible AI:

Bias and fairness in generative AI models, Privacy concerns and data protection in generative AI applications, Responsible use of generative models in society

Back to Semester- VI

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester:VI Semester**
Course Title: Computer Communication Networks I Lab		**Course Code: 23EECP303**
L-T-P: 0-0-1	**Credits: 1**	**Contact Hours: 2 Hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: --	**Examination Duration:2 Hrs**	

Experiment wise plan

1. Implement echo server using socket.
2. Implement a chat application using multiple client sockets.
3. Write a program to transfer a file from server using sockets.
4. Write a program for implement Cyclic Redundancy Check
5. Introduction to network operating system
6. Configure and demonstrate a VLAN.
7. Configure and analyze OSPF
8. Configure and demonstrate DHCP

   OPEN ENDED:
9. Configure and analyze BGP

   OR
10. Implement a Socket application

Text Books

1. Kurose & Ross, ComputerNetworkingATop-DownApproach,6theditionPEARSON, 2013.

Reference Books:

1. Cisco networking academy, https://www.netacad.com/
2. Juniper networking academy, https://learningportal.juniper.net/

Back to Semester- VI

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester:VI Semester
Course Title: Minor Project I		Course Code: 24EECW302
L-T-P: 0-0-6	Credits: 6	Contact Hours: 12 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 14Hrs	Examination Duration:2 Hrs	

Application Areas are,

- Smart City
- Connected Cars
- Home Automation
- Health care
- Smart energy
- Agriculture

<u>Guide lines for selection of a project:</u>

1. The project needs to encompass the concepts leant in a subject/s studied in the previous five semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the defined problem statement of the minor-projects.
2. Student can select a project which leads to a product or model or prototype.
3. Time plan: Effort to do the project should be between 120-150 Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).
4. Learning overhead should be 20-25% of total project development time.

<u>Criteria for group formation:</u>

1. 3-4 students in a team.
2. Role of teammates: Team lead and members.

<u>Allocation of Guides and Mentors for the projects:</u>

Every Project batch will be allocated with one faculty.

<u>Details of the project batches:</u>

1. Number of faculty members: 64
2. Number of students: 278

Role of a Guide

The primary responsibility of the guide is to help students to understand the meaning and need of various stages in the implementation of the project. At every stage of the project development, guide should help towards its successful completion as per the predefined standards.

How student should carry out a project:

1. **Define the problem**
2. **Specify the requirements**
3. **Specify the design in the understandable form (Block Diagram, Flowchart, Algorithm, etc)**
4. **Analyze the design**
5. **Select appropriate simulation tool and development board for the design.**
6. **Implement the design**
7. **Optimize the design and generate the results with optimized design.**
8. **Result representation and analysis**
9. **Prepare a document and presentation.**

Report Writing

The format for report writing should be downloaded from ftp://10.3.0.3/minorprojects
The report needs to be shown to guide and committee for each review.

Back to Semester- VI

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester:VI Semester
Course Title: Analog Integrated Circuit Design		Course Code: 24EECE301
L-T-P: 1-0-2	Credits: 3	Contact Hours: 5 Hrs/week
ISA Marks: 67	ESA Marks:33	Total Marks: 100
Teaching Hours: 30Hrs	Examination Duration:3 Hrs	

Unit I

1. **Basic MOS Device Physics:** General considerations, MOS I/V characteristics, second order effects and MOS device models.
2. **Current Mirrors:** Basic current Mirror, Widlar, Cascode and Wilson Current Mirrors.
3. **Single Stage Amplifiers:** CS, CG, CD, Cascode and Folded Cascode. Frequency response curves.

Unit II

4. **Differential Amplifiers:** Differential Amplifier, 5 pack differential Amplifier, CMRR, PSRR.
5. **Op-Amp:** Performance parameters, two stage (7-pack) Op-amp, Slew rate, PSRR, Noise in Op-amps.
6. **Compensation Technique:** Nyquist stability Criterion, Gain and Phase margins, Compensation of Two stage op-amp and Dominant pole compensation technique.

Unit III

7. **Reference Circuits:** Current reference, startup circuits, Bandgap reference circuit, Current mode Bandgap reference.
8. **Comparators:** Basic Comparator architecture, non-idealities-offset error, bandwidth consideration, Dynamic comparator

Text Books:

1. B Razavi 'Design of Analog CMOS Integrated Circuits' First Edition McGraw Hill 2001
2. Phillip. E. Allen, Douglas R. Holberg, "CMOS Analog circuit Design" Oxford University Press, 2002.

Reference Books:

1. Baker, Li, Boyce, "CMOS: Circuit Design, Layout and Simulation", Prentice Hall of India, 2000

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VI Semester
Course Title: Architectural Design of Integrated Circuits		Course Code: 24EECE302
L-T-P: 1-0-2	Credits: 3	Contact Hours: 5 Hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hours: 30Hrs	Examination Duration:3 Hrs	

Chapter No. 1. Digital Integrated Circuits

Challenges in digital design, Design metrics, Cost of Integrated circuits, ASIC, Evolution of SoC ASIC Flow Vs SoC Flow, SoC Design Challenges. Introduction to CMOS Technology, PMOS & NMOS Operation, CMOS Operation principles, Characteristic curves of CMOS, CMOS Inverter and characteristic curves, Delays in inverters, Buffer Design, Power dissipation in CMOS, CMOS Logic, Stick diagrams and Layout diagrams. Setup time, Hold Time, Timing Concepts.

Chapter No. 2. System Building Blocks

Modeling finite state Machines, Data Path and controller design, Synthesizable Verilog, Pipeline modelling

Chapter No. 3. Design and simulation of Micro - Architectural blocks

Efficient technique/s for Algorithm to Architecture Mapping, Recent Trends on Adder/Subtractor Design, Efficient VLSI Architectures for Various DSP blocks (FIR filter, CORDIC, FFT), Pipeline Implementation of Processor, Verilog Modeling of Processor

Chapter No. 4. Timing Analysis

Fundamentals of Efficient Design and Implementation strategies of Digital VLSI Design (Clock Tree synthesis, Timing Closure, Synthesis), Static Timing Analysis, Clock Skew.

Reference Books:

1. Digital Design by Morris Mano M, 4th Edition.
2. Verilog HDL: A Guide to Digital Design and Synthesis by Samir Palnitkar, 2nd Edition.
3. Principles of VLSI RTL Design: A Practical Guide by Sapan Garg, 2011.

Tools: Questa Sim, NC Verilog, NC Sim, CVER + GTKWave, VCSMX, Modelsim for Verilog

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VI Semester
Course Title: Internet of Things and its Applications		Course Code: 24EECE307
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4 Hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hours: 30Hrs	Examination Duration:2 Hrs	

Unit I

Chapter No. 1. Introduction to IoT

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges.

Chapter No. 2. Physical and Logical Design of IoT

Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs.

Chapter No. 3. Smart Objects: The "Things" in IoT

Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria.

Unit II

Chapter No. 4. IoT design and Methodology

Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device & Component Integration, Application Development.

Chapter No. 5. IoT Physical servers and Cloud Offerings

Introduction to Cloud Storage Models & Communication APIs, WAMP – AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework – Django, designing a RESTful Web API, Amazon Web Services for IoT, SkyNet IoT Messaging Platform.

Chapter No. 6. Data and Analytics for IoT

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology.

Unit III

Chapter No. 7. Securing IoT

A brief history about OT, Common challenges in OT Security, device level security, Software level securities.

Chapter No.8. IoT in Industry

Manufacturing: Introduction to connected manufacturing, an architecture for the connected factory, connected factory security.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 stEdition, VPT, 2014. (ISBN: 978-8173719547)

Reference Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VI Semester
Course Title: Information Theory and Coding		Course Code: 21EECE308
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40Hrs	Examination Duration:3 Hrs	

Unit I

Chapter 01. Review of information theory:

Basics of Information, Measure of information, Entropy.

Chapter 02. Discrete Channels:

Discrete memory less Channels, Mutual information, Channel Capacity, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

Chapter 03. Source Coding:

Encoding of the source output, Shannon's encoding algorithm. Source coding theorem, Binary, ternary and quaternary Huffman coding, Construction of instantaneous codes.

Unit II

Chapter 04. Introduction to Error Control Coding:

Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding, Generation of Hamming Codes.

Chapter 05. Binary Cycle Codes:

Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Systematic codes, non-systematic codes, Error detection and error correction (Syndrome calculation) circuits.

Chapter 06. Convolutional codes:

Convolution Codes, Time domain approach. Transform domain approach. Systematic Convolution codes, Maximum Likelihood Decoding of Convolutional codes.

Unit III

Chapter 07. Coding for burst error correction and other types of codes:

Burst and random error correcting codes, cyclic codes and convolutional codes for bursts error correction, Reed soloman codes, Cyclic redundancy codes, Golay codes, shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

Text Books

1. K. Sam Shanmugam, Digital and analog communication systems, John Wiley, 1996
2. Simon Haykin, Digital communication, John Wiley, 2003

Reference Books:

1. Ranjan Bose, ITC and Cryptography, TMH (reprint 2007), 2002
2. Glover and Grant, Digital Communications, 2, Pearson, 2008
3. D Ganesh Rao, K N Haribhat, Digital Communications, Sanguine, 2009

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester:VI Semester
Course Title: Embedded Intelligent Systems		Course Code: 24EECE310
L-T-P: 1-0-2	Credits: 3	Contact Hours: 5 Hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hours: 14Hrs	Examination Duration:3 Hrs	

1.Basics of embedded systems

Linux Application Programming, System V IPC, Linux Kernel Internals and Architecture, Kernel Core, Linux Device Driver Programming, Interrupts & Timers, Sample shell script, application program, driver source build and execute.

2.Heterogeneous computing

Basics of heterogeneous computing with various hardware architectures designed for specific type of tasks, Advanced heterogeneous computing with a. Introduction to Parallel programming b. GPU programming (OpenCL) c. Open standards for heterogeneous computing (Openvx), Basic OpenCL examples - Coding, compilation and execution.

3.ML Frameworks lab with the target device

Caffe, TensorFlow, TF Lite machine learning frameworks & architecture, Model parsing, feature support and flexibility, supported layers, advantages and disadvantages with each of these frameworks, Android NN architecture overview, Full stack compilation and execution on embedded device.

4. Model Development and Optimization

Significance of on device AI, Quantization, pruning, weight sharing, Distillation, Various pre-trained networks and design considerations to choose a particular pre-trained model, Federated Learning, Flexible Inferencing.

5.Android Anatomy

Android Architecture, Linux Kernel, Binder, HAL Native Libraries, Android Runtime, Dalvik Application framework, Applications, IPC.

Text Books

1. Linux System Programming, by Robert Love, Copyright © 2007 O'Reilly Media
2. Heterogeneous Computing with OpenCL, 2nd Edition by Dana Schaa, Perhaad Mistry, David R. Kaeli, Lee Howes, Benedict Gaster, Publisher: Morgan Kaufmann

Reference Books:

1. Deep Learning, MIT Press book, Goodfellow, Bengio, and Courville's
2. Beginning Android, by Wei-Meng Lee , Publisher: Wrox , O'Reilly Media

Back to List of Program Electives

Experiment wise plan

Expt./Job No.	Experiment/job Details
1.	Practice programs on Linux Application Programming, system IPC
2.	Implement toolchain, linker, and loaders while building Hello World on the host, then execute on target.
3.	Basic OpenCL examples - Coding, compilation, and execution
4.	High-level language to assembly language translation – optimization and power management.
5.	Implementation of Caffe TensorFlow, TF Lite machine learning frameworks & architecture. Execution of sample programs with various pre-trained models
6.	Full stack compilation and execution on an embedded device. Quantization, pruning, weight sharing, Distillation execution with parameters.
7.	Implement basic programs in the Android framework and implement Android NN architecture.
8.	Push the ML/DL model on an Android device and run the application.
9.	Design an ML/DL model for a given problem targeted at Android devices with different architectures based on provided specifications.

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester:VI Semester
Course Title: Multicore Architecture and Programming		Course Code: 23EECE340
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4 Hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hours: 30Hrs	Examination Duration: 2 Hrs	

Chapter No. 1: Introduction to Multicore

Drivers for Multicore Architectures: Low power, Performance/Throughput and need for memory bandwidth – Limits of single core computing – Moore's law - Limits to Instruction Level Parallelism (ILP) – Power and heat dissipation issue – Increased amount of data to process – Evolution from traditional System-On-Chip (SoC) to MPSoCs (Multi processor System-On-Chips) - Need for Multicore controllers in Automotive domain.

Chapter No. 2: Multicore Architecture

Dependent Multicore software and hardware architectures –Multicore hardware architecture overview: Heterogeneous and Homogenous Multicore hardware – Communication between hardware processing elements: Point-to-point connections, Shared buses, On-chip cross bar, Network-On-Chip (NoC) - Memory access in Multicore architectures: Symmetric Multi-Processing (SMP), Asymmetric Multi processing aka NUMA (Add pros and cons)– Multicore architecture specific to applications - Example Multicore hardware used in Automotive – Infineon Tricore series, ST devices.

Chapter No. 3: Scheduling concepts and OS aspects

What is Scheduling? – Static and Dynamic Scheduling - Scheduling algorithms: Rate Monotonic Scheduling (RMS), Fixed priority pre-emptive scheduling, Round robin scheduling, Earliest deadline first, first come First serve – Process and threads - What is pre-emption? Why is it needed? - Types of Multicore Scheduling: Global, Semi-partitioned and Partitioned –OS for General purpose and Real time systems - Scheduling in Single core vs Scheduling in Multicore – Timing Jitter.

Chapter No. 4: Concurrency and Parallelism

Amdahl's law – Need for Parallelism – Concurrency Fundamentals – Data parallelism, Functional Parallelism, loop Parallelism – Dependencies – Producer consumer`–– Need for Synchronization, Loop dependencies–Shared resources – Caching aspects - Problems with no synchronization - Synchronization primitives – Semaphore, Mutex, spinlocks, Test and Set, Compare and swap–Synchronization related issues and how to avoid them: Data races, Lovelocks, Deadlock, Non-atomic operations.

Chapter 5: Advanced Multicore topics – Introduction/Overview

Multicore timing analysis - Timing simulation: Why it is needed? – WCET (Worst Case Execution Time) analysis – Schedulability analysis – Additional challenges in Multicore - Tools used in automotive: Timing architect, ChronSIM, Sym TA/S- Deterministic behaviour – Logical Execution Time (LET)

Reference Books:

1. Highly Recommended: Real world Multicore embedded systems – Bryon Moyer
2. Highly Recommended for Embedded system and Real Time basics -Programming Embedded Systems with C and GNU Development Tools – Michael Barr

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: VI Semester**
Course Title: OOPS using C++		**Course Code: 25EECE321**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4 Hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hours: 30Hrs	**Examination Duration: 2 Hrs**	

Unit I

Chapter 1: Fundamental concepts of object-oriented programming:

Introduction to object-oriented programming, Programming Basics (keywords, identifiers, variables, operators, classes, objects), Arrays and Strings, Functions/ methods (parameter passing techniques).

Chapter 2: OOPs Concepts:

Overview of OOPs Principles, Introduction to classes & objects, Creation & destruction of objects, Data Members, Member Functions, Constructor & Destructor, Static class member, Friend class and functions, Namespace.

Unit II

Chapter 3: Inheritance:

Introduction and benefits, Abstract class, Aggregation: classes within classes Access Specifier, Base and Derived class Constructors, Types of Inheritance. Function overriding.

Chapter 4: Polymorphism:

Virtual functions, Friend functions, static functions, this pointer.

Unit III

Chapter 5: Exception Handling:

Introduction to Exception, Benefits of Exception handling, Try and catch block, throw statement, Pre-defined exceptions in C++, Writing custom Exception class.

Chapter 6: I/O Streams:

C++ Class Hierarchy, File Stream, Text File Handling, Binary File Handling
Error handling during file operations, Overloading << and >> operators

Text Books

1. Robert Lafore, "Object oriented programming in C++", 4th Edition, Pearson education, 2009.

Reference Books:

1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5ed, Addison Wesley, 2013.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VI Semester
Course Title: Multimodal Machine Learning		Course Code: 25EECE327
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4 Hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hours: 30Hrs	Examination Duration: 2Hrs	

Unit I

Chapter No.1: Introduction: Multimodal AI technologies, Multimodal behavior and signals, Dimensions of heterogeneity, Multimodal data types (text, audio and images)

Chapter No. 2: Challenges in multimodality: Representation, alignment, reasoning, generation, Transference and quantification

Chapter No. 3: Tools for multimodal learning: Introduction to deep learning techniques Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Auto Encoders and transformer- based models, and their application to multimodal data.

Unit II

Chapter No. 4 Natural Language Processing (NLP): Techniques for processing and analyzing textual data, including tokenization, embedding, and language models including BERT and GPT

Chapter No. 5 Computer Vision: Techniques for processing and analyzing image and video data, including object detection, segmentation, and classification

Chapter No. 6 Audio processing: Techniques for processing and analyzing audio data, including speech recognition, speaker identification, and music classification.

Unit III

Chapter No. 7 Knowledge distillation models: Response based, Feature based and Relation based knowledge distillation models.

Chapter No. 8 Evaluation and optimization: Techniques for evaluating multimodal machine learning models and optimizing their performance, including metrics, cross-validation, and hyperparameter tuning

Reference Books:

1. Clark, Alexander, Chris Fox, and Shalom Lappin, eds. The handbook of computational linguistics and natural language processing. Vol. 118. John Wiley & Sons, 2012.
2. Forsyth, David A., and Jean Ponce. Computer vision: a modern approach. prentice hall professional technical reference, 2002.
3. Christensen, Mads G. Introduction to audio processing. Springer, 2019.
4. Multimodal Machine Learning -CVPR 2022 Tutorial by Carnegie Mellon University

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester:VI Semester
Course Title: Dynamics of Linear Systems		Course Code: 24EECE341
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40Hrs	Examination Duration:3 Hrs	

Unit I

Chapter No. 1. Mathematical Background

Vector subspace, linear combination linear dependent, Basis, Span, Rank, Row space, Column space, Linear transformations, Eigen values, Eigen Vectors.

Chapter No. 2. State Variable Analysis

Introduction, concepts of state, state variables and state model, state-space representation for linear systems, State space modelling of Electrical Systems, State space modelling of Mechanical Systems.

Unit II

Chapter No. 3. State-space Representation

State Diagram, First Canonical form, Second Canonical Form, Jordan Canonical Form, Relationship between state equations and transfer function, Signal flow graph of state equations, Diagonalization (State transformation method), Time domain solution of state equations: Solution of homogeneous state equations, state transition matrix, evaluation of matrix exponential (e^{At}), solution of non-homogeneous state equations, Properties of State Transition Matrix, Computation of State transition Matrix: Unforced and Forced systems, Computation based on Caley Hamilton Theorem, Evaluation using Similarity transformation.

Unit III

Chapter No. 4. Controllability and Observability

Concept of Controllability and Observability, Controllability and Observability tests for continuous time systems: Gilbert test, Kalman's test, Complete Output Controllability, Pole placement techniques, Design via pole placement (Ackermann's formula), State observer design.

Text Books:

1. Katsuhiko Ogata, Discrete Time Control Systems, Prentice Hall of India Pvt. Ltd, 1995
2. I. J. Nagrath and M. Gopal, Control Systems Engineering, 5th, New Age International (P) Limited, 2011

Reference Books:

1. M. Gopal, Digital Control and State variable methods, TATA McGraw Hill Company
2. Benjamin C. Kuo, Digital Control Systems, Oxford University Press, USA, 1995

Back to List of Program Electives

7th Semester

Program: Electronics & Communication Engineering		**Semester: VII**
Course Title: Wireless and Mobile Networks		**Course Code: 25EECC403**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hours: 30Hrs	**Examination Duration: 2 Hrs**	

Unit I

Chapter No. 1. Local Area Networks: Error-detection and correction techniques, multiple access links and protocols, Link-Layer Addressing and ARP, Ethernet 802.3, Token ring 802.5, FDDI and LAN standards, Link-Layer Switches, Virtual Local Area Networks (VLANS).

Chapter No. 2. Wireless Networks: Introduction, Wireless Links and Network Characteristics, CDMA, WiFi: 802.11 Wireless LANs, The 802.11 Architecture, The 802.11 MAC Protocol, The IEEE 802.11 Frame, Mobility in the Same IP Subnet, Advanced Features in 802.11, Personal Area Networks: Bluetooth and Zigbee.

Unit II

Chapter No. 3 Cellular Networks: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular Subscribers, 4G LTE Cellular Networks: Architecture and Elements, LTE Protocols Stacks, LTE Radio Access Network, Additional LTE Functions: Network Attachment and Power Management, The Global Cellular Network: A Network of Networks

Chapter No. 4: 5G Networks-1: Basics of 5G Technology: Overview of 5G architecture, Layered Architecture, Key features and requirements, Spectrum considerations for 5G

Mobility Management: Principles, Device Mobility: a Network-layer Perspective, Home Networks and Roaming on Visited Network, Direct and Indirect Routing to/from a Mobile Device, Mobility Management in Practice, Mobility Management in 5G Networks Mobile IP, Wireless and Mobility: Impact on Higher-Layer Protocols

Text Book (List of books as mentioned in the approved syllabus)

1.Kurose & Ross, Computer Networking A Top-Down Approach, 6th edition, PEARSON, 2013.

2.5G NR: The Next Generation Wireless Access Technology &quote; Erik Dalman, Stefan Parkvall, Johan Sköld , Academic Press

References

1.Behrouz A. Forouzan, 1. Data Communications and Networking, 4th Edition, Tata McGraw, 2006

2.Larry L. Peterson and Bruce S. Davie, Computer Networks A Systems Approach, : 4th Edition, Elsevier, 2007

Back to Semester- VII

Program: Electronics & Communication Engineering		Semester: VII
Course Title: CIPE & EVS		Course Code: 15EHSC402
L-T-P: 2-0-0	Credits: Audit	Contact Hours: 2 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 30Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter No. 1 Features of Indian Constitution : Features of Indian Constitution, Preamble to the constitution of India, Fundamental rights under Part III – details of Exercise of rights, Limitations & Important cases. Berubari Union and Exchange of Enclaves, Kesavan and Bharati vs. UOI, Maneka Gandhi vs. UOI, Air India Ltd. vs. NargeesMeerza, T.M.A. Pai Foundation v. St. of Karnataka, M.C. Mehta vs. UOI etc.,

Chapter No. 2 Relevance of Directive principles of State Policy : Relevance of Directive principles of State Policy under Part IV, Fundamental duties & their significance. SarlaMudgal v. UOI

Chapter No. 3 Union : Union – President, Vice President, Union Council of Ministers, Prime Minister, Parliament & the Supreme Court of India.

Chapter No.4 State : State – Governors, State Council of Ministers, Chief Minister, State Legislature and Judiciary.

Chapter No. 5 Constitutional Provisions for Scheduled Castes & Tribes : Constitutional Provisions for Scheduled Castes & Tribes, Women &Children & Backward classes, Emergency Provisions.

Chapter No. 6 Electoral process : Electoral process, Amendment procedure, 42nd, 44th and 86th Constitutional amendments.

Unit II

Chapter No. 7 Scope & Aims of Engineering Ethics : Scope & Aims of Engineering Ethics: Meaning and purpose of Engineering Ethics, Responsibility of Engineers, Impediments to responsibility, Honesty, Integrity and reliability, risks, safety & liability in engineering. Bhopal Gas Tragedy, Titanic case.

Chapter No. 8 Intellectual Property Rights : Intellectual Property Rights (IPRs)- Patents, Copyright and Designs

Chapter No. 9 Ethical perspectives of professional bodies : Ethical perspectives of professional bodies- IEEE, ASME, NSPE and ABET, ASCE etc.

Unit III

Chapter No. 10 Effects of human activities on environment

Effects of human activities on environment - Agriculture, Housing, Industry, Mining, and Transportation activities, Environmental Impact Assessment, Sustainability and Sustainable Development.

Chapter No. 11 Environmental Protection

Environmental Protection – Constitutional Provisions and Environmental Laws in India.

Text Book (List of books as mentioned in the approved syllabus)

1. Dr. J. N. Pandey, “Constitutional Law of India”, Central Law Agency, 2005
2. Dr. M.K. Bhandari, “Law relating to Intellectual Property Rights”, Central Law Publications, Allahabad, 2010.
3. Charles E. Harris and others, “Engineering Ethics: Concepts and Cases”, Thomson Wadsworth, 2003

References

1. Durga Das Basu, “Introduction to the Constitution of India”, Prentice-hall EEE, 2001
2. Mike Martin and Ronald Schinzinger, “Ethics in Engineering”, Tata McGraw-Hill Publications.

Back to Semester- VII

Program: Electronics & Communication Engineering		Semester: VII
Course Title: Senior Design Project		Course Code: 20EECW401
L-T-P: 0-0-6	Credits: 6	Contact Hours: 12 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: --	Examination Duration: 3 Hrs	

- Smart City
- Connected Cars
- Home Automation
- Health care
- Smart energy
- Automation of Agriculture

Guide lines for selection of a project:

- The project needs to encompass the concepts learnt in the previous semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the defined problem statement of the project work.
- Student can select a project which leads to a product or model or prototype.
- Time plan: Effort to do the project should be between 60-70 Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).
- Learning overhead should be 20-25% of total project development time.

Criteria for group formation:

- 3-4 students in a team.
- Role of teammates: Team lead and members.

Allocation of Guides and Mentors for the projects:

Every Project batch will be allocated with one faculty.

Details of the project batches:

- Number of faculty - members: 50
- Number of students:3-4 students in a team.

Role of a Guide

The primary responsibility of the guide is to help students to understand the meaning and need of various stages in the implementation of the project. At every stage of the project development, guide should help towards its successful completion as per the predefined standards.

How student should carry out a project:

- **Define the problem.**
- **Specify the requirements.**
- **Specify the design in the understandable form (Block Diagram, Flowchart, Algorithm, etc).**
- **Analyze the design and identify hardware and software components separately.**
- **Select appropriate simulation tool and development board for the design.**
- **Implement the design.**
- **Optimize the design and generate the results.**
- **Result representation and analysis.**
- **Prepare a document and presentation.**

Report Writing

- **The format for report writing should be downloaded from ftp://10.3.0.3/projects**
- **The report needs to be shown to guide and committee for each review.**
-

Evaluation Scheme

- **Internal semester assessment (ISA)**
- **Evaluation is done based on the evaluation rubrics given in Table 1**
- **Project shall be reviewed and evaluated by the concerned Guide for 50% of the marks.**
- **Project shall be evaluated by the review committee for 50% of the marks.**

Back to Semester- VII

7th semester Electives

Program: Electronics & Communication Engineering		**Semester: VII**
Course Title: System Verilog for Verification		**Course Code: 25EECE418**
L-T-P: 1-0-2	**Credits: 3**	**Contact Hours: 5 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hours: 14 Hrs	**Examination Duration: 3 Hrs**	

Chapter No. 1. Verification Concepts

Concepts of verification, importance of verification, Stimulus vs Verification, functional verification, test bench generation, functional verification approaches, typical verification flow, stimulus generation, direct testing, Coverage: Code and Functional coverage, coverage plan**.**

Chapter No. 2. System Verilog – Language Constructs

System Verilog constructs - Data types: two-state data, strings, arrays: queues, dynamic and associative arrays, Structs, enumerated types. Program blocks, module, interfaces, clocking blocks, mod-ports.

Chapter No. 3. System Verilog – Classes & Randomization

SV Classes: Language evolution, Classes and objects, Class Variables and Methods, Class instantiation, Inheritance, and encapsulation, Polymorphism.

Randomization: Directed Vs Random Testing. Randomization: Constraint Driven Randomization.

Chapter No. 4. System Verilog – Assertions & Coverage

Assertions: Introduction to Assertion based verification, Immediate and concurrent assertions. Coverage driven verification: Motivation, Types of coverage, Cover Group, Cover Point, Cross Coverage, Concepts of Binning and event sampling.

Chapter No. 5. Building Testbench

Layered testbench architecture. Introduction to Universal Verification Methodology, Overview of UVM Base Classes and simulation phases in UVM and UVM macros. Unified messaging in UVM, UVM environment structure, Connecting DUT- Virtual Interface

Reference Books

1. System Verilog LRM
2. Chris Spear, Gregory J Tumbush – System Verilog for verification - a guide to learning the testbench language features - Springer, 2012

Tools: Questa Sim, NC Verilog, NC Sim, CVER + GTKWave, VCSMX, Modelsim for Verilog

Back to List of Program Electives

Program: Electronics & Communication Engineering		**Semester: VII**
Course Title: Speech Processing		**Course Code: 24EECE422**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hours: 30Hrs	**Examination Duration: 2 Hrs**	

Unit I

Chapter 1: Introduction : Speech production and perception, nature of speech; short-term processing: need, approach, time, frequency and time-frequency analysis.

Chapter 2: Short-term Fourier transform (STFT): Overview of Fourier representation, non-stationary signals, development of STFT, transform and filter-bank views of STFT.

Chapter 3: Cepstrum analysis: Basis and development, delta, delta-delta and mel-cepstrum, homomorphic signal processing, real and complex cepstrum.

Unit II

Chapter No 4: Linear Prediction (LP) analysis: Basis and development, Levinson-Durbin's method, normalized error, LP spectrum, LP cepstrum, LP residual.

Chapter 5: Sinusoidal analysis: Basis and development, phase unwrapping, sinusoidal analysis and synthesis of speech.

Chapter 6: Mathematical models and Applications: Gaussian mixture models and hidden Markov models

Unit III

Chapter No 7: Introduction to Bayesian Approach: Bayesian classification, Bayesian Learning, Bayes Optimal Classifier, Naive Bayes Classifier and Bayesian Network.

Chapter 8: Introduction to Speech Technologies: Automatic Speech recognition, speaker recognition, speaker diarization, speech synthesis, language and dialect identification and speech coding

Text Books:

1. L.R. Rabiner and R.W. Schafer, Digital Processing of Speech Signals Pearson Education, Delhi, India, 2004
2. J. R. Deller, Jr., J. H. L. Hansen and J. G. Proakis Discrete-Time Processing of Speech Signals, Wiley-IEEE Press, NY, USA, 1999.

Reference Books:

1. D. O'Shaughnessy, Speech Communications: Human and Machine, Second Edition, University Press, 2005.
2. T. F. Quatieri, "Discrete time processing of speech signals", Pearson Education, 2005.
3. L. R. Rabiner, B. H. Jhuang and B. Yegnanarayana, "Fundamentals of speech recognition", Pearson Education, 2009.

Back to List of Program Electives

Program: Electronics & Communication Engineering		**Semester: VII**
Course Title: Multimedia Communication		**Course Code: 18EECE410**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours:3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40Hrs	**Examination Duration: 3 Hrs**	

Unit I

Chapter 1: Introduction to Multimedia: Multimedia and Hyper media, WWW, overview of multimedia software tools.

Chapter 2: Graphics and Image representation: Graphics / Image data types, Popular file formats.

Chapter 3: Fundamental concepts in video: Types of video signals, analog video, digital video.

Chapter 4: Basics of digital audio: Digitization of sound, MIDI, Quantization and transmission of audio.

Unit II

Chapter 4: Lossless compression algorithms: Introduction, run-length coding, variable length coding, dictionary-based coding, arithmetic coding, lossless image compression.

Chapter 5: Lossy compression algorithms: Introduction, distortion measures, quantization, transform coding, wavelet-based coding, wavelet packets, embedded zero tree of wavelet coefficients.

Chapter 6: Image compression standards: The JPEG standard, The JPEG2000 standard, The JPEG-LS standard, Bi level image compression standard.

Unit III

Chapter 7: Basics video compression techniques: Overview, video compression based on motion compensation, H.261

Chapter 8: Overview of MPEG-1, 2 4 and 7.

Text Books

1. Ze-Nian Li & Mark S Drew, “Fundamentals of multimedia”, Pearson Education, 2004**.**

References

1. Ralf Steinmetz & Kalra Nahrstedt, “Multimedia: Computing, Communication & Applications”, Pearson Education, 2004
2. K R Rao, Zoran S Bojkovic, Dragord A Milovanvic, Pearson education, “Multimedia communication systems: Techniques, Standards, & Networks”, Second Indian reprint, 2004.

Back to List of Program Electives

Program: Electronics & Communication Engineering		Semester: VII
Course Title: Physical Design - Analog		Course Code: 25EECE419
L-T-P: 1-0-2	Credits: 3	Contact Hours:5 hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hours: 14 Hrs	Examination Duration: 3 Hrs	

Chapter No 1. Standard cell Layout creation

Layout Practice Sessions (DRC/LVS Dirty layout), Understanding verification errors, Error debugging skills, Hands on experience of using layout editor, Quality of the layout, Half DRC rules, Mega module creation.

Chapter No 2. Analog layout

Importance of performance in Analog layout, Importance of floor planning and placement, Attributes need to be taken care during routing stage, Introduction to DRC, LVS, Density and RCX.

Chapter No 3. Matching

Introduction to mismatch concepts, Causes for mismatch, Types of mismatches, Rules for matching, Activities.

Chapter No 4. Guard ring and shielding

Guard ring- need of guard ring, what is guard ring, Usage of guard ring shielding- What is shielding, Types of shielding, importance of shielding.

Chapter No 5. Physical design of amplifier and buffer

Applying the studied concepts and doing layout, Prioritising the constraints given, Quality checks, Buddy reviews and implementations, Documentation

References

1. The Art of Analog Layout – Alan Hastings
2. CMOS IC layout – Dan Clien
3. IC Layout Basics – Chris saint and Judy saint

Back to List of Program Electives

Program: Electronics & Communication Engineering		Semester: VII
Course Title: CMOS ASIC Design		Course Code: 25EECE420
L-T-P: 1-0-2	Credits: 3	Contact Hours: 5 hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hours: 14 Hrs	Examination Duration: 3 Hrs	

Chapter No. 1. Introduction:

Design of combinational and sequential logic gates in CMOS. Layout and characterization of standard cells. Verilog for representing gate level netlists.

Chapter No. 2. Timing Analysis:

Sequential circuit timing and static timing analysis. Cell and net delays and cross-talk. Rationale and implementation of scan chains for testing standard-cell based logic circuits. Timing Verification: Setup Timing Check, Hold Timing Check, Timing across Clock Domains

Chapter No. 3: Physical design

Physical design of standard-cell based CMOS ASICs: scan insertion, placement, and clock tree synthesis and routing. Netlist transformations at each step of the physical design process. Net parasitic and parasitic extraction. Use of PLLs for clock generation and de-skew.

Chapter No. 4. Standard Data formats:

Standard data formats for representing technology and design: LEF, Liberty, SDC, DEF and SPEF. Clock gating and power gating for reduction of device power consumption. Design for reliability: electro- migration, wire self heat and ESD checks and fixes.

Chapter No. 5. Packaging

An overview of package design and implementation and system level timing.

Reference Books:

1. The Design & Analysis of VLSI Circuits, L. A. Glassey & D. W. Dobbepahl, Addison Wesley Pub Co. 1985.
2. H. Bhatnagar, Advanced ASIC Chip Synthesis Using Synopsys Design Compiler Physical Compiler and Prime Time, 2nd edition, 2001.
3. Static Timing Analysis for Nanometre Designs A Practical Approach, J. Bhasker • Rakesh Chadha, Springer Science Business Media, LLC 2009

Tools: Cadence Innovous, Encounter

Back to List of Program Electives

Program: Electronics & Communication Engineering		Semester: VII
Course Title: Microwave & Antenna		Course Code: 23EECE411
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter No. 1. Microwave Vacuum Tube Devices: Introduction, Reflex Klystron, Problems.

Chapter No. 2. Microwave Network Theory & Passive Devices: Introduction, S- Matrix Representation of Multiport network, Microwave Passive Devices: Directional couplers, Circulators, Magic T, Isolator, Attenuators, Numerical. Microwave Applications: Microwave Radar systems, microwave communication system, industrial applications of microwave: Microwave heating, thickness and moisture content measurement.

Unit II

Chapter No. 3. Antenna Parameters: Introduction, Basic antenna parameters, Pattern, Beam width, Radiation intensity, Beam efficiency, Directivity, Gain, Aperture, Effective height, Polarization, Antenna field zone, The radio communication link. Radiation resistance of Short electric dipole and half wave length antenna.

Chapter No. 4. Sources and Arrays: Introduction, Point sources, Power patterns, Power theorem, Examples on power theorem, Directivity and beam width of point sources, Arrays of two isotropic point sources, Non isotropic but similar point sources and Pattern multiplication, Linear array of n isotropic point sources of equal amplitude and spacing, Broad side array, End fire array.

Unit III

Chapter No. 5. Antenna practice: Yagi-Uda Antenna, Dipole/Monopole antenna, Loop antenna, Horn antenna, Parabolic reflector, Helical antenna, Log periodic antenna, Microstrip Patch Antenna, Mobile Station Antennas, Antennas for GPR: Pulse Bandwidth, Embedded Antennas, UWB Antennas for Digital Applications, The Plasma Antenna, Types of antenna for 4G/LTE and 5G.

Text Book (List of books as mentioned in the approved syllabus)

1. Annapurna Das, Sisir K Das, Microwave engineering, TMH Publications, 2001.
2. J.D. Kraus & Khan, Antennas, third edition, MGH publication, 2006.
3. Liao, Microwave Devices and Circuits, PHI Pearson Education.

References

1. John Krauss and Daniel, Electromagnetics with Applications, 5th, McGraw-Hill, 1999.
2. E.C.Jordan, Electromagnetic waves & radiating systems, second edition, PHI publication.
3. K.D.Prasad, “Antenna and wave propagation” first edition, 1990.
4. C.A.Balnis “Antenna theory and analysis and design”, third edition,1999.

Back to List of Program Electives

Program: Electronics & Communication Engineering		**Semester: VII**
Course Title: AUTOSAR		**Course Code: 25EECE406**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hours: 26 Hrs	**Examination Duration: 2 Hrs**	

Chapter No. 1: AUTOSAR Fundamentals

Evolution of AUTOSAR – Motivations and Objectives AUTOSAR consortium – Stake holders – work Packages, AUTOSAR Partnership, Goals of the partnership, Organization of the partnership, AUTOSAR specification, AUTOSAR Current development status, BSW Conformance classes: ICC1, ICC2, ICC3, and Drawbacks of AUTOSAR.

Chapter No. 2: AUTOSAR layered Architecture

AUTOSAR Basic software, Details on the various layers , Details on the stacks Virtual Function Bus (VFB) Concept Overview of AUTOSAR Methodology , Tools and Technologies for AUTOSAR Application Software Component (SW-C) ,Types of SW-components AUTOSAR Run Time Environment (RTE): RTE Generation Process: Contract Phase, Generation Phase, MCAL, IO HW Abstraction Layer, Partial Networking, Multicore, J1939 Overview, AUTOSAR Ethernet, AUTOSAR E2E Overview , AUTOSAR XCP, Metamodel , From the model to the process , Software development process.

Chapter No. 3: Methodology of AUTOSAR and Communication in AUTOSAR

CAN Communication, CAN FD, CANape, Application Layer and RTE, intra and inter ECU communication, Client-Server Communication, Sender-Receiver, Communication, CAN Driver, Communication Manager (ComM), Overview of Diagnostics Event and Communication Manager

Chapter No. 4: Overview about BSW constituents

BSW Constituents: Memory layer, COM and Services layer, ECU abstraction, AUTOSAR, operating system, Interfaces: Standard interface, AUTOSAR standardized interface, BSW-RTE interface, (AUTOSAR interface), BSW-ECU hardware interface, Complex device drivers and BSW module configuration, AUTOSAR Integration.

Chapter 5: MCAL and ECU abstraction Layer

Microcontroller Drivers, Memory drivers: on-chip and off chip drivers, IO drivers (ADC, PWM, DIO), Communication drivers: CAN driver, LIN drivers, Flexrfay

Chapter 6: Service Layer

Diagnostic Event Manager, Function inhibits Manager, Diagnostic communication manager, Network management, Protocol data unit router, Diagnostic log and trace unit, COMM manager.

Text Book (List of books as mentioned in the approved syllabus)

1. Ronald K. Jurgen, Infotainment systems, 2007, SAE International, 2007

Back to List of Program Electives

Program: Electronics & Communication Engineering		Semester: VII
Course Title: Human Machine Interface		Course Code: 25EECE428
L-T-P: 1-0-2	Credits: 3	Contact Hours: 5 hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hours: 14 Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter 1: Introduction to HMI

Overview of HMI, general introduction to HMI, HMI Architecture & Concepts/HMI Sub-Components (Widgets, Framework, state machine)

Chapter 2: Automotive HMI

Evolution of HMI in cars, HMI for car multimedia, GUI Tools (GTK, QT, HTML5)

Lab: Widget design using GUI tools

Chapter 3: UX and Guidelines

Introduction to UX design (theory, design thinking), graphics design (Blender, GIMP), 2D/3D rendering, OpenGL, GPU architectures, shader programming

Lab: UX design using OpenGL, rendering using Blender.

Unit II

Chapter 4: Car Multimedia

Instrument cluster, in-vehicle infotainment, professional system/ rear-seat entertainment.

Lab: Design instrument cluster for dashboard and infotainment control

Chapter 5: App Development and Testing

App development for Android/ iOS, Unity, HMI testing and automation

Lab/ Project: Design an app to control vehicle infotainment system using a mobile device

Chapter 6: Advanced Topics

Voice/ Gesture control, haptics, eye gaze sensor, Virtual/ Augmented Reality, Analytics

References:

1. The Handbook of Human-Machine Interaction: A Human-Centered Design Approach. Eds. G. A. Boy, CRC Press.

2. Designing for Situation Awareness: An Approach to User-Centered Design. M. R. Endsley & D. G. Jones, CRC Press.

3. The Humane Interface: New Directions for Designing Interactive Systems. J. Raskin, Addison-Wesley.

4. Tutorials for tools/ libraries: Blender, GIMP, GTK, QT, unity, OpenGL

Back to List of Program Electives

Program: Electronics & Communication Engineering		Semester: VII
Course Title: Wireless & Mobile Communication		Course Code: 24EECE432
L-T-P: 3-0-0	Credits: 3	Contact Hours:3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter 01 Radio Propagation

Free space propagation model, Relating power to electric field., Relation, ground reflection, scattering, Practical link budget design using path loss model, Outdoor propagation models, Signal penetration into buildings, Ray tracking and site specific modelling, Small scale Multipath measurements, Parameters of mobile Multipath channels, Types of small scale fading.

Unit II

Chapter 02 Diversity techniques

Concept of Diversity branch and signal paths, Combining and switching methods, C/N, C/I performance improvements, RAKE receiver.

Chapter 03 Cellular concept

Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trucking and grade of service, improving coverage, Capacity in cellular systems, FDMA, TDMA, Pseudo noise sequences, notion of spread spectrum, processing gain and Jamming margin, direct sequence spread spectrum, frequency hop spread spectrum, Spread spectrum multiple access, SDMA packet radio. Capacity of cellular systems.

Unit III

Chapter 4: 5G: Implementation, components of the 5G, 5G architecture, 5G design, 5G network, 5G applications, Advantages and disadvantages

Chapter 5: Satellite orbits GEO, MEO, LEO and applications.

Fiber to the home (FTTH): Working, FTTH architecture and components, benefits, advantages and disadvantages

Text Book (List of books as mentioned in the approved syllabus)

1. T.S. Rapport, Wireless Communication, 2, Pearson Education, 2002

References

1. Kamil O Feher, Wireless digital communications: Modulation and spread spectrum Techniques, Prentice Hall of India, 2004
2. Vijay K Garg, IS_95 CDMA and cdma 2000, Pearson publication pvt. Ltd, 2004
3. Xiaodong Wang and Vincent Poor, wireless Communicating system: Advanced Techniques for signal Reception, Pearson publication pvt. Ltd, 2004

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: 5G & Software Defined Networking		Course Code: 24EECE434
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40Hrs	Examination Duration: :3 Hrs	

Unit I

Chapter No. 1: Overview of 5G Technology

Introduction to 5G NR and its importance in wireless communication
Evolution from previous generations (1G to 4G) and key differences
Use cases and applications of 5G technology
Overview of 5G architecture and protocol stack
Exploring NS-3 (Network Simulator 3) for code development

Chapter No. 2. Physical Layer Design and Techniques

Physical layer in 5G NR, waveforms, numerology, and frame structure
Understanding modulation, coding, and MIMO techniques in 5G NR
Hands-on exercises on simulating and implementing physical layer techniques using C/NS-3

- Simulating Basic NR Waveforms
- Implementing 5G NR Frame Structure
- Coding and Decoding Techniques in 5G NR

Chapter No. 3. Protocol Stack and Radio Access Network (RAN)

Overview of the protocol stack layers in 5G NR, including PHY, MAC, RLC, PDCP, and RRC. Understanding the functions and interactions between different protocol layers.5G RAN architecture, including gNBs (Next-Generation NodeBs) and NG-RAN interfaces.

- Implementing Basic NR Physical Layer Procedures
- Designing a Simple NR MAC Scheduler
- Implementing RLC Layer Functionality for Data Segmentation and Reassembly
- Developing PDCP Layer for Header Compression and Encryption
- Establishing RRC Connection Setup and Management

Unit II

Chapter No. 4. Core Network Protocols and Technologies

Exploration of core protocols and technologies in 5G NR, including core network architecture, network slicing, and service-based architecture (SBA)

Implementation of key core network protocols using software-defined networking (SDN) principles and open-source tools

- Simulating Basic Network Functionality in 5G Core
- Implementing Authentication and Security Mechanisms
- Setup of Basic Session Management in 5G Core

Chapter No. 5. Network Slicing, Quality of Service (QoS), and Emerging Trends

Understanding network slicing concepts and its role in enabling customized services in 5G NR

Implementation of network slicing and QoS management using SDN principles and open-source software platforms. Overview of emerging technologies beyond 5G NR, research challenges, and opportunities

Unit III

Chapter No. 6. Software-Defined Networking and Virtualization

Open Flow Concepts: Match fields and actions in OpenFlow protocol

Flow tables and pipeline stages in OpenFlow switches

SDN Controllers: Centralized, distributed, and hybrid SDN controller architectures

Overview of popular SDN controllers: Open Daylight, ONOS, Ryu, Floodlight

SDN Applications: Traffic engineering and load balancing in SDN networks

Network slicing and virtualization for resource allocation

Programmable Data Planes: Overview of programmable data plane technologies such as P4 Benefits and challenges of programmable data planes in SDN

Network Function Virtualization (NFV): Introduction to NFV and its relationship with SDN NFV orchestration and service chaining for network services

Text Books

1. "5G NR: The Next Generation Wireless Access Technology" by Erik Dahlman, Stefan Parkvall, Johan Sköld (Academic Press)
2. “Software-Defined Networking: Anatomy of OpenFlow” by Flavio Esposito, William M. Jr. (O’Reilly Media)

Reference Books:

1. "5G Mobile Communications" by Mischa Dohler, Afif Osseiran (Wiley)
2. "Software Defined Networks: A Comprehensive Approach" by Paul Goransson, Chuck Black (Morgan Kaufmann)

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Product and Functional Safety		Course Code: 24EECE433
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hours: 40Hrs	Examination Duration: :3 Hrs	

Unit I

Chapter 1: Introduction to Product Safety

Introduction, What Is Safety? Product-Safety Management versus Product-Safety Engineering, Product Safety and Product-Safety Engineering, History and Safety, Product Liability

Chapter 2: International Regulations and Global Market Access

Regional Regulations: How They Differ, CE Marking, NRTLs, Certification Body (CB) Scheme, Product Certification Marks, ISO Registration Process

Chapter 3: Product Safety Standards

Introduction, Product Safety and Standardization, What Is a Standard? Structure of the Product Safety Standard, Conformity to Product Safety Standards, Objectives for Products Safety Standards, Product Safety Standard Developers.

Unit II

Chapter 4: Hazards, Risks, Accidents, and Outcomes

Introduction, Recent History of System Safety, Hazards, Risks, Accidents and Outcomes, Risk Estimation, Risk Management

Chapter 6: Functional Safety in Road Vehicles

Introduction, Quality Management System, Process Models, Automotive and Safety life cycles, Hazard Analysis and Risk Assessment according to ISO 26262, Safety Goals, Safety Concepts, Product Development at System and component Level, Verifications and Tests, Safety Validation, Approvals/Releases

Unit III

Chapter 5: Methods for Failure Analysis

Introduction to analysis, FMEA, FTA, HAZOP, AEA

Chapter 7: STPA, SOTIF and ISO

Introduction to STPA, SOTIF, Integration with ISO

Text Books

1. "Engineering Ethics and Design for Product Safety", 1st Edition, ISBN: 9781260460537, McGraw Hill.

2. "Electrical product compliance and safety engineering", Steli L., Constantin B., Jan Swart, Artech House, 2017
"Functional Safety for Road Vehicles New Challenges and Solutions for E-mobility and Automated Driving", Hans-Leo Ross, Springer International Publishing Switzerland 2016.

Reference Books:

1. "The Safety Critical Systems Handbook a Straightforward Guide to Functional Safety: IEC 61508", David Smith, Kenneth Simpson, Elsvier
2. "Assessment of Safety Standards for Automotive Electronic Control Systems", Van Eikema Hommes, Qi D, National Highway Traffic Safety Administration
"Functional Safety: A Straightforward Guide to Applying IEC 61508 and Related Standards", David J. Smith and Kenneth G. L. Simpson.

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: VII**
Course Title: Advance IC Packaging		**Course Code: 25EECE436**
L-T-P: 1-0-2	**Credits: 3**	**Contact Hours: 5 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks:100**
Teaching Hours: 14Hrs	**Examination Duration: 3hrs**	

Chapter 1: Introduction to Advanced Semiconductor Packaging

- Overview of semiconductor packaging
- Evolution of packaging technologies
- Challenges and trends in advanced packaging

Chapter 2: Packaging Materials and Processes

- Materials used in advanced packaging
- Assembly and packaging processes
- Flip-chip, wafer-level packaging, and 3D packaging
- Thermal and reliability considerations

Chapter 3: System-in-Package (Sip) and Multi-Chip Modules (MCM)

- Introduction to Sip and MCM
- Design considerations for Sip and MCM
- Introduction to SerDes, on-die PHYs and signal integrity

Chapter 4: Advanced Interconnect Technologies

- Micro bump and fine-pitch technologies
- Through-Silicon Via (TSV) and 3D interconnects
- High-density interconnects (HDI)

Chapter 5: Layout of Package Substrates (Lecture & Lab)

- Review provided bump-to-ball connectivity data and fill out assigned lab worksheet
- Open single-die package layout database in a commercial package design tool such as APD+ and explore signal routing and power planes, filling out assigned lab worksheet
- Given a bump-to-ball map and substrate layer information, implement substrate layout

Chapter 6: Layout of Silicon Interposers (Lecture & Lab)

- Layout a silicon interposer given a micro bump map for an ASIC and C4 ball assignments using a commercial router such as in Novus

Reference Books

1. Rao R Tummala, Fundamentals of Device and Systems Packaging, McGraw Hill, 2020.
2. Glenn R. Blackwell, The Electronics Packaging Handbook, CRC Press, 2017.
3. Bernard S Matisoff, Handbook of Electronics Packaging Design and Engineering, Springer, 2012.
4. Rao R Tummala, Fundamentals of Microsystems Packaging, McGraw Hill, 2001.

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics and Communication Engineering)		**Semester: VII Semester**
Course Title: Design For Testability		**Course Code: 25EECE447**
L-T-P: 1-0-2	**Credits: 3**	**Contact Hours: 5 Hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hours: 16 Hrs	**Examination Duration: 3 Hrs**	

Chapter No. 1. Introduction to Design for Testability

- Overview of the importance of design for testability in modern electronic systems.
- Historical context and evolution of testability strategies.
- Introduction to key concepts: fault models, testing methodologies, and industry standards **(3 Hrs)**

Chapter No. 2. Built-in Self-Test (BIST) Techniques

- Principles and implementation of built-in self-test techniques.
- Advantages and limitations of BIST in electronic circuit testing.
- Lab sessions: Simulations and exercises focusing on BIST. **(3 Hrs)**

Chapter No. 3. Scan Chains and Serial Testing

- Concept of scan chains and their role in serial testing.
- Implementation and optimization of scan chains for improved testability.
- Lab sessions: Hands-on exercises with scan chain design and testing **(2 Hrs)**

Chapter No. 4. Fault Modeling and Simulation

- Development of fault models for electronic circuits.
- Utilization of simulation tools to predict and analyze potential faults in a design.

and deskew. **(2 Hrs)**

Chapter No. 5. Design for Testability Strategies

- Exploration of various design for testability strategies.
- Case studies: Analyzing successful implementations of design for testability. **(1.5 Hrs)**

Chapter No. 6. Industry Standards in Testability

- Overview of industry standards related to testability.
- Compliance and certification requirements for testable designs. **(1.5 Hrs)**

Reference Books:

1. Tripathi, Suman. Advanced VLSI Design and Testability Issues. CRC Press, 2020.

2. Wang, Laung-Terng. VLSI Test Principles and Architectures. Morgan Kaufmann, 2006.

3. Huhn, Sebastian. Design for Testability, Debug and Reliability. Springer Nature, 2021.

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics and Communication Engineering)		**Semester: VII**
Course Title: Signal and Power Integrity		**Course Code: 25EECE448**
L-T-P: 1-0-2	**Credits: 3**	**Contact Hours: 5 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hours: 14 Hrs	**Examination Duration: 3 Hrs**	

Unit I

Chapter No. 1. Introduction to EMC and Signal Integrity

- Overview of Electromagnetic Compatibility (EMC) and Signal Integrity
- Importance of EMC in electronic systems and its impact on signal integrity **(7 Hrs)**

Chapter No. 2. EMC Standards and Regulations

- Study of international EMC standards and regulatory requirements
- Case studies on the consequences of non-compliance **(8 Hrs)**

Unit II

Chapter No. 3. Signal Integrity Fundamentals

- Fundamentals of signal integrity in high-speed digital and mixed-signal designs
- Analysis of transmission line effects, reflections, and signal degradation **(7 Hrs)**

Chapter No. 4. PCB Layout Considerations

- PCB layout techniques for EMC and signal integrity
- High-speed routing guidelines, power distribution, and grounding strategies **(8 Hrs)**

Unit III

Chapter No. 5. EMI Mitigation Techniques

- Strategies for minimizing electromagnetic interference (EMI)
- Filtering, shielding, and grounding techniques for EMI mitigation **(6 Hrs)**

Chapter No. 6. Simulation Tools for Signal Integrity

- Introduction to simulation tools for signal integrity analysis
- Hands-on exercises using simulation software to predict and optimize signal integrity. **(6 Hrs)**

References:

1. Bogatin, Eric. Signal and Power Integrity - Simplified. Prentice Hall, 2017.
2. Montrose, Mark. EMC and the Printed Circuit Board. John Wiley & Sons, 2004.
3. Christopoulos, Christos. Principles and Techniques of Electromagnetic Compatibility. CRC Press, 2018.
4. Russ, Samuel. Signal Integrity. Springer Nature, 2022.

Back to List of Program Electives

8th Semester Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: VIII**
Course Title: OOPS using C++		**Course Code:25EECE421**
L-T-P: 2-0-1	**Credits:3**	**Contact Hours: 4 hrs/week**
ISA Marks:67	**ESA Marks:33**	**Total Marks:100**
Teaching Hours: 30Hrs	**Examination Duration:2Hrs**	

UNIT I

Chapter 1: Fundamental concepts of object-oriented programming:

Introduction to object-oriented programming, Programming Basics (keywords, identifiers, variables, operators, classes, objects), Arrays and Strings Functions/ methods (parameter passing techniques)

Chapter 2: OOPs Concepts:

Overview of OOPs Principles, Introduction to classes &objects, Creation & destruction of objects, Data Members, Member Functions, Constructor & Destructor, Static class member, Friend class and functions, Namespace

UNIT II

Chapter 3: Inheritance:

Introduction and benefits, Abstract class, Aggregation: classes within classes, Access Specifier, Base and Derived class Constructors, Types of Inheritance, Function overriding

Chapter 4: Polymorphism:

Virtual functions, Friend functions, static functions, this pointer

Unit III

Chapter 5: Exception Handling:

Introduction to Exception, Benefits of Exception handling, Try and catch block, throw statement, pre-defined exceptions in C++, Writing custom Exception class

Chapter 6: I/O Streams:

C++ Class Hierarchy, File Stream, Text File Handling, Binary File Handling
Error handling during file operations, Overloading << and >> operators

Textbook:

1. Robert Lafore, "Object oriented programming in C++", 4th Edition, Pearson education, 2009. Neural Networks and Deep Learning by Michael Nielsen.

Reference books:

1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5ed, Addison Wesley, 2013.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics and Communication Engineering)		**Semester: VII**
Course Title: Multisensory Data fusion		**Course Code: 25EECE453**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 44 Hrs	**Examination Duration: 3 Hrs**	

Unit I

Chapter 1: Fundamentals of multi-sensor data Fusion system

Synergy, Multi sensor data fusion strategies, formal framework, catastrophic fusion, fusion applications. 06 Hrs

Chapter 2: Sensor Models

Smart /logical sensor, interface file system, sensor observation, sensor characteristics, sensor model. 06 Hrs.

Chapter 3: Architecture and Data representation formats

Fusion node, simple fusion network, network topology, Spatial-temporal transformation, geographical information system, common representation format, subspace methods, multiple training sets. 08 Hrs.

Unit II

Chapter 4: Spatial alignment

Image registration, resample/interpolation, pair wise transformation, image fusion 04 Hrs.

Chapter 5: Temporal alignment

Dynamic time warping, dynamic programming, video compression. 06 Hrs.

Chapter 6: Semantic Alignment

Assignment Matrix, Clustering Algorithms, Cluster Ensembles 04 Hrs.

Unit III

Chapter 7: Bayesian Inference

Bayesian analysis, probability model, Posteriori distribution, Model selection, computation. 06 Hrs.

Chapter 8: Sensor management

Hierarchical classification, sensor management techniques 04 Hrs.

Textbook:

1. H.B.Mitchell, , Multi Sensor Data Fusion, An Introduction, II, springer, 2007

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics and Communication Engineering)		**Semester: VIII**
Course Title: Advanced DFT for ASIC Design		**Course Code: 25EECE449**
L-T-P: 1-0-2	**Credits: 3**	**Contact Hours: 5 hrs/week**
ISA Marks: 67	**ESA Marks: 33**	**Total Marks: 100**
Teaching Hours: 16Hrs	**Examination Duration: 3Hrs**	

Week 1: DFT Foundations and Modern Challenges

Lectures:

- Review of basic DFT concepts and fundamentals
- Advancements in modern ASIC testing requirements
- Test economics and the impact of DFT on product quality
- Current industry standards and methodologies

Lab:

- DFT tool setup and environment configuration
- Analysis of ASIC test coverage metrics

Assignment:

- Case study analysis of DFT implementations in commercial ASICs

Week 2: Advanced Scan Architectures

Lectures:

- Multi-mode scan architectures
- Scan compression techniques
- On-chip clock control for scan testing
- Low-power scan techniques

Lab:

- Implementation of compressed scan chains using industry tools
- Analysis of test pattern count reduction

Assignment:

- Design and implementation of a scan compression architecture

Week 3: At-Speed Testing Methodologies

Lectures:

- Clock domain crossing test considerations
- Launch-on-shift vs. launch-on-capture techniques
- Multiple clock domain test strategies
- Path delay fault testing methods

Lab:

- Setting up at-speed test for a sample design
- Transition and path delay fault ATPG

Assignment:

- Analysis and improvement of at-speed test coverage for a given design

Week 4: Memory Testing and BIST

Lectures:

- Memory fault models and test algorithms
- Memory BIST architectures
- Repair strategies and redundancy analysis
- Memory test interfaces and standards

Lab:

- Memory BIST implementation and simulation
- Analysis of memory test coverage

Assignment:

- Design of a memory BIST solution for an embedded SRAM array

Week 5: Boundary Scan and IEEE 1149.x Standards

Lectures:

- IEEE 1149.1 (JTAG) standard in depth
- IEEE 1149.6 for AC-coupled signals
- IEEE 1687 (IJTAG) for instrument access
- Boundary scan test pattern generation

Lab:

- Implementation of JTAG interface and boundary scan cells
- IJTAG network design and implementation

Assignment:

- Development of a comprehensive boundary scan solution for a complex ASIC

Week 6: DFT for Mixed-Signal ICs

Lectures:

- ADC/DAC testing methodologies
- Analog test access mechanisms
- IEEE 1149.4 and mixed-signal test bus
- Loopback testing strategies

Lab:

- Design of test structures for mixed-signal components
- Mixed-signal DFT insertion and analysis

Assignment:

- Development of a test strategy for a mixed-signal subsystem

Week 7: Midterm Project Week

Project:

- Comprehensive DFT implementation for a medium-complexity ASIC
- Test strategy documentation and presentation

- Coverage analysis and optimization

Week 8: Advanced ATPG and Fault Models

Lectures:

- Beyond stuck-at fault models
- Cell-aware fault models
- Small delay defect testing
- Advanced ATPG algorithms and optimizations

Lab:

- Implementation of cell-aware and advanced fault models
- Pattern generation for multiple fault models

Assignment:

- Analysis of test coverage improvement using advanced fault models

Week 9: DFT for Low Power Designs

Lectures:

- Power-aware test strategies
- DFT for power gating architectures
- Testing for power domain isolation
- IEEE 1801 (UPF) integration with DFT

Lab:

- Implementation of power-aware scan insertion
- Analysis of test power consumption

Assignment:

- Development of a low-power test strategy for a multi-power domain design

Week 10: DFT for Advanced SoCs and Multi-Core Designs

Lectures:

- Hierarchical test strategies

- DFT for NoC (Network on Chip) architectures
- Test scheduling and optimization
- Reuse of IP test structures

Lab:

- Implementation of hierarchical test architecture
- Integration of IP-level test structures

Assignment:

- Development of a test strategy for a complex SoC with multiple IP blocks

Week 11: DFT for Emerging Technologies and Final Project

Lectures:

- DFT for 2.5D/3D ICs
- Machine learning applications in testing
- DFT for security (secure scan, anti-tampering)
- Future trends in ASIC testing

Final Project Presentation:

- Comprehensive DFT implementation for a complex ASIC/SoC
- Test coverage analysis and optimization
- Test time and cost evaluation
- Presentation of results and design decisions

Textbook:

1. "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits" by M. Bushnell and V. Agrawal
2. "VLSI Test Principles and Architectures" by L.T. Wang, C.W. Wu, and X. Wen
3. Selected IEEE papers on advanced DFT methodologies
4. Industry white papers on modern DFT implementation

Referenc Tools:

- Mentor Graphics Tessent

Back to List of Program Electives

Swayam Courses

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Phase-locked loops(Swayam)		Course Code:22EECE432
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: VLSI Design Flow: RTL to GDS (Swayam)		Course Code:23EECE435
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Cyber Security and Privacy (Swayam)		Course Code:23EECE439
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Introduction To Algorithms And Analysis (Swayam)		Course Code:23EECE440
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Cryptography And Network Security (Swayam)		Course Code:22EECE431
L-T-P: 0-0-3	Credits:3	Contact Hours: 6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Cryptography And Network Security (Swayam)		Course Code:22EECE431
L-T-P: 0-0-3	Credits:3	Contact Hours: 6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Cloud Computing (Swayam)		Course Code:22EECE444
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Fabrication Techniques for MEMs-based Sensors: Clinical Perspective(Swayam)		Course Code:25EECE430
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Computer Vision (Swayam)		Course Code:25EECE443
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: C-Based VLSI Design(Swayam)		Course Code:23EECE436
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Fundamentals of Micro and Nanofabrication(Swayam)		Course Code:23EECE438
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Software Testing(Swayam)		Course Code:25EECE446
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Applied Linear Algebra for Signal Processing, Data Analytics and Machine Learning(Swayam)		Course Code:23EECE437
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: Introduction to Adaptive Signal Processing(Swayam)		Course Code:25EECE448
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title: RFIC Design(Swayam)		Course Code:25EECE449
L-T-P: 0-0-3	Credits:3	Contact Hours:6 hrs/week
ISA Marks:100	ESA Marks:	Total Marks:100
Teaching Hours:42Hrs	Examination Duration:3Hrs	

Back to List of Program Electives

Program: Electronics & Communication Engineering		Semester: VIII
Course Title: Capstone Project		Course Code: 20EECW402
L-T-P: 0-0-11	Credits: 11	Contact Hours: 22 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: --	Examination Duration: 3 Hrs	

- Smart City
- Connected Cars
- Home Automation
- Health care
- Smart energy
- Automation of Agriculture

Guide lines for selection of a project:

- The project needs to encompass the concepts learnt in the previous semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the defined problem statement of the project work.
- Student can select a project which leads to a product or model or prototype.
- Time plan: Effort to do the project should be between 60-70 Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).
- Learning overhead should be 20-25% of total project development time.

Criteria for group formation:

- 3-4 students in a team.
- Role of teammates: Team lead and members.

Allocation of Guides and Mentors for the projects:

Every Project batch will be allocated with one faculty.

Details of the project batches:

- Number of faculty - members: 50
- Number of students:3-4 students in a team.

Role of a Guide

The primary responsibility of the guide is to help students to understand the meaning and need of various stages in the implementation of the project. At every stage of the project development, guide should help towards its successful completion as per the predefined standards.

How student should carry out a project:

- Define the problem.

- Specify the requirements.
- Specify the design in the understandable form (Block Diagram, Flowchart, Algorithm, etc).
- Analyze the design and identify hardware and software components separately.
- Select appropriate simulation tool and development board for the design.
- Implement the design.
- Optimize the design and generate the results.
- Result representation and analysis.
- Prepare a document and presentation.

Report Writing

- The format for report writing should be downloaded from ftp://10.3.0.3/projects
- The report needs to be shown to guide and committee for each review.
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Evaluation Scheme

- Internal semester assessment (ISA)
- Evaluation is done based on the evaluation rubrics given in Table 1
- Project shall be reviewed and evaluated by the concerned Guide for 50% of the marks.
- Project shall be evaluated by the review committee for 50% of the marks.

Back to Semester VIII

Program: Electronics & Communication Engineering		Semester: VIII
Course Title: Internship- Training		Course Code: 18EECI493
L-T-P: 0-0-6	Credits: 6	Contact Hours: 12 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: --	Examination Duration: 3 Hrs	

Evaluation parameters for Internship Training

- Initiative and creativity
- Adaptation capacity
- Commitment and perseverance
- Independence
- Handling supervisor's comments and development skills
- Time management
- Formulation goals, framework project
- Theoretical underpinning, use of literature
- Use of methods and processing data
- Reflection on results
- Conclusions and discussion
- Presentation skills

Back to Semester VIII

Program: Electronics & Communication Engineering		Semester: VIII
Course Title: Internship- Project		Course Code: 20EECW494
L-T-P: 0-0-11	Credits: 11	Contact Hours: 22 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: --	Examination Duration: 3 Hrs	

Evaluation parameters for Internship Project

- Initiative and creativity
- Adaptation capacity
- Commitment and perseverance
- Independence
- Handling supervisor's comments and development skills
- Time management
- Formulation goals, framework project
- Theoretical underpinning, use of literature
- Use of methods and processing data
- Reflection on results
- Conclusions and discussion
- Presentation skills

Back to Semester VIII