KLE Technological University | Creating Value, Leveraging Knowledge

Curriculum Structure and Curriculum Content for the Academic Year – 2020-24
School /Department: Electronics & Communication Engineering
Program: Bachelor of Engineering

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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 endeavors.

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.

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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, 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 using first principles of mathematics, natural sciences, and engineering sciences.
PO 3: Design/Development of Solutions: 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, and cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8: Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10: 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, and give and receive clear instructions.
PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological 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-Overall

Semester					Total Program Credits:			
	I	II	III	IV	V	VI	VII	VIII
Course with course code	Single Variable Calculus 18EMAB101 (4-1-0)	Multivariable Calculus 18EMAB102 (4-1-0)	BS: Integral Transforms and Statistics 15EMAB203 (4-0-0)	BS: Linear Algebra &Partial Differential Equations 17EMAB208 (4-0-0)	ES3: Arithmetical Thinking & Analytical Reasoning 22EHSH301 (0.5-0-0)	H3: Professional Aptitude and Logical reasoning. 16EHSC301 (3-0-0)	Wireless and Mobile Networks 22EECC401 (3-0-0)	PSE Elective 6 18EECE (3-0-0)
	Engineering Physics 15EPHB101 (3-0-0)	Engineering Chemistry 15ECHB102 (3-0-0)	PC1: Circuit Analysis 15EECC201 (4-0-0)	ES4: Electromagnetic Fields and Waves 21EECC209 (3-0-0)	P10: CMOS VLSI Circuits 19EECC301 (4-0-0)	ES4: Industry Readiness & Leadership Skills 22EHSH302 (0.5-0-0)	PSE Elective 2 18EECE (3-0-0)	Open Elective 18EECE (3-0-0)
	Engineering Mechanics 15ECVF101 (4-0-0)	Problem Solving with Data Structures 18ECSP102 (0-0-3)	PC2: Analog Electronic Circuits 15EECC202 (4-0-0)	PC5: Linear Integrated Circuits 19EECC203 (4-0-0)	PC11: Communication System 22EECC302 (3-0-0)	PC13: Automotive Electronics 22EECC305 (3-0-0)	PSE Elective 3 18EECE (3-0-0)	Internship-Training 18EECI493 (0-0-6)

								Internship- Project 20EECW494 (0-0-11)
	C Programming for Problem solving 18ECSP101 (0-0-3)	Engineering Exploration 15ECRP101 (0-0-3)	PC3: Digital Circuits 19EECC201 (4-0-0)	PC6: Control Systems 15EECC206 (4-0-0)	PC12: Digital Signal Processing 22EECC303 (3-0-0)	PC14: Computer Communication Networks I 17EECC306 (4-0-0)	PSE Elective 4 18EECE (3-0-0)	Project Work 20EECW402 (0-0-11)
	Basic Electrical Engineering 18EEEF101 (3-0-0)	Basic Electronics 18EECF101 (4-0-0)	PC4: Signals & Systems 19EECC202 (4-0-0)	PC7: ARM Processor & Applications 15EECC207 (3-0-0)	PC13: Operating System & Embedded Systems Design 22EECC304 (3-0-0)	PC11: Communication System II 21EECC307 (3-0-0)	PSE Elective 5 18EECE (3-0-0)	
	Design Thinking for Social Innovation15EHSP101 (0-1-1)	Basic Mechanical Engg. 15EMEF101 (2-1-0)	PCL1: Digital Circuits Lab 15EECP201 (0-0-1)	PC8: Digital System Design using Verilog 15EECC208 (0-0-2)	PCL5: Signal Processing Lab 22EECP305 (0-0-1)	PSE Elective 1 17EECEXXX (3-0-0)	P3: Senior Design Project 20EECW401 (0-0-6)	

	Engineering Physics Lab 16EPHP101 (0-0-1)	Professional Communication 15EHSH101 (1-1-0)	PCL2: Analog Electronic Circuits Lab 15EECP202 (0-0-1)	PCL3: Data acquisition and controls Lab 15EECP203 (0-0-1)	PCL6: RTOS Lab 22EECP302 (0-0-1)	PCL7: Computer Communication Networks Lab 17EECP303 (0-0-1)	CIPE & EVS 15EHSA401 (2-0-0)	
			ES2: Microcontroller Architecture & Programming 21EECF202 (0-0-3) C Programming (Dip)18EECF204 (0-0-3)	PCL4: ARM Microcontroller Lab 15EECP204 (0-0-1)	PCLx: CMOS VLSI Circuits Lab 19EECP301 (0-0-1)	PCL8: Automotive Electronics Lab 22EECP304 (0-0-1)		
				PCL3: Data Structure Applications Lab	PC15: Machine Learning 17EECC307	PCL9: Communication System Lab 22EECP306		

				21EECF201 (0-0-2) PCL3: Data Structure Using C Lab(Diploma) 21EECF203 (0-0-3)	(2-0-1)	(0-0-1)		
					P1: Mini Project 17EECW301 (0-0-3)	P2: Minor Project – I 17EECW302 (0-0-6)		
					Calculus and Integra Transforms (Diploma) (15EMAB232) (4-0-0)			
Credits	21	23	25	24	22.5	25.5	21	17

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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	15EPHB101	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	15EHSP101	Social Innovation	HSS	0-1-1	2	3	50	50	100	1.5hrs
7	16EPHP101	Engineering Physics Lab	BS	0-0-1	1	2	80	20	100	3 hrs
Total				**14-2-5**	**21**	**27**	**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	15ECHB102	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	15ECRP101	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	15EMEF101	Basic Mechanical Engineering	ES	2-1-0	3	4	50	50	100	3 hrs
7	15EHSH101	Professional Communication	HSS	1-1-0	2	3	50	50	100	1.5 hrs
Total				**15-2-6**	**23**	**32**	**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	15EECC201	PC1: Circuit Analysis	PC	4-0-0	4	4	50	50	100	3 hours
3	15EECC202	PC2: Analog Electronic Circuits	PC	4-0-0	4	4	50	50	100	3 hours
4	19EECC201	PC3: Digital Circuits	PC	4-0-0	4	4	50	50	100	3 hours
5	19EECC202	PC4: Signals & Systems	ES	4-0-0	4	4	50	50	100	2 hours
6	15EECP201	PCL1: Digital Circuits Lab	PC	0-0-1	1	2	80	20	100	2 hours
7	15EECP202	PCL2: Analog Electronic Circuits Lab	PC	0-0-1	1	2	80	20	100	2 hours
8	21EECF202 18EECF204	ES2: Microcontroller Architecture & Programming C Programming (Dip)	ES	0-0-3	3	6	80	20	100	2 hours
TOTAL				**20-0-5**	**25**	**32**	**490**	**310**	**800**	

Semester- IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	17EMAB208	BS: Linear Algebra &Partial Differential Equations	BS	4-0-0	4	4	50	50	100	3 hours
2.	21EECC209	ES4: Electromagnetic Fields and Waves	PC	3-0-0	3	3	50	50	100	3 hours
3.	19EECC203	PC5: Linear Integrated Circuits	PC	4-0-0	4	4	50	50	100	3 hours
4.	15EECC206	PC6: Control Systems	PC	4-0-0	4	4	50	50	100	3 hours
5.	15EECC207	PC7: ARM Processor & Applications	PC	3-0-0	3	3	50	50	100	3 hours
6.	15EECC208	PC8: Digital System Design using Verilog	PC	0-0-2	2	4	80	20	100	2 hours
7.	15EECP203	PCL3: Data acquisition and controls Lab	PC	0-0-1	1	2	80	20	100	2 hours
8.	15EECP204	PCL4: ARM Microcontroller Lab	PC	0-0-1	1	2	80	20	100	2 hours
9.	21EECF201	PCL3: Data Structure Applications Lab	ES	0-0-2	2	4	80	20	100	2 hours
	21EECF203	PCL3: Data Structure Using C Lab(Diploma)		0-0-3	3	6				
	Total			**18-0-6**	**24**	**30**	**570**	**330**	**900**	

Semester- V

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1.	22EHSH301	ES3:Arithmetical Thinking & Analytical Reasoning	ES	0.5-0-0	0.5	4	100	--	100	3 hours
2.	19EECC301	PC10:CMOS VLSI Circuits	PC	4-0-0	4	4	50	50	100	3 hours
3.	22EECC302	PC11: Communication System I	PC	3-0-0	3	3	50	50	100	3 hours
4.	22EECC303	PC12: Digital Signal Processing	PC	3-0-0	3	3	50	50	100	3 hours
5.	22EECC304	PC13: Operating System & Embedded Systems Design	PC	3-0-0	3	3	50	50	100	3 hours
6.	22EECP305	PCL5: Signal Processing Lab	PC	0-0-1	1	2	80	20	100	2 hours
7.	22EECP302	PCL6: RTOS Lab	PC	0-0-1	1	2	80	20	100	2 hours
8.	19EECP301	PCLx: CMOS VLSI Circuits Lab	PC	0-0-1	1	2	80	20	100	2 hours
9.	17EECC307	PC15: Machine Learning	PC	2-0-1	3	4	50	50	100	3 hours
10.	17EECW301	P1: Mini Project	PW	0-0-3	3	6	50	50	100	2 hours
11.	15EMAB232	Calculus and Integra Transforms (Diploma)	PC	4-0-0	4	4	50	50	100	3 hours
TOTAL				**16.5-0-7**	**22.5**	**33**	**640**	**360**	**1000**	

Semester- VI

No	Code	Course	Category	L-T-P	Credits	Contact Hours	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.	22EHSH302	ES4: Industry Readiness & Leadership Skills	ES	0.5-0-0	0.5	4	100	--	100	3 hours
3.	22EECC305	PC13:Automotive Electronics	PC	3-0-0	3	3	50	50	100	3 hours
4.	17EECC306	PC14:Computer Communication Networks	PC	4-0-0	4	4	50	50	100	3 hours
5.	21EECC307	PC11: Communication System II	PC	3-0-0	3	3	50	50	100	3 hours
6.	17EECEXXX	PSE Elective 1	PE	3-0-0	3	3	50	50	100	3 hours
7.	17EECP303	PCL7: Computer Communication Networks Lab	PC	0-0-1	1	2	80	20	100	2 hours
8.	22EECP304	PCL8: Automotive Electronics Lab	PC	0-0-1	1	2	80	20	100	2 hours
9.	22EECP306	PCL9: Communication System Lab	PC	0-0-1	1	2	80	20	100	2 hours
10.	17EECW302	P2: Minor Project	PW	0-0-6	6	12	50	50	100	2 hours
TOTAL				**16.5-0-9**	**25.5**	**36**	**640**	**360**	**1000**	

Semester- VII

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	22EECC401	PC16: Wireless & Mobile Communication	PSC	3-0-0	3	3	50	50	100	3 hours
2	18EECE	PSE Elective 1	PSE	3-0-0	3	3	50	50	100	3 hours
3	18EECE	PSE Elective 2	PSE	3-0-0	3	3	50	50	100	3 hours
4	18EECE	PSE Elective 3	PSE	3-0-0	3	3	50	50	100	3 hours
5	18EECE	PSE Elective 4	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	15EHSA401	CIPE & EVS	M	2-0-0		2	50	50	100	3 hours
TOTAL				**15-0-6**	**21**	**29**	**350**	**350**	**700**	

Semester- VIII

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	18EECE	PSE Elective 5	PSE	3-0-0	3	3	50	50	100	3 hours
2	18EECE	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	Project Work	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	24	22.5	25.5	21	17	179

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 Circuits Design	17EECE301
2.	Introduction to Deep Learning	19EECE322
3.	Advanced Digital Logic Design	17EECE302
4.	Internet of Things	17EECE307
5.	Information Theory and Coding	21EECE308
6.	Embedded Intelligence Systems	17EECE310
7.	Multi core Architecture & Programming	22EECE340
8.	OOPS using C++	22EECE321
9.	Advanced Digital Logic verification	18EECE418
10.	Multimedia Communication	18EECE410
11.	Physical Design-Analog	18EECE419
12.	CMOS ASIC Design	18EECE420
13.	AUTOSAR	20EECE406
14.	Human Machine Interface	23EECE428
15.	OOPS using C++	23EECE421
16.	Microwave & Antennas	23EECE411
17.	Digital Image Processing	23EECE414
18.	MEMS	23EECE403
19.	Introduction to Deep Learning	23EECE422
20.	Multi-core Architecture & Programming	23EECE430
21.	Fabrication Techniques for MEMs-based sensors **(Swayam)**	22EECE430
22.	Phase-locked loops**(Swayam)**	22EECE432

23.	Computer Graphics**(IITD-Online)**	21EECE425
24.	Advanced Computer Graphics(**IITD + KLE Tech**)	22EECE433
25.	Advanced Computer Vision(**IITD + KLE Tech**)	22EECE434
26.	VLSI Design Flow: RTL to GDS (Swayam)	23EECE435
27.	C- Based VLSI Design (Swayam)	23EECE436
28.	Applied Linear Algebra For Signal Processing, Data Analytics And Machine Learning (Swayam)	23EECE437
29.	Fundamentals Of Micro And Nanofabrication (Swayam)	23EECE438
30.	Cyber Security and Privacy (Swayam)	23EECE439
31.	Introduction To Algorithms And Analysis (Swayam)	23EECE440
32.	Linear Systems Theory (Swayam)	23EECE441
33.	Microwave Engineering (Swayam)	23EECE442
34.	Introduction To Wireless And Cellular Communications (Swayam)	23EECE443
35.	Cloud Computing (Swayam)	22EECE444
36.	Introduction to Cyber Security(Swayam)	23EECE445

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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:6 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 (07 hours)

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 (13 hours)

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 (06 hours)

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 (14 hours)

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 (10 hours)

(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 Transcendental 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

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Program: Electronics & Communication Engineering		**Semester: I**
Course Title: Engineering Physics		**Course Code: 15EPHB101**
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: Conduction in semiconductors (05 hours)

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 (10 hours)

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 drop, 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 (15 hours)

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 (10 hours)

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

KLE Technological University | Creating Value, Leveraging Knowledge

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 (04 hours)

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 (12 hours)

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.

Chapter 3: Coplanar non-concurrent force system (05 hours)

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

Chapter 4: Equilibrium of a force system (Chapter 3 contd..) (05 hours)

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 (08 hours)

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 (06 hours)

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 (05 hours)

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) (05 hours)

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, New Delhi- 110 001, 1995.

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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: 72 Hrs	Examination Duration: 3 Hrs	

Introduction to Problem solving (03 hours)

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

Basics of C programming language (15 hours)

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 (12 hours)

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 (12 hours)

while, do while, for, nested statements

Functions (10 hours)

Introduction, Function declaration, definition, call, returns statement, passing parameters to functions, introduction to macros.

Introduction to Coding Standards

Arrays and Strings (15 hours)

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 (08 hours)

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 (05 hours)

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

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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 (02 hours)

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 (05 hours)

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 (08 hours)

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 (09 hours)

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) (06 hours)

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) (05 hours)

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 (05 hours)

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. Petruzella, 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

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering		**Semester: I**
Course Title: Design Thinking for Social Innovation		**Course Code: 15EHSP101**
L-T-P: 0-1-1	**Credits: 2**	**Contact Hours:3 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 Innovators in Class**	• Class activity on Behavioural Blocks to Innovation **Discussion on the behavioural blocks.** • **Introducing oneself with three Adjectives- Appreciating diversity and discovering self** • **Group Formation Activity (Forming square) (Making four equilateral triangles out of popsicle sticks to enhance group cohesiveness**

				amongst the group mates)
	Create Mindsets	**Seven Mindsets:** 1. Empathy **(Example of The Boy and the Puppies)** 2. Optimism **(Person Paralyzed waist down / Glass Health full Half Empty)** 3. Iteration **(Thomas Alva Edison)** 4. Creative Confidence **(Origamy – 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)** **(Spending one lakh for the business which is never launched)**	**Reading assignments** • Handout on " Create Mindsets"	• **(How to train the Dragon? Common Video for all the mindsets)** • **Watching in Class TED Talk on "How to build youir Creative Confidence by David Kelley – IDEO Founder)**
	Process of Social Innovation	**Engage**	**Reading assignments** • Handout on Community Study	• Activity on Observation skills To know how to

		Community study and Issue Identification	and Issue Identification • Case Study on "EGramSeva" • Case Study on "Janani Agri Serve" **Class Presentations** • Initial observations being made by the group **(Literature Survey of Places of Hubli-Dharwad)** **www.readwhere.com** • Detailed interaction / engagements with the society and finalize the social issue for intervention **Use template 1: Frame your Design Challenge**	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
		PEER REVIEW		
		2. Inspiration	**Reading assignments**	• Familiarization of the

		• Plan for the Research • Development of Interview guide • Capture your Learnings	• Handout on Overview of Inspiration **Class Presentations** • Entirety of the Social Issue • Identification of the Stake Holders **(Examples on Fluoroscent Curtain and Students' Punctuality for Class)** • Interview Questions **(Role Play on Interview with Stakeholders)** • Category wise Learnings capture **Use template 2: Plan your Research** **Template 3. Development of Interview Guide** **Template 4. Capture your Learning**	respective templates with the help of sample case study
		3. Ideation **3.1 Synthesis** • Search for meaning	**Reading assignments** • Handout on Overview of Ideation-Synthesis	• Familiarization of the respective

		• Create "How might we" question	**Class Presentations** • Create insights • "How might we" questions **Use template 5: Create Insights** **Template 6: Create "How Might We' Questions**	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 • Test and get feedback	**Reading assignments** • Handout on Overview of Ideation-Prototyping **Class Presentations** • Story board-demonstrating the possible solutions **Use template 7: Select your best ideas** **Template 8 : Determine what to prototype**	• 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
		PEER REVIEW		
		4.0 Implementation	**Reading assignments**	• Familiarization of the respective

		• 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) • Duration • Ethical concerns • Launch your solution • Feedback (Impact)	• Handout on Overview of Implementation **Class Presentations** • Pilot implementation plan with required resources and Budget indicating stake holders & their enagement	templates with the help of sample case study

		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

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Program: Electronics & Communication Engineering		**Semester: I**
Course Title: Engineering Physics lab		**Course Code: 16EPHP101**
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		

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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 (12 hours)**
   Function of several variables, Partial derivatives, Level curves, Chain rule, Errors and Approximations. Extreme value problems. Lagrange's multipliers.
2. **Double integrals (08 hours)**
   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 (07 hours)**

   Triple integrals, Cartesian, change to Cylindrical and Spherical coordinates Application of Triple integrals

4. **Calculus of Vector Fields (13 hours)**

   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

1. **Differential equations of higher orders (5+5 hours)**

   (a) Linear differential equations of second and higher order with constant coefficients. 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

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Program: Electronics & Communication Engineering		**Semester: II**
Course Title: Engineering Chemistry		**Course Code: 15ECHB102**
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

1. Chemical Bonding (04 hours)

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 (06 hours)

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 (06 hours)

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 (04 hours)

Introduction, technological importance. Electroplating, Principles of electroplating. Factors affecting nature of electro deposit, 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 (09 hours)

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 (03 hours)

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 (04 hours)

Advantages over conventional methods. Electro analytical methods: Potentiometer - principle, methodology and applications. Optoanalytical methods: Colorimeter - Principle, methodology and applications.

Spectral methods of analysis: UV – Spectrophotometer - Instrumentation and applications.

8. Environmental Chemistry (04 hours)

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 nalysis, 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 (12 hours)

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

Stacks and Recursion (16 hours)

Stack: Definition, Operations, Stack ADT Implementation of stack operations. Applications of stack. Recursion- Need for Recursion and problems on Recursion.

Queues (16 hours)

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 (18 hours)

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 (16 hours)

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: 15ECRP101**
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. Modelling, 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, Mc GrawHill Higher Education, 6th Edition (2011)
2. Engineering Exploration (Edited Book, 2008) by Pearson Publication

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ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Content

Unit I

Chapter 1: Trends in Electronic Industries: (03 hours)

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 PoliISAs, Electronic System Components.

Chapter 2: Basic Components, Devices and Applications: (10 hours)

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 and OR gates.

Chapter 3: Transistor: (07 hours)

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 3: Digital Logic: (14 hours)

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's Theorems, 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 4: Operational Amplifier: (06 hours)

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 5: Communication Systems: (07 hours)

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 6: Linear Power Supply, UPS & CRO: (03 hours)

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

Text Book:

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

References:

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. BoylesteadNashelsky, Electronic devices & Circuit theory, Prentice Hall India, 2000
5. RamakantGaikawad , Operational Amplifiers & applications, PHI, 2000

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Course Title: Basic Mechanical Engineering		Course Code: 15EECF101
L-T-P: 2-1-0	Credits: 3	Contact Hours:4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 25+25Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter 1: Introduction to Mechanical Engineering: (02 hours)

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 (08 hours)

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, Mechatronic 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 (06 hours)

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. (04 hours)

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 (05 hours)

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.4

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.
3. 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:3 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 (09 hours)

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 (06 hours)

Vocabulary, Word Formation and Active and Passive Voice

Chapter No. 3. Bouncing Practice (06 hours)

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

Chapter No. 4. Rephrasing and Structures (08 hours)

Comprehension and Rephrasing, PNQ Paradigm and Structural practice.

Chapter No. 5. Dialogues (03 hours)

Introduction of dialogues, Situational Role plays.

Chapter No. 6. Business Communication (09 hours)

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: Electronics & Communication Engineering		**Semester: III**
Course Title: Integral transforms and Statistics		**Course Code: 15EMAB203**
L-T-P: 4-0-0	**Credits: 04**	**Contact Hours: 4Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50Hrs	**Examination Duration: 3 Hrs**	

Unit I

Chapter 1. Laplace Transforms (10 hours)

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 (10 hours)

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

Unit II

Chapter 3: Regression (05 hours)

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

Chapter 4: Fourier Series (08 hours)

Complex Sinusoids, Fourier series representations of four classes of signals, Periodic Signals: Fourier Series representations, Derivation of Complex Coefficient 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 (07 hours)

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 (10 hours)

1. Introduction to Joint Probability Distributions, marginal distribution, joint PDF and CDF, mean, variance, covariance, correlation.
2. 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.

References

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 Applications for Engineering and the Computing Sciences, 4th edition, TATA McGraw-Hill Edition, 2017
3. Ian Glover & Peter Grant, Digital Communications, 3rd edition, Pearson 2009.

Back to Semester III

Program: Electronics & Communication Engineering		Semester: III
Course Title: Circuit Analysis		Course Code: 15EECC201
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4Hrs/week
ISA: Marks: 50	ESA: Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration:3 Hrs	

Unit I

Chapter 1: Basics (06 hours)

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 (08 hours)

Homogeneity, Superposition and Linearity, Thevenin's & Norton's Theorems, Maximum Power Transfer Theorem, Miller's theorem, Reciprocity principle.

[Text 1 : Chapter 5]

Chapter 3: Network topologies (04 hours)

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 (06 hours)

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 (06 hours)

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 (08 hours)

Transient response of R-C and R-L networks (with Initial conditions)

Concept of phasor, Phasor diagrams, Frequency response characteristics, Polar plots

R-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 7: Higher order circuits (12 hours)

HigherorderR-C,R-L,andR-L-Cnetworks,timedomainandfrequencydomainrepresentation, Phasor diagrams, Polar and logarithmic plots, Series R-L-C circuit, Transient response, Damping factor, Quality factor, Frequency response curve, Peaking of frequency curve and its relation to damping factor, Resonance Parallel, R-L-C circuit, Tank circuit, Resonance, Quality factor and Bandwidth

[Text 2: Chapter 7,8]

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

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 PrivateLimited, 2014

Back to Semester III

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Program: Electronics & Communication Engineering		Semester: III
Course Title: Analog Electronic Circuits		Course Code: 15EECC202
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter 1: Applications of a Junction diode (06 hours)

Recap of diode models: piece-wise linear model, constant voltage drop model, ideal diode model, small signal model. Applications of diodes as a Clipping circuit and clamping circuits Voltage doubler. (T1 : 2.2,2.3.1 to 2.3.8,2.6.1to 2.6.3.)

Chapter No. 2. Bipolar junction transistors. (07 hours)

The common emitter characteristics, Dependence of IC on the collector voltage-the early effect large signal operation-the transfer characteristics, the amplifier gain, operation as a switch. DC load line and bias point, base- bias, collector to base bias, voltage divider, comparison of bias circuit, small signal models of bipolar transistors, two port modeling of amplifiers, AC analysis of BJT circuits-coupling and bypass capacitor, Common emitter circuit analysis, CE circuit with un-bypassed emitter resistor. (T1: 3.1.1, 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: (07 hours)

Device structure, operation with no gate voltage, creating a channel for current flow, applying small vds, operation as vds is increased, derivation of the id-vds relationship, the P-channel MOSFET, complementary MOS or CMOS, operating the MOS transistor in the sub threshold region. Current-voltage characteristics: circuit symbol, the id vsvds characteristics, finite output resistance in saturation, characteristics of the p-channel MOSFET, the role of the substrate-the body effect, temperature effects, breakdown and input protection. MOSFET circuits at DC.

(T1: 4.1, 4.2 ;4.3)

Unit II

Chapter 4: Biasing of MOSFETs (08 hours)

MOSFET circuits at DC. Biasing in MOS amplifier circuits, By fixing VGS; By fixing VG; With drain to gate feedback resistor; Constant current source biasing and numerical **(T1:4.3)**

Chapter 5: MOSFET amplifiers (12 hours)

Biasing in MOS amplifier circuits, small signal operation and models, single stage MOS amplifiers, the MOSFET internal capacitance and high frequency model, frequency response of CS amplifier.(CD and CG), Cascode Connection: Implications on gain and Bandwidth

(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 (05 hours)

General feedback structure (Block schematic), Feedback de-sensitivity factor, positive and negative feedback Nyquist stability Criterion, RC phase shift oscillator, wein bridge Oscillator, 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 (05 hours)

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

1. JacobMillman and Christos Halkias,-Integrated Electronics "McGraw Hill Education, 2nd edition 2017
2. DavidA.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: Electronics & Communication Engineering		**Semester: III**
Course Title: Digital Circuits		**Course Code: 19EECC201**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50 Hrs	**Examination Duration: 3 Hrs**	

Unit-I

Chapter No. 1. Logic Families (03 hours)

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

Chapter No. 2. Principles of Combinational Logic (10 hours)

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 No. 3. Analysis and design of combinational logic (06 hours)

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 No. 4. Introduction to Sequential Circuits (10 hours)

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 No. 5. Analysis of Sequential Circuits (10 hours)

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 (05 hours)

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 (04 hours)

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 editionCengage Learning,2006
3. A Anand Kumar , Fundamentals of digital circuits 4th Revised edition, PHI ,2016

References

1. Charles H Roth, Fundamentals of Logic Design,7th edition ,Cengage Learning, 2015
2. ZviKohavi, Switching and Finite Automata Theory Cambridge UniversityPress; 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

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

Unit I

Chapter No. 01: Signal Representation (10 hours)

Definition of a signals and systems, classification of signals(analog and discrete signal, periodic and a periodic, 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)

Chapter No. 02: LTI System Representation (10 hours)

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

Unit II

Chapter No. 03: Fourier representation for signals (10 hours)

Introduction, Discrete time Fourier series (derivation of series excluded) and their properties. Discrete Fourier transform (derivation of transform excluded) and properties

Chapter No. 04: Applications of Fourier transform (10 hours)

Introduction, frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals. Sampling of continuous time signals.

Unit III

Chapter No. 05: Z-transform (10 hours)

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

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

References

1. H. P Hsu, R. Ranjan, Signals and Systems, 2nd edition, McGraw Hill ,2017
2. Ganesh Raoand Satish Tunga,SignalsandSystems1st edition, Cengage India, 2017
3. M.J.Roberts, Fundamentals of Signals and Systems2nd edition, McGraw Hill Education, 2017

Back to Semester III

Program: Electronics & Communication Engineering		**Semester: III**
Course Title: Digital Circuits Laboratory Experiments		**Course Code: 15EECP201**
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: 2Hrs**	

List of Experiments:

1. Characterization of TTL Gates– Propagation delay, Fan-in, Fan-out and Noise Margin.
2. To verify of Flip flops (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 bit parallel adder.
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 mod-6 synchronous and asynchronous counters using flip flops.
8. Design and implement given functionality using decoders and multiplexers.
9. Design and implement a digital system to display a 3 bit counter on a 7 segment display. Demonstrate the results on a general purpose PCB.

****Note-All above experiments is 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 labprimer, Pearson Education Asia Publications, 2003.
2. A.P. Malvino, -Electronic Principles 7th edition, McGraw Hill Education,2017

Back to Semester III

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Program: Electronics & Communication Engineering		Semester: III
Course Title: Analog Electronics Laboratory Experiments		Course Code: 15EECP202
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 : 2Hrs	

List of Experiments:

Exercise

1. Design &Testing of Diode Clipping (single/double ended) circuits
2. Design &Testing of Clamping circuits for Positive and Negative Clamping.
3. Design &Testing of BJT as a switch
4. MOSFET characteristics
5. Design &Testing of MOSFET as a switch
6. Design and testing Current mirror circuit with MOSFET
7. Design and testing of Transformer-less push-pull class B power amplifier

Structured Enquiry

1. Design and study of single stage Common Emitter BJT amplifier.

A) Design and study of CS Amplifier using MOSFET.

B) Voltage series feedback

Open Ended

1. 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 MOSFET based circuits using netlist based Spice Simulators (Avoid using drag n drop), with the spice models of MOSFETs in the same netlist file before using hardware using breadboard.

Reference Books

1. "Electronic Devices & circuit Theory – by Nashelsky& Boylstead,11th Edition, Pearson, 2015
2. "Integrated Electronics"–By Jacob Millman and Christos Halkias ,McGraw Hill Education; 2nd edition 2017
3. "Electronic Principles" by A.P. Malvino,7th edition, McGraw Hill Education,2017

Back to Semester III

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Program: Electronics & Communication Engineering		**Semester: III**
Course Title: Microcontroller Architecture & Programming		**Lab. Code: 21EECF202**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 6 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: 30Hrs	**Examination Duration: 2Hrs**	

Unit -I

Chapter 1: Microprocessors and microcontroller **(02 hours)**

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

Chapter 2: The 8051 Architecture **(04 hours)**

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

Chapter 3: Addressing Modes and Arithmetic Operations **(04 hours)**

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 **(03 hours)**

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

Chapter 5: 8051 Programming in 'C' **(04 hours)**

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 **(03 hours)**

Programming 8051 Timers, Programming Timer0 and Timer1 in 8051C

Unit III

Chapter 7: Serial Communication **(04 hours)**

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 **(04 hours)**

Interfacing 8051 to LCD, Keyboard, ADC, DAC, Stepper Motor, DC Motor. **(02 hours)**

Chapter 9: Interrupts Introduction to interrupts, interrupts vs polling, classification of interrupts, interrupt priority, interrupt vector table, interrupt service routine

Text Book

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

References

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

Back to Semester III

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

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

Expt./Job No.	*Experiment/job Details*	*No. of Lab. Session/s per batch (estimate)*
1.	Write a C program to perform addition, subtraction, multiplication and division of two numbers.	*01*
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.	*01*
2.	Write a C program to i) To find the roots of a quadratic equation. ii) Find the factorial of given number.	*01*
3.	Write a C program to i) To find the sum of n natural numbers. ii) Print the sum of 1 + 3 + 5 + 7 + + n	*01*
4.	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	*01*
6.	Write a C program To test whether the given character is Vowel or not. (using switch case)	*01*
7.	Write a C program to accept 10 numbers and make the average of the numbers using one dimensional array.	*01*
8.	Write a C program to Find out square of a number using function.	*01*

9	Write a C program To find the summation of three numbers using function.	*01*
10	Write a C program to Find out addition of two matrices.	*01*

1. ***Materials and Resources Required*:**

Text Book

1. Programming in ANSI C, E Balagurusamy

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Program: Electronics & Communication Engineering		Semester: IV
Course Title: Linear Algebra and Partial Differential Equations		Course Code: 17EMAB208
L-T-P: 4-0-0-0	Credits: 4	Contact Hours: 4Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter1: Partial differential equations (10 hours)

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 of variables.

Chapter2: Finite difference method (10 hours)

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

Chapter3: Fourier Series (10 hours)

Complex Sinusoids, Fourier series representations of four classes of signals, Periodic Signals: Fourier Series representations, Derivation of Complex Coefficients 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 (10 hours)

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 (05 hours)

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 7: Complex Integration (05 hours)

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

Text Book

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,"AdvancedEngineeringMathematics",4th edition, NarosaPublishingHouse,NewDelhi,2012

References

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

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Program: Electronics & Communication Engineering		Semester: IV
Course Title: Electromagnetic Fields and Waves		Course Code: 21EECC209
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 Hrs/week
ISA Marks: 40	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter No. 1. Electrostatic Fields (05 hours)

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 No. 2. Electric Fields in Material Space (05 hours)

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

Chapter No. 3. Electrostatic Boundary-Value Problems (05 hours)

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 No. 4. Magnetostatic Fields (06 hours)

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 No. 5. Magnetic Forces, Materials and Devices (06 hours)

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 No. 6. Maxwell's Equations (03 hours)

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 No. 7. Electromagnetic Wave Propagation (05 hours)

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.

Chapter No. 8. Transmission Lines (05 hours)

Introduction, Transmission Line Parameters, Transmission Line Equations, Input Impedance, SWR, and Power, The Smith Chart, Transients on Transmission Lines, Microstrip Transmission Lines, Some Applications of Transmission Lines.

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

1. William Hayt. Jr. John A. Buck, Engineering Electromagnetics ,9th edition, McGraw Hill Education,2018.
2. R. K. Shevgaonkar, Electromagnetic Waves McGraw Hill Education; 1st edition,2017

3. Mathew N. O. Sadiku, Elements of Electromagenics; Sixth edition, Oxford University , 2015

Back to Semester IV

KLE Technological University | Creating Value, Leveraging Knowledge

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

Unit I

Chapter No 1. Current Mirrors (04 hours)

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

Chapter No 2. Basic OPAMP architecture (06 hours)

Basic differential amplifier, Common mode and difference mode gain, CMRR, 5-pack differential amplifier with design, 7-pack operational amplifier, Slew rate limitation, Bandwidth and frequency response curve.

Chapter No 3. OPAMP characteristics (08 hours)

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

Unit II

Chapter No 4. OPAMP with Feedback (10 hours)

OPAMP 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 No 5. Linear applications of OPAMP (12 hours)

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

Unit III

Chapter No 6. Nonlinear applications of OPAMP (10 hours)

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 DAC, Current steering DAC, Pipeline DAC, Analog to Digital Converters: Flash, Pipeline ADC, SAR

Text Book

1. Behzad Razavi, Fundamentals of Microelectronics 2nd edition, Wiley, 2013
2. Phillip E. Allen, Douglas R. Holberg, CMOS Analog Circuit Design 3rd edition , OUP USA ,2012
3. Ramakant A. Gayakwad, Op - Amps and Linear Integrated Circuits,. Pearson Education,4thedition, 2015

References

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

2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, , 3rd edition , MHE ,2012
3. David A. Bell, Operational Amplifiers and LinearIC's.; Third edition, Oxford University Press, 2011
4. B. Razavi, Design of Analog CMOS Integrated Circuits, Second edition, McGraw Hill Education; 2017

Back to Semester IV

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering		Semester: IV
Course Title: Control Systems		Course Code: 15EECC206
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter No. 1. Control System Representation (06 hours)

Concepts of Control Systems- Open Loop and Closed Loop Control Systems, Feed-Back characteristics, Examples, System representation: Differential Equations, Transfer function, Impulse response, System Modelling: Electrical Mechanical, Electro mechanical, Rotational Mechanical Systems.

Chapter No. 2. Block Diagram and Signal Flow Graphs (08 hours)

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

Chapter No. 3. Time Response Analysis (06 hours)

Standard Test Signals (impulse, step, ramp, parabola)-Order and Type of System, Concept of Dominant pole, 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 (10 hours)

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 (10 hours)

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, All Pass And Minimum Phase Systems

Unit III

Chapter No. 6. Stability Analysis In Frequency Domain (06 hours)

Polar Plots, Nyquist Plots Stability Analysis, Assessment Of Relative Stability Using Nyquist Criterion.

Chapter No. 7. Introduction to Controller Design (06 hours)

The Design Problem. Preliminary Consideration Of Classical Design, Realization Of Basic Compensators (Lag, Lead and dominant pole compensation), P, I, PI, PD & PID Controllers.

Text Books

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

References

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

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KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering		Semester: IV
Course Title: ARM Processor & Applications		Course Code: 15EECC207
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3Hrs/week
ISA Marks: 50	ESA Marks: - 50	Total Marks: 100
Teaching Hours: 40Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter 1: Introduction to Microprocessor and Microcontroller (10 hours)

Microprocessor, Microcontroller, Comparing Microprocessor and Microcontroller, RISC vs. CISC, Von-Neumann vs. Harvard Architecture, Microcontroller Survey, Development systems for microcontroller, Case study: Architecture of 8085/8086 and 8051 Microprocessor and Microcontroller respectively

Chapter 2: ARM Architecture (06 hours)

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

Chapter 3: Instruction set 1 (06 hours)

Introduction, ARM instruction set-Data processing and branch instructions, Arithmetic and example programs Data processing instruction, Branch instruction, Load store instruction, Software interrupt instruction, Program status register instruction, Conditional execution, Example programs

Unit II

Chapter 4: Instruction set 2 (05 hours)

The Thumb programmer model, Thumb branch instructions, Thumb software interrupt instructions, Thumb data processing instructions, Thumb breakpoint instruction, Thumb implementation, and Thumb applications. Example programs: The Thumb programmer model, ARM-Thumb interworking, other branch instructions, Data processing instructions, Single/Multiple register load store instruction, Stack operation, Software interrupt instructions, Thumb breakpoint instruction, Thumb implementation, and Thumb applications example programs.

Chapter 5: Assembler rules and Directives (03 hours)

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

Chapter 6: Exception handling (05 hours)

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

Chapter 7: Architectural support for high level languages (05 hours)

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

Unit – III

Chapter 8: LPC 2129/2148 Controller Architectural overview (10 hours)

On-chip memory, GPIOs, Timers, UART, ADC, I2C, SPI , RTC ARM interfacing techniques and programming: LED, LCD, Stepper Motor, Buzzer, Keypad, ADC

Text Book:

1. The 8051 Microcontroller Architecture, Programming & Applications " By _KennethJ. 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

References:

1. -ARM system Developer‘s Guide-ardbound,Publicationdate:2004Imprint:MORGANKAUFFMAN
2. User manual onLPC21XX.

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KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering		Semester: IV
Course Title: Digital System Design using Verilog		Lab Code: 15EECC208
L-T-P: 0-0-2	Credits: 2	Contact Hours: 4Hrs/week
ISA Marks: 80	ESA Marks:20	Total Marks: 100
Teaching + Lab. Hours: 48 Hrs	Examination Duration:2 Hrs	

Introduction to Verilog (02+02 hours)

Verilog as hdl, levels of design description, simulation and synthesis, digital design flow.

Programming on Data flow description (02+02 hours)

Structure of data-flow description, data type – vectors. Simple combinational circuit design like decoder, multiplexers, code converters.

Programming on Behavioral Descriptions (04+04 hours)

Behavioral Description highlights, sequential statements. Introduction to Test bench. Design of sequence multiplier, Booth multiplier. Introduction to FPGAs, Synthesis

Programming on Structural Descriptions (02+02 hours)

Highlights of structural Description, Organization of the structural Descriptions, state Machines, Generate, Generic, statements. Design of 16 bit RCA and CLA

Programming on Tasks and Functions: (04+04 hours)

Highlights of Tasks, and Functions, FSM, design like counter, Mealy and Moore machine, Sequence Detector.

Programming on Interfacing (04+01 hours)

Interfacing with 7-segment display and push buttons. Interfacing with PS/2 Keyboard and VGA display.

Programming on Advanced HDL Descriptions (02+04 hours)

Block RAMs on an FPGA and understand memory interfacing, File operations in Verilog, File processing examples.

Open ended Experiment (06 hours)

Bowling Score Keeper / Floating Point Unit Arithmetic Units/pipelined processor/traffic light controller

Text Book

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

References

1. Samir Palnitkar,-Verilog HD,PearsonEducation,2ndEdition,2003.
2. Thomas and Moorby,-The Verilog Hardware Description Language Kluwer academic publishers,5thedition, 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

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering		Semester :IV
Course Title: Data Acquisition and Control Lab		Lab Code: 15EECP203
L-T-P: 0-0-1	Credits: 1	Contact Hours: 2Hrs/week
ISA Marks: 80	ESA Marks: - 20	Total Marks: 100
Teaching Hours: 28 Hrs	Examination Duration: 2 Hrs	

List of Experiments:

1. **Basic Signal Conditioning Techniques**
   a) Inverting and Non Inverting Amplifier using OPAMP.
   b) Comparator. (ZCD &Schmitt trigger)
   c) Precision rectifier
2. **Realize and verify the performance of Instrumentation Amplifier using op-amp**
3. **Feedback Concepts:** Realize and verify the performance of Wein Bridge Oscillator using op-amp
4. **To design and implement the filters for a given specification**
   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. **System Modeling**
   - Realize the system modeling for DC Motor using QuanserQube
7. **To determine System Response of RLC circuits**
   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 Lab view.
   Time response using QuanserQube
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

QuanserQube).

10. **Structured Enquiry (16+16=32marks)**
    - MOS Amplifier Design and implementation
    - 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

References:

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

Back to Semester IV

Program: Electronics & Communication Engineering		**Semester: IV**
Course Title: Data Structures Application Lab		**Lab Code: 21EECF201**
L-T-P: 0-0-2	**Credits: 2**	**Contact Hours: 4Hrs/week**
ISA Marks: 80	**ESA Marks:20**	**Total Marks: 100**
Teaching + Lab. Hours: 48 Hrs	**Examination Duration:2 Hrs**	

Chapter No 1. Analysis of algorithms (10 hours)

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 (10 hours)

Complexity analysis of basic data structures (Stacks, Queues, Linked lists)

Chapter No 3. Analysis of non-linear data-structures and its applications (28 hours)

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 (List of books as mentioned in the approved syllabus)

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: Electronics & Communication Engineering		**Semester: IV**
Course Title: **Data Structures using C**(Diploma)		**Course Code: 21EECF203**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 6Hrs/week**
ISA Marks: 80	**ESA Marks:20**	**Total Marks: 100**
Teaching + Lab. Hours: 72Hrs	**Examination Duration:2 Hrs**	

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

Category: Demonstration		**Total Weight age: 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:*			1

	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			
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 Weight age: 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.			3

	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.			
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: *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.			4
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 1. Selection 2. Insertion 3. Bubble 4. Merge 5. Quick 6. Heap			5
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
	Books/References: 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

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering		Semester: IV
Course Title: ARM Microcontroller Laboratory Experiments Lab Code: 15EECP204		
L-T-P: 0-0-1	Credits:01	Total Marks: 100
Teaching Hours: 28Hrs	Examination Duration: 2 Hrs	Contact Hours: 2Hrs/week

List of Experiments:

1. Writeaprogramthatdisplaysavalueof_Y‘atport0and_N‘atport2andalsogeneratesasquarewave of 10Khz with Timer 0 in mode 2 at port pin p1.2 XTAL=22MHz
2. Write a C program that continuously gets a single bit of data from P1.7 and sends it to P1.0 in main, while simultaneously creating a square wave of 200us period on pin P2.5. ii. Sending letter _A‘to serial port. Use Timer 0to create square wave..
3. 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
4. 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.
5. Write an ALP to i. Find the length of the carriage r1eturn terminated string. ii. Compare two strings for equality
6. Write an ALP to pass parameters to a subroutine to find the factorial of a number or prime number generation
7. Write a C‘program to test working of LED‘s usingLPC2148.
8. Write a C‘program& demonstrate an interfacing of Alphanumeric LCD 2X16 panel to LPC2148 Microcontroller.
9. WriteanALPtogeneratethefollowingwaveformsofdifferentfrequenciesi.Squarewaveii.Triangular
    a. iii. Sine wave
10. Write a C‘ program & demonstrate interfacing of buzzer to LPC2148(using external interrupt)
11. Write a program to set up communication between 2 microcontrollers usingI2C.
12. Write a C‘ program & demonstrate an interfacing of ADC
13. Develop an ARM based application using i. sensors ii. Actuators iii. Displays

Text Books

1. Steve Furber, ARM System- on-Chip Architecture, 2nd, LPE,2002

2. The 8051 Microcontroller Architecture, Programming & Applications " By _KennethJ.Ayala,
Cenage Learning; 3rd edition 2007
3. William Hohl ARM Assembly Language fundamentals and Techniques||by,CRC press CRC Press; 2nd edition ,2014

Back to Semester IV

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering		**Semester: V**
Course Title: Arithmetical Thinking and Analytical Reasoning		**Course Code: 22EHSH301**
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

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

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering		Semester: V
Course Title: CMOS VLSI Circuits		Course Code: 19EECC301
L-T-P: 4-0-0	Credits: 04	Contact Hours: 4Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration: 3 Hrs	

Unit I

Chapter No. 1. Introduction to VLSI and IC fabrication technology (08 hours)

VLSI Design Flow, Semiconductor Technology - An Overview, Czochralski method of growing Silicon, Introduction to Unit Processes (Oxidation, Diffusion, Deposition, Ion-implantation), Basic CMOS technology - Silicon gate process, n-Well process, p-Well process, Twin-tub Process, Oxide isolation. FinFET device, The root cause of short channel effects in twenty-first century MOSFETS, The thin body MOSFET concept, The FinFET and a new scaling path for MOSFETs, Ultra-thin body FET, Recent trends in fabrication technology.

Chapter No. 2. Electronic Analysis of CMOS logic gates (14 hours)

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.

Unit II

Chapter No. 3. Design of CMOS logic gates (06 hours)

Stick Diagrams, Euler Path, Layout design rules, DRC, Circuit extraction, Latch up – Triggering Prevention.

Chapter No. 4. Designing Combinational Logic Networks (14 hours)

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.

Unit – III

Chapter No. 5. Sequential CMOS Circuit Design (08 hours)

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

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

1. John P. Uyemura, Introduction to VLSI Circuits and Systems, 1, Wiley, 2007
2. Neil Weste, David Harris & Ayan Banerjee,CMOS VLSI Design, 4, Pearson Ed 2011
3. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3, Tata McGraw, 2007

References

1. FinFET Modeling for IC Simulation and Design: Using the BSIM-CMG Standard By Yogesh Singh Chauhan, Darsen Duane Lu, Vanugopalan Sriramkumar, Sourabh Khandelwal, Juan Pablo Duarte, Navid Payvadosi, Ai Niknejad, Chenming Hu, Elsevier Publication, 2015
2. Wayne, Wolf, Modern VLSI design: System on Silicon, 3, Pearson Ed,2005
3. Douglas A Pucknell and Kamran Eshraghian, Basic VLSI Design, 3rd edition, PHI,2005
4. Phillip. E. Allen, Douglas R. Holberg, CMOS Analog circuit Design, 3rd edition, Oxford University,2011

Back to Semester V

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering		**Semester: V**
Course Title: Communication Systems I		**Course Code: 22EECC302**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40Hrs	**Examination Duration: 3 Hrs**	

Unit – 1

Chapter 01. Analog Communication Techniques (14 hours)

Introduction, need for modulation, Amplitude modulation, Time-Domain description, Frequency-Domain description. Generation of AM wave- square law modulator. Detection of AM waves, square law and envelope detector. Double side band suppressed carrier modulation (DSBSC), Generation of DSBSC waves: balanced modulator. Coherent detection of DSBSC modulated waves: Costas loop. Quadrature carrier multiplexing. Single side band modulation, Frequency-Domain and time-domain description of SSB modulated Signals-Generation, detection.

Comparison of amplitude modulation techniques, Frequency division multiplexing (FDM).

Chapter 02. Receiver and its characteristics (06 hours)

Radio receivers: Tuned radio frequency receiver, Super heterodyne receiver Sensitivity and selectivity, selection of IF. Block diagram and features of Communication Receiver.

Unit – 2

Chapter 03. Angle modulation (08 hours)

Basic definitions, 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, Generation of FM Waves: indirect FM, Direct FM, Demodulation of FM Waves,

Chapter 04. Random Variables and processes (06 hours)

Random variables-average, variance, CDF, PDF, Joint CDF and PDF, Random Process- Stationary, Mean, Correlation and Covariance functions., autocorrelation function, Cross-correlation functions. Power spectral density: Properties of the spectral density, Gaussian Process: Central limit theorem, Properties of Gaussian processes.

Chapter 05. Noise in Continuous wave modulation Systems (06 hours)

Sources of noise: Shot noise, thermal noise, White noise. Frequency domain representation, Effect of filtering on Gaussian noise, Mixing and superposition of Noises, Noise equivalent bandwidth, Quadrature components of noise, Narrowband noise, Noise figure., Equivalent noise temperature. Receiver model, Noise in AM Receivers, Noise in FM receivers

Unit - 3

Chapter 06. Introduction to Sampling (10 hours)

Sampling theorem, Quadrature sampling of Band pass signals, Reconstruction of a message from its samples. Time Division Multiplexing (TDM) Signal distortion in Sampling.

Text book:

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

References

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: Electronics & Communication Engineering		**Semester: V**
Course Title: Digital Signal Processing		**Course Code: 22EECC303**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 42Hrs	**Examination Duration: 3 Hrs**	

Unit - 1

Chapter No. 1. Discrete Fourier Transforms (08 hours)

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.

Chapter No. 2. Fast-Fourier-Transform (FFT) algorithms (08 hours)

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 - 2

Chapter No. 3. Design of Digital Filters (08 hours)

Design of digital filters: Considerations and characteristics of practical digital filters. Design of digital filters: symmetric and anti-symmetric FIR filters, design of linear phase FIR filters using windowing method - Rectangular, Hamming, Hanning, Bartlet and Kaiser windows.

Chapter No. 4. Design of IIR filters from analog filters (08 hours)

Design of IIR filters from analog filters: approximation of derivative, impulse invariance method, bilinear transformation, Characteristics of commonly used analog filters: Butterworth and Chebyshev filters, frequency transformation in the digital domain.

Unit - 3

Chapter No. 5. Realization of Digital FIR Systems (04 hours)

Implementation of Digital systems: structures for FIR systems: direct form I, direct form II, cascade, frequency sampling and lattice structure, Comparison of the realization techniques.

Chapter No. 6. Realization of Digital IIR Systems (04 hours)

Structures for IIR systems - direct form I, direct form II, cascade, parallel and lattice structure, Comparison of the realization techniques.

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

References

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

Back to Semester V

Program: Electronics & Communication Engineering		**Semester: V**
Course Title: Operating System and Embedded System Design		**Course Code: 22EECC304**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40 Hrs	**Examination Duration: 3 Hrs**	

Unit I

Chapter 1: Introduction and System structures (03 hours)

What is an operating system? Goals of an operating system. Operation of an OS .Resource allocation and related functions. Classes of an operating system. Operating System Services. System Calls and Types. Operating system Structure – Simple, Layered, Microkernels, Modules and Hybrid systems. System Boot

Chapter 2: Process Management (05 hours)

Process concept- operating on process, inter process communication, process scheduling- CPU scheduler- pre-emptive scheduling, scheduling criteria, scheduling algorithms- first come first served scheduling, shortest job first scheduling, priority scheduling, round robin scheduling.

Chapter 3: Memory Management (06 hours)

Memory Management Strategies: process address space static vs dynamic loading. Swapping, memory allocation; fragmentation Paging; Structure of page table; Segmentation, Virtual Memory.

Unit II

Chapter 4: Introduction To Real-Time Operating Systems (08 hours)

Introduction To Real-Time Operating Systems: Introduction to OS, Introduction to real time embedded system- real time systems, characteristics of real time systems and the future of embedded systems. Introduction to RTOS, key characteristics of RTOS, its kernel, components in RTOS kernel, objects, scheduler, services, context switch, Scheduling types: Pre-emptive priority-based scheduling, Round-robin and pre-emptive scheduling.

Chapter 5: Tasks, Semaphores and Message Queues (08 hours)

Tasks, Semaphores and Message Queues: A task, its structure, A typical finite state machine, Steps showing the how FSM works. A semaphore, its structure, binary semaphore, mutual exclusion (mutex) semaphore, Synchronization between two tasks and multiple tasks, Single shared-resource-access synchronization, Recursive shared- resource-access synchronization. A message queue, its structure, Message copying and memory use for sending and receiving messages, Sending messages in FIFO or LIFO order, broadcasting messages.

Unit III

Chapter 6: Typical Embedded System and bus protocols (05 hours)

Classification and purposes of embedded system, Characters and Quality attributes of embedded system, Core and Supporting components of embedded system, Embedded firmware, AMBA Bus Protocol, SPI, RS 485, wireless protocols (Bluetooth, 802.11 and its variants, ZigBee)

Chapter 7: Case study (05 hours)

Applications based on Cortex M series in RTOS environment

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,3rd edition, McGraw-Hill Education, 2017

References

1.DhananjayDhamdhere , Operating Systems a Concept Based Approach ,3rd edition, McGraw HillEducation,2017

Back to Semester V

Program: Electronics & Communication Engineering		**Semester: V**
Course Title: Machine Learning		**Course Code: 17EECC307**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours: 4 Hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 34+12Hrs	**Examination Duration: 3 Hrs**	

Unit – 1

Chapter No. 1. Introduction (05 hours)

Introduction what is machine learning? Applications of machine learning, types of machine learning: supervised, unsupervised and reinforcement learning, dataset formats, basic terminologies.

Chapter No. 2. Supervised Learning (10 hours)

Linear regression, logistic regression linear regression: single and multiple variables, sum of squares error function, the gradient descent algorithm, application, logistic regression, the cost function, classification using logistic regression, one-v/s-all classification using logistic regression, regularization.

Unit – 2

Chapter No. 3. Supervised Learning: Neural Network (10 hours)

Introduction to perception learning, implementing simple gates XOR, AND, OR using neural network. Model representation, gradient checking, back propagation algorithm, multi-class classification, application-Classifying digits, SVM.

Chapter No. 4. Unsupervised Learning: Clustering (05 hours)

Introduction, K means clustering, algorithm, cost function, application.

Unit – 3

Chapter No. 5. Unsupervised Learning: Dimensionality reduction (04 hours)

Dimensionality reduction, PCA- principal component analysis, applications, clustering data and PCA.

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: Electronics & Communication Engineering	**Semester: V**

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Course Title: Signal Processing Lab		Lab Code: 22EECP305
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: -2 Hrs	

Experiment wise Plan

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

Category: Tool Learning		Total Weight age: 0.00		No. of lab sessions: 1.00
Expt. / Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
1	Complete the MATLABs onramp certification courses a. MATLAB onramp b. SIMULINK onramp c. GUIDE tutorial	1.00	5.00	
	Learning Outcomes: The students should be able to: 1. Identify and learn the tool for implementing communication and signal processing concepts			Foundation
Category: Exercise		**Total Weight age: 20.00**		**No. of lab sessions: 4.00**
Expt. / Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
2	Analyze various mathematical operations on the given input sequences.	1.00	5.00	

	Learning Outcomes: The students should be able to: 1. Implement Convolution operations.			Theoretical concepts
3	Time and frequency domain representation and operations on signals.	1.00	5.00	
	Learning Outcomes: The students should be able to: 1. Apply Fourier transformations and use frequency domain properties on the discrete signals.			Theoretical concepts
4	Demonstration of Sampling Theorem	1.00	5.00	
	Learning Outcomes: The students should be able to: 1. Demonstrate the Nyquist sampling criterion			Theoretical concepts
5	Design and Implement filtering of long data sequences in time and frequency domain.	1.00	5.00	
	Learning Outcomes: The students should be able to: 1. Demonstrate the principles of convolution and interpolation.			Theoretical concepts
Category: Structured Enquiry		**Total Weight age: 40.00**		**No. of lab sessions: 4.00**
Expt. / Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
6	Design and implement correlation and correlation coefficient of the signals.	1.00	10.00	

	Learning Outcomes: The students should be able to: 1. Analyze correction concept			Theoretical concepts
7	Design and Implement IIR filters using different approximation techniques	1.00	10.00	
	Learning Outcomes: The students should be able to: 1. Design and analyze the effect of various approximation techniques			Theoretical concepts
8	Design and implementation of FIR Filter with different Windowing techniques	1.00	10.00	
	Learning Outcomes: The students should be able to: 1. Design and analyze the effect of various windowing techniques			Theoretical concepts
9	Implementation of digital filters algorithms on hardware platform	1.00	10.00	
	Learning Outcomes: The students should be able to: 1. Develop the usage of hardware platforms			Theoretical concepts
Category: Open Ended		**Total Weight age: 20.00**		**No. of lab sessions: 1.00**
Expt. / Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
10	Design and implement a suitable digital low pass filter to remove the high	1.00	15.00	

	frequency noise in the given input signal.			
	Learning Outcomes: The students should be able to: 1. Apply, design and analyze the digital filter to remove noise in the signal 2. Analyze the signal characteristics.			

Back to Semester V

Program: Electronics & Communication Engineering		Semester: V
Course Title: CMOS VLSI Circuits Laboratory Experiments		Course Code: 19EECP301
L-T-P: 0-0-1	Credits: 1	Contact Hours: 02 hours/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: 14	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).

Structured Enquiry

1. Design a Phase Detector using D-FF

Open Ended

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

Books/References:

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: Electronics & Communication Engineering		**Semester: V**
Course Title: RTOS Lab		**Course Code: 22EECP302**
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**	

1	Develop 'C' program & demonstrate basic Scheduling algorithms using Cortex M3 and comment on performance.
2	Write an optimized 'C' program to demonstrate the concept of semaphore using Cortex M3 and comment on performance.
3	Write an optimized 'C' program & demonstrate concept of Round Robin Task Scheduling and comment on performance.
4	Write an optimized 'C' program to demonstrate the concept of basic preemptive scheduling algorithm by using RTX Kernel and comment on performance.
5	Write an optimized 'C' program & demonstrate concept of Events and Flags for inter task communication using RTX Kernel. Also comment on performance.
6	Write an optimized 'C' program & demonstrate concept of Mailbox and comment on performance.
7	Write an optimized 'C' program & demonstrate concept of Semaphore and comment on performance.
8	Write an optimized 'C' program & demonstrate concept of interrupts (hardware and software).Also comment on performance.
9	Write an optimized 'C' program to interface I2C-RTC with LPC2148 and comment on performance.
10	Write an optimized 'C' program to interface SPI-EEPROM with LPC2148 and comment on performance.

Books/References:

1ARMSystem- on-Chip Architecture by 'SteveFurber, LPE, Second Edition, Addison Wesley; 2000.

2.EmbeddedSystems-Architecture,ProgrammingandDesignbyRajKamal,3rd edition,TMH,2017

3.Dr.K.V.K.K.Prasad,—Embedded/Realtimesystems:concepts,Design&Programming,publishedbydreamtechpress,

2003.

Manual

1. LPC2148 datasheet by NXP.
2. LPC2148 board manual by ALS, Bangalore.

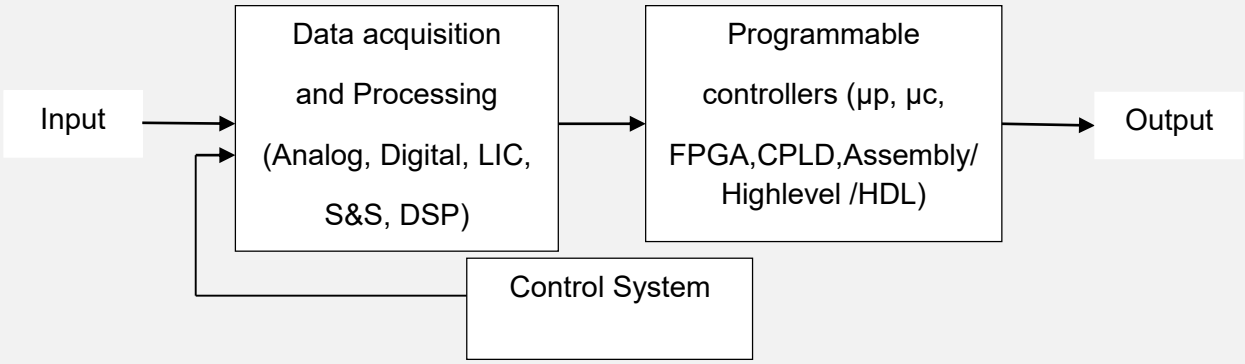
Back to Semester V

Program: Electronics & Communication Engineering		Semester: V
Course Title: Mini Project		Course Code: 23EECW301
L-T-P: 0-0-3	Credits: 3	Contact Hours: 2 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 28	Examination Duration: 2 Hrs	

Guide lines for selection of a project:

1. 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.
2. Project should be able to exhibit sensing, controlling and actuation sections.
3. 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.



3. 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

4. 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).

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

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Program: Electronics & Communication Engineering		Semester: V Semester
Course Title: Calculus and Integra Transforms (Diploma)		Course Code: 15EMAB232
L-T-P: 4-0-0	Credits: 4	Contact Hours: 4Hrs/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 50Hrs	Examination Duration:3 Hrs	

Unit I

Chapter 1.Differential Calculus: (05 hours)

Differentiation of standard functions of first and higher orders, Taylor's and Maclaurin's series expansion of simple functions for single variable.

Chapter 2. Integral Calculus: (06 hours)

Evaluation of integrals, properties, Beta and Gamma functions, relation between Beta and Gamma functions simple problems. Approximate Integrations- Trapezoidal rule and Simpson's rule

Chapter.3.Laplace Transforms: (09 hours)

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.

Chapter 4. Fourier Series: (08 hours)

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 5.Fourier Transform: (06 hours)

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

Chapter 6.Ordinary Differential Equations of first order: (06 hours)

Introduction, order and degree of equation, Solution of first order first-degree differential equations –variable separable methods, Linear differential equations, Initial value problems, solution of differential equations by Laplace transform method.

Chapter 7.Numerical solution of Initial value problem: (05 hours)

Numerical solution of initial value problems by Euler's Method, Modified Euler's method and Runge Kutta Method

Chapter 8.Differential equations of higher orders: (05 hours)

Differential equations of second and higher order with constant coefficients

Text Books

1. Kreyszig E., Advanced Engineering Mathematics, 8ed, John Wiley & sons, 2003.
2. Bali and Iyengar, A text book of Engineering Mathematics, 6ed, Laxmi Publications(p) Ltd, New Delhi,2003

Reference Books:

1. Early Transcendental Calculus- James Stewart, Thomson Books, 5e 2007
2. Ganesh Rao and and Satish Tunga, Signals and Systems, Sanguine T, 2004.
3. Simon Haykin, Barry Van Veen, Signals and Systems, John Wiley, 2002
4. Ian Glover & Peter Grant, Digital Communications, 2nd Ed, Pearson 2012.

Back to Semester V

Program: Electronics & Communication Engineering		**Semester: VI**
Course Title: Professional Aptitude and Logical reasoning		**Course Code: 16EHSC301**
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. – Arithmetical Reasoning (10 hours)
Chapter 2. – Analytical Thinking (04 hours)
Chapter 3. – Syllogistic Logic (03 hours)

Unit II
Chapter 1. – Verbal Logic (09 hours)
Chapter 2. – Non-Verbal Logic (06 hours)

Unit III
Chapter 1. - Lateral Thinking (08 hours)

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: 0.5-0-0	**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. 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 toSemester VI

Program: Electronics & Communication Engineering		**Semester: VI**
Course Title: Automotive Electronics		**Course Code: 22EECC305**
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. Introduction to Vehicle Drivelines / Power train Systems (07 hours)

Overview of Automotive industry, ECU Design Cycle: Types of model development cycles (V and Agile), Components of ECU, Examples of ECU on Chassis, Infotainment, Body Electronics and cluster. Introduction to power train, manual and automatic transmissions, automotive axles, 4-wheel and 2-wheel drives, Vehicle braking fundamentals, Steering Control, Overview of Hybrid Vehicles,

Chapter No: 2. Automotive Control Systems Design (07 hours)

Derivation of models and design of control strategies for power train control modules and integration into automotive platforms. Engine control functions, Fuel control, Electronic systems in Engines, Development of control algorithm for EMS with consideration of vehicle performance. Automotive grade microcontrollers: Architectural attributes relevant to automotive applications, Automotive grade processors ex: Renesas, Quorivva, and Infineon.

Chapter No: 3. Automotive Sensors and Actuators (08 hours)

Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Avoiding redundancy, Smart Nodes, Examples of sensors: Accelerometer (knock sensors), wheel speed sensors, Engine speed sensor, Vehicle speed sensor, Throttle position sensor, Temperature sensor, Mass air flow (MAF) rate sensor, Exhaust gas oxygen concentration sensor, Throttle plate angular position sensor, Crankshaft angular position/RPM sensor, Manifold Absolute Pressure (MAP) sensor. Actuators: Engine Control Actuators, Solenoid actuator, Exhaust Gas Recirculation Actuator.

Unit II

Chapter No:4. Automotive Stability and Safety Systems (08 hours)

Passive/active safety systems and design philosophies. Investigation of stability issues associated with vehicle performance and the use of sensors and control system strategies for stability enhancement. Implementation and application to intelligent cruise control, lane departure warning systems, ABS, Traction Control, active steering systems, vehicle dynamic control systems.

Chapter No:5. Automotive communication protocols (07 hours)

Overview of Automotive communication protocols : CAN, CAN FD, SOME/ IP Protocol, LIN , Flex Ray, MOST

Unit III

Chapter No: 6. Overview of ADAS/AV and Functional safety standards (05 hours)

Advanced Driver Assistance Systems (ADAS), Autonomous vehicle basics, sensing, planning and controls for autonomous driving, connected vehicles.

Functional Safety: Need for safety standard-ISO 26262, safety concept, safety process for product life cycle, safety by design, validation.

Chapter No:7. Diagnostics and Reliability (05 hours)

Discussion of legislated state, federal and international requirements. On-board automotive sensors to monitor vehicle operation, typical diagnostic algorithms. Analytical methods for designing fault-tolerant systems and assessing vehicle reliability, including safety critical

systems and 'limp-home' modes. Use of handheld scanners and specialized diagnostic equipment to classify faults. Diagnostic protocols: KWP2000 and UDS.

Text Books

1. Ribbens, Understanding of Automotive electronics, 8th edition, Elsevier,2017
2. Denton.T , Automobile Electrical and Electronic Systems, 5th edition, Routledge, 2017
3. Denton.T , Advanced automotive fault diagnosis, 4th edition Routledge, 2016

Reference Books:

1. Ronald K Jurgen, Automotive Electronics Handbook, 2nd Edition, McGraw-Hill,1999
2. JamesD Halderman, Automotive electricity and Electronics, 5th edition, Pearson, 2016
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: Electronics & Communication Engineering		Semester: VI
Course Title: Computer Communication Networks		Course Code: 17EECC306
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 - 1

Chapter No. 1. Computer Networks and the Internet (08 hours)

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 (12 hours)

Principles of network applications, the web and HTTP,DHCP, file transfer-FTP, electronic mail in the internet, DNS, peer-to-peer applications, socket programming-creating network applications

Unit - 2

Chapter No. 3. Transport Layer (10 hours)

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 (10 hours)

Introduction, virtual circuit and datagram networks, what's inside router? The Internet protocol (IP): forwarding and addressing in the internet, routing algorithms, routing in the internet, broadcast and multi cast routing.

Unit - 3

Chapter No. 5. The link layer: Links, Access networks, and LANs (10 hours)

Introduction to the link layer, error-detection and correction techniques, multiple access links and protocols, switched local area networks, link virtualization: A network as a link layer, data center networking, retrospective: A day in the life of a web page request.

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 ,

Back to Semester VI

Program: Electronics & Communication Engineering		Semester: VI
Course Title: Communication Systems II		Course Code: 21EECC307
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40 Hrs	Examination Duration: 3 Hrs	

Unit – I

Chapter 01. Quantization and Coding techniques (06 hours)

Quantization, PCM, quantization noise and SNR, robust quantization, DPCM, DM, ADM, coding speech at low bit rates, applications, Binary data formats

Chapter 02. Digital Modulation Techniques (10 hours)

Digital Modulation formats, Coherent binary modulation techniques, Coherent quadrature modulation techniques. Non-coherent binary modulation techniques, Comparison of Binary and Quaternary Modulation techniques. M-ary Modulation Techniques, effect of ISI, Bit versus Symbol error probability, Synchronization and applications

Unit – II

Chapter 03. Base band shaping for data transmission (06 hours)

Base-Band Shaping for Data Transmission, Discrete PAM signals, power spectra of discrete PAM signals. ISI, Nyquist's criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band Mary PAM systems, and adaptive equalization for data transmission.

Chapter 04. Detection and Estimation (08 hours)

Gram-Schmidt Orthogonalization procedure, geometric interpretation of signals, response of bank of correlators to noisy input, Detection of known signals in noise, probability of error, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise, estimation: concept and criteria, maximum likelihood estimation.

Chapter 05. Introduction to Information Theory (02 hours)

Basics of Information, Discrete communication channels.

Unit - III

Chapter 06. Information Theory (08 hours)

Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences.

Text Book:

1. Simon Haykin, Digital communications, John Wiley, 2006
2. K. Sam Shanmugam, Digital and analog communication systems, John Wiley, 2006

Reference Book:

1. Simon Haykin, An introduction to Analog and Digital Communication, John Wiley, 2003

Back to Semester VI

Program: Electronics & Communication Engineering		Semester: VI
Computer Communication Networks Laboratory Experiments		Course Code: 17EECP303
L-T-P: 0-0-1	Credits:01	Total Marks: 100
Teaching Hours: 24Hrs	Examination Duration:-2Hrs	Contact Hours: 2 Hrs/week

List of Experiments

1. Introduction to Hardware components and Ethernet LAN setup.
2. Introduction to socket programming
3. Implementation of FTP
4. Implementation of error control techniques.
5. Implementation of flow control ARQs
6. Introduction to Network operating system.
7. Subnet design
8. VLANsetup
9. OSPF and RIP configuration and performance analysis
10. eBGP and iBGP configuration and performance analysis

Text Book

1. Kurose&Ross,ComputerNetworkingATop-DownApproach,6th editionPEARSON, 2013.

References

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

Back to Semester VI

Program: Electronics & Communication Engineering		Semester: VI
Course Title: Automotive Electronics Lab		Course Code: 22EECP304
L-T-P: 0-0-1	Credits: 1	Contact Hours: 2 hrs/week
L-T-P: 0-0-1	Credits - 1	Total Marks: 100
Teaching Hours:	Examination Duration: 2 Hrs	

1	Demonstration of cut section modules: Engine, Transmission , Steering, Braking, Suspension
2	Simulink Onramp
3	Modeling a vehicle motion on a flat surface during hard acceleration, deceleration and steady acceleration.
4	Automotive suspension modeling using simulink and simscape
5	EGAS modeling and simulation using Simulink and realization on the hardware platform.
6	Realization of vehicle speed control based on the gear input on hardware platform.
7	Interior lighting control and seat belt warning system modeling with state flow and realization on the hardware platform.
8	Modeling and simulation of Automatic temperature Control using stateflow and simulink.
8	Gear input transmission over CAN bus using ARM Cortex m3 and signal analysis using CANalyzer/BusMaster software.
9	Realize Steer by wire system using model based design
10	Design and develop advance driver assistance system using simulink and realization on the hardware platform.

Text Books

1. Ribbens, Understanding of Automotive electronics, 6th , Elsevier,2003
2. Denton.T , Automobile Electrical and Electronic Systems, 5th edition, Routledge, 2017

Back to Semester VI

Program: Electronics & Communication Engineering		Semester: VI
Course Title: Communication System Lab		Course Code: 22EECP306
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: -	

List of Experiments

Category: Tool Learning		Total Weightage: 0.00		No. of lab sessions: 1.00
Expt. / Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
1	Complete the MATLABs onramp certification courses d. MATLAB onramp e. SIMULINK onramp f. GUIDE tutorial	1.00	5.00	
	Learning Outcomes: The students should be able to: 2. Identify and learn the tool for implementing communication and signal processing concepts			Foundation

Category: Exercise		Total Weightage: 20.00		No. of lab sessions: 4.00
Expt. / Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
2	Analyze various mathematical operations on the given input sequences.	1.00	5.00	
	Learning Outcomes: The students should be able to: 1. Implement Convolution and correlation operations.			Theoretical concepts

3	Time and frequency domain representation and operations on signals.	1.00	5.00	
	Learning Outcomes: The students should be able to: 1. Apply Fourier transformations and use frequency domain properties on the discrete signals.			Theoretical concepts
4	Demonstration of Sampling Theorem	1.00	5.00	
	Learning Outcomes: The students should be able to: 1. Demonstrate the Nyquist sampling criterion			Theoretical concepts
5	Design and Implement Analog modulators and demodulators.	1.00	5.00	
	Learning Outcomes: The students should be able to: 1. Demonstrate the principles of AM, DSBSC and FM MODEM			Theoretical concepts
Category: Structured Enquiry		**Total Weightage: 40.00**		**No. of lab sessions: 4.00**
Expt. / Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
6	Design and implement M-ASK,M-PSK and QPSK and QAM modulation using Gram-Schmidt Orthogonalization Process	1.00	10.00	
	Learning Outcomes: The students should be able to: 1. Analyze Gram-Schmidt Orthogonalization Process			Theoretical concepts
7	Design and Implement Digital modulators and demodulators.	1.00	10.00	
	Learning Outcomes:			Theoretical concepts

	The students should be able to: 1. Demonstrate the principles of ASK, FSK, PSK and QPSK			
8	Design and implementation of FIR Filter with different Windowing techniques	1.00	10.00	
	Learning Outcomes: The students should be able to: 1. Design and analyze the effect of various windowing techniques			Theoretical concepts
9	Design and implementation of IIR Filter with different approximating techniques	1.00	10.00	
	Learning Outcomes: The students should be able to: 1. Design and analyze the effect of various approximation techniques			Theoretical concepts
Category: Open Ended		**Total Weightage: 20.00**		**No. of lab sessions: 1.00**
Expt. / Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
10	Design and Implement a complete real-time RF transceiver on Advanced Omni Software Radio Transceiver (AOSRT) either by using BPSK or QPSK modulation techniques. OR Design and implement a suitable digital lowpass filter to remove the high frequency noise in the given input signal.	1.00	15.00	
	Learning Outcomes: The students should be able to: 4. Apply, design and analyze the use of RF modem using SDR			

	5. Apply, design and analyze the use of RF trans-reciever for various M-ary technique using SDR	

Back to Semester VI

Program: Electronics & Communication Engineering		Semester: VI
Course Title: Minor Project I		Course Code: 17EECW302
L-T-P: 0-0-6	Credits:6	Contact Hours: 2 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 48 Hrs	Examination Duration: 2 Hrs	

Application Areas are,

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

Guide lines for selection of a project:

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.

*

Criteria for group formation:

1. 3-4 students in a team.
2. 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:

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 an understandable form (Block Diagram, Flowchart, Algorithm,etc)
4. Analyse 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

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

Back to Semester VI

Program: Electronics & Communication Engineering		Semester: VI
Course Title: Analog Circuit Design		Course Code: 17EECE301
L-T-P: 0-0-3	Credits: 3	Contact Hours: 6 hrs/week
ISA Marks: 100	ESA Marks: --	
Teaching Hours: 42+42	Examination Duration: 3 hours	Total Marks: 100

UNIT I

1. **Basic MOS Device Physics (04 hours)**
   General considerations, MOS I/V characteristics, second order effects and MOS device models.
2. **Current Mirrors (04 hours)**
   Basic current Mirror, Widlar, Cascode and Wilson Current Mirrors.
3. **Single Stage Amplifiers (08 hours)**
   CS, CG, CD, Cascode and Folded Cascode. Frequency response curves

UNIT II

4. **Differential Amplifiers (05 hours)**
   Differential Amplifier, 5 pack differential Amplifier, CMRR, PSRR
5. **Op-Amp (05 hours)**
   Performance parameters, Two stage (7-pack) Op-amp, Slew rate, PSRR , Noise in Op-amps
6. **Compensation Technique (06 hours)**
   Nyquist stability Criterion, Gain and Phase margins, Compensation of Two stage op-amp and Dominant pole compensation technique.

UNIT III

7. **Reference Circuits (04 hours)**
   Current reference, startup circuits, Bandgap reference circuit, current mode Bandgap reference.
8. **Comparators (04 hours)**
   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.
3. Baker, Li, Boyce, "CMOS: Circuit Design, Layout and Simulation", Prentice Hall of India, 2000

Reference Books

1. N. Weste and K. Eshranghian, Principles of CMOS VLSI Design, Addison Wesley. 1985.
2. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997

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Program: Electronics & Communication Engineering		Semester: VI
Course Title: Introduction to Deep Learning		Course Code: 19EECE322
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 30+28	Examination Duration: 3 Hrs	

Unit I

Chapter 1: Introduction to Deep Learning (06 hours)

What is Deep Learning?, Applications of deep learning, Differences between machine learning and deep learning, Basics of Neural Networks, Supervised Learning with Neural Networks, Logistic regression as a neural network, Computation graph, shallow neural networks, Deep neural networks

Chapter 2: Hyper-Parameter Tuning, Regularization and Optimization (10 hours)

Basics of Hyper-parameters, Regularization, Need for regularization, dropout regularization, gradient checking, mini-batch gradient descent, exponentially weighted averages and its bias correction, Gradient descent with decay, Adam's optimization algorithm, The problem of local minima, weight initialization in neural networks, Normalizing activations in a network, Fitting Batch norm into a network, Softmax regression, Softmax classifier, Introduction to metric tensors and tensorflow, Basic programs in tensorflow.

Unit II

Chapter 3: Convolutional Neural Networks (12 hours)

Introduction to Computer Vision and Image Processing, 2D Convolutions, Strided convolution, convolution over volume, One layer of a convolution network, ReLu and pooling, Example of a ConvNet, Classic CNN Networks, ResNet architecture, Inception Networks, Transfer learning, Data Augmentation, Basics of Keras, Residual networks, Object Localization, Landmark and object detection, Convolutional implementation of sliding windows, YOLO algorithm, Car detection algorithm using YOLO, One shot learning, Face recognition algorithm.

Chapter 4: Recurrent Neural Networks (04 hours)

Backpropogation through time, RNN model, Types of RNN, Vanishing gradients with RNN, Gated Recurrent Unit, LSTM, Bidirectional RNN, Deep RNN, basics of NLP and Concept of word embedding, speech recognition.

Unit III

Chapter 5: Unsupervised Deep Learning (10 hours)

Concepts of Unsupervised deep learning, RBM (Restricted Boltzman Machine) and auto encoders, structure of Auto encoders, collaborative filtering with RBM, Deep belief networks.

Text Books

1. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, http://www.deeplearningbook.org, 2016.
2. *Neural Networks and Deep Learning* by Michael Nielsen.

References

1. Deep Learning with Python, Francois Chollet, by Manning Publications, 2018.
2. Deep Learning by Microsoft Research

Deep Learning Tutorial by LISA lab, University of Montreal

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Program: Electronics & Communication Engineering	**Semester: VI**	
Course Title: Advanced Digital Logic Design	**Course code: 17EECE302**	
L-T- P: 0-0-3	**Credits: 03**	**Contact Hrs: 04hrs/week**
ISA Marks: 100	**ESA Marks: 00**	**Total Marks: 100**
Teaching Hrs: 42+42		

Chapter No. 1. Digital Integrated Circuits (08 hours)

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. Digital Building Blocks **(06 hours)**

Decoder, encoder, code converters, Priority encoder, multiplexer, demultiplexer, Comparators, Parity check schemes, Multiplexer, De-multiplexer, Pass Transistor Logic, application of multiplexer as a multi-purpose logical element. Asynchronous and synchronous up-down counters, Shift registers. FSM Design, Mealy and Moore Modelling, Adder & Multiplier concepts, Memory Concept

Chapter No. 3. Logic Design Using Verilog **(10 hours)**

Evolution & importance of HDL, Introduction to Verilog, Levels of Abstraction, Typical Design Flow, Lexical Conventions, Data Types Modules, Nets, Values, Data Types, Comments, arrays in Verilog, Expressions, Operators, Operands, Arrays, memories, Strings , Delays , parameterized designs Procedural blocks, Blocking and Non-Blocking Assignment, looping, flow Control, Task, Function, Synchronization, Event Simulation. Need for Verification, Basic test bench generation and Simulation

Chapter No. 4. Principles of RTL Design **(08 hours)**

Verilog Coding Concepts, Verilog coding guide lines: Combinational, Sequential, FSM. General Guidelines, Synthesizable Verilog Constructs, Sensitivity List, Verilog Events, RTL Design Challenges, Clock Domain Crossing. Verilog modelling of combinational logic and sequential logic

Chapter No. 5. Design and simulation of Architectural building blocks **(08 hours)**

Basic Building blocks design using Verilog HDL: Arithmetic Components – Adder, Subtractor, and Multiplier design, Data Integrity – Parity Generation circuits, Control logic – Arbitration, FSM Design – overlapping and non-overlapping Mealy and Moore state machine design

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

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KLE Technological University | Creating Value, Leveraging Knowledge

Program: Electronics & Communication Engineering	Semester: VI
Course Title: Internet of Things	Course Code: 17EECE307
L-T-P : 2-0-1	Credits : 3
Total Contact Hours: 30 + 28	Duration of ESA: 3 Hours
ISA Marks: 50	ESA Marks: 50

Unit I

Chapter No. 1. Introduction to IoT (06 hours)

Defining IoT, Characteristics of IoT, What is the IoT and why is it important? Elements of an IoT ecosystem. Technology and business drivers. IoT applications, trends and implications. Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

Chapter No. 2. IoT Architecture: State of the Art (04 hours)

History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols

Applications:

Remote Monitoring & Sensing, Remote Controlling, Performance Analysis.

Unit II

Chapter No. 3. IoT Communication (04 hours)

The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN, Security aspects in IoT

Chapter No. 4. IoT Application Development (06 hours)

Application Protocols

MQTT, REST/HTTP, CoAP, MySQL

Unit III

Chapter No. 5. Case Study & advanced IoT Applications (06 hours)

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment's. Use of Big Data and Visualization in IoT, Industry 4.0 concepts.

Hands-on Lab

Arduino, Android and AWS based Experiments

1. AWS Setup and instance creation.
2. Controlling LEDs blinking pattern through UART/WiFi
3. Simple photocell to measure the ambient light level
4. Controlling LEDs blinking pattern through PHP web server.
5. Temperature measurement through ADC and WiFi
6. Controlling and interacting with basic actuators (relay).
7. Android Application development.
8. Controlling of Arduino embedded system using Android App.
9. Motor Speed control using Embedded board and NodeMCU

Lua Programming Based Experiments

1. Introduction to Lua programming

2. Controlling inbuilt LED of ESP8266
3. Controlling Motion Sensor using NodeMCU module.
4. Using ESP8266 as Webserver
    a. Understanding HTML Tags.
    b. Understanding Request.
    c. Reading Parameter Values.
    d. Controlling LED.
5. ThingSpeak Cloud - Data Visualization
    a. Working with Temperature & Humidity Sensor
    b. Working with ThingSpeak Cloud
    c. Posting & Analyzing Sensor Data on ThingSpeak Cloud
    d. ThingSpeak Cloud - Mobile App

Working with MQTT/HTTP

1. Introduction to Cloud MQTT
2. MQTT - Wireless Communication between two ESP boards
3. Controlling LED using voice commands - HTTP to MQTT Bridge

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Program: Electronics & Communication Engineering		Semester: VI
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 (02 hours)

Basics of Information, Measure of information, Entropy.

Chapter 02. Discrete Channels (08 hours)

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

Chapter 03. Source Coding (08 hours)

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 (06 hours)

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 (05 hours)

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 (05 hours)

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 (08 hours)

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

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

References

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

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Program: Electronics & Communication Engineering		**Semester: VI**
Course Title: Embedded Intelligent Systems		**Course Code: 17EECE310**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 6 hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: 42+42Hrs	**Examination Duration: 3 Hrs**	

Basics of embedded systems (10 hours)

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.

Heterogeneous computing (12 hours)

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

ML Frameworks lab with the target device (16 hours)

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

Model Development and Optimization (08 hours)

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

Android Anatomy (08 hours)

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

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

Scheme for End Semester Assessment (ESA)

UNIT	Experiments to be set of 10 Marks Each	Chapter Numbers	Instructions
I	Project Examination	1,2,3,4,5	Project implementation and demonstration 20 marks

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Program: Electronics & Communication Engineering		Semester: VI
Course Title: Multicore Architecture and Programming		Course Code: 20EECE340
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 42+42Hrs	Examination Duration: 3 Hrs	

Chapter No. 1: Introduction to Multicore (04 hours)

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 (12 hours)

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 (10 hours)

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 (10 hours)

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, Livelocks, Deadlock, Non-atomic operations

Chapter 5: Advanced Multicore topics – Introduction/Overview (04 hours)

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 behavior – Logical Execution Time (LET)

References:

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

References in the internet for Multicore timing analysis:

Why is timing analysis important: http://embedded.cs.uni-saarland.de/publications/EnablingCompositionalityRTNS2016.pdf

Multicore timing simulation solutions:
https://www.vector.com/int/en/events/global-de-en/webinars/2020/timing-analysis-for-multicore-ecus/
https://www.rapitasystems.com/multicore-timing
https://www.inchron.com/tool-suite/chronsim/
https://www.absint.com/ait/symtas.htm
https://www.danlawinc.com/wp-content/uploads/MC-BR-006-Multicore-Timing-Analysis-Solution-For-Aerospace-v3.pdf

Logical Execution Time (LET)
https://ieeexplore.ieee.org/document/5577967

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Program: Electronics & Communication Engineering		**Semester: VI**
Course Title: OOPS using C++		**Course Code: 22EECE421**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 6 hrs/week**
ISA Marks: 100	**ESA Marks: --**	**Total Marks: 100**
Teaching Hours: 42+42Hrs	**Examination Duration: --**	

Unit I

Chapter 1: Fundamental concepts of object oriented programming (04 hours)

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 (08 hours)

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 (08 hours)

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

Chapter 4: Polymorphism (06 hours)

Virtual functions, Friend functions, static functions, this pointer

Unit III

Chapter 5: Exception Handling (08 hours)

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 (06 hours)

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

Text Book

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

References

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

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Program: Electronics & Communication Engineering	**Semester: VII**	
Course Title: Wireless & Mobile Communication	**Course Code: 22EECC401**	
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3Hrs/Week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40	**Exam Duration: 3 hrs**	

Unit I

Chapter 01 Radio Propagation (16 hours)

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 (04 hours)

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

Chapter 03 Cellular concept (12 hours)

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 (04 hours)

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

Chapter 5 (04 hours)

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

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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 (02 hours)

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

Chapter 2 (02 hours)

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

Chapter 3 (06 hours)

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

Chapter 4 (05 hours)

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

Unit II

Chapter 4 (05 hours)

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

Chapter 5 (06 hours)

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

Chapter 6 (06 hours)

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

Unit III

Chapter 7 (08 hours)

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

Chapter 8 (02 hours)

Overview of MPEG-1, 2 4 and 7.

Text Books

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

References

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

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Program: Electronics & Communication Engineering		Semester: VII
Course Title: MEMS		Course Code: 23EECE403
L-T-P: 2-0-1	Credits: 3	Contact Hrs: 4 Hrs/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30 +28 hrs	Exam Duration: 3 hrs	

Unit I

Chapter 1: Overview of MEMS and Microsystems (03 hours)

Evolution of Microsystems, Miniaturization, Applications of Microsystems in Automotive, Aerospace, Health Care Industry, Industrial Products, Consumer Products and Telecommunications.

Chapter 2: Working principles of Microsystems (07 hours)

Micro-sensors: Acoustic wave sensor, Biomedical Sensors and Biosensors, Chemical Sensors Optical Sensors, Pressure Sensors, Thermal Sensors.

Micro-actuation: Actuation Using Thermal Forces, Shape Memory Alloys (SMA), Piezoelectric Crystals and Electrostatic Forces.

Applications of Micro-actuations: Micro-grippers, Micro-motors, Micro-valves, Micro-pumps.

Micro-accelerometers, Micro-fluidics, Numerical Problems.

Unit II

Chapter 3: Scaling laws in miniaturization (07 hours)

Introduction to scaling, Scaling in Geometry, Rigid-Body Dynamics, Electrostatic Forces, Electromagnetic Forces, Electricity, Fluid Mechanics, Heat Transfer, numerical problems.

Chapter 4: Materials for MEMS and Microsystem (03 hours)

Substrate and Wafers, Active Substrate Materials, Silicon as Substrate Material, Silicon Compounds, Silicon Piezo resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals, Polymers, Packaging Materials.

Unit III

Chapter 5: Microsystems Fabrication Processes (05 hours)

Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapor Deposition (CVD), Physical Vapor Deposition (PVD), Etching.

Chapter 6: Micro-manufacturing (05 hours)

Bulk Micro-manufacturing, Surface Micro machining,The LIGA Process.

Text Book:

1. “MEMS and Microsystems– Design and Manufacture”, Tai-Ran Hsu, TMH Edition 2002.

References:

1. "Micro system Design", Stephen D. Senturia, Kluwer Academic Publishers, 2001.
2. "Foundations of MEMS", Chang Liu, Pearson Edition 2012.
3. "RF MEMS: Theory, Design, and Technology", Gabriel M. Rebeiz, John Wiley & Sons Publication, 2003.

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Program: Electronics & Communication Engineering	**Semester: VII**	
Course Title: Physical Design-Analog	**Course code: 18EECE419**	
L-T- P: 0-0-3	***Credits: 03***	***Contact Hrs: 06hrs/week***
ISA Marks: 100	***ESA Marks: 00***	***Total Marks: 100***
Teaching Hrs: 28 hrs	**Exam Duration: 3 hrs**	

Chapter No 1. Standard cell Layout creation **(08 hours)**

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 **(08 hours)**

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 and Guard rings, Matching: **(06 hours)**

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

Guard ring : What is guard ring, Usage of guard ring

Chapter No 4. Reliability issues **(08 hours)**

Introduction to failure mechanism, Causes of reliability issues, Process enhancement techniques and Layout considerations to reduce reliability issues

Chapter No 5. Physical design of amplifier and buffer **(10 hours)**

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

Reference:

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

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Program: Electronics & Communication Engineering	**Semester: VII**	
Course Title: Cryptography and Network Security	**Course Code: 18EECE415**	
L-T-P: 3-0-0	**Credits: 3**	**Contact Hrs: 3Hrs/Week**
IAS Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 42	**Exam Duration: 3 hrs**	

Unit I

Chapter No. 1. Overview (02 hours)

Introduction, Services, Mechanisms and attacks of OSI architecture, Model

Chapter No. 2: Introduction to Finite Fields (04 hours)

Groups, Rings and fields. Modular Arithmetic, Euclid's Algorithm, Extended Euclid's algorithm, Finite fields of the form GF (p), Finite fields of the form GF(2n) , Polynomial arithmetic, Euler's and format's theorem, Chinese remainder theorem

Chapter No. 3: Classical Encryption techniques (05 hours)

Symmetric cipher model, substitution technique, Transposition Techniques

Chapter No. 4: Block Ciphers and DES (05 hours)

Design and principles of Block Ciphers, DES, Strength of DES, Block Cipher Modes of Operation

Unit II

Chapter No. 5: Advanced Encryption Standards (04 hours)

Evaluation Criterion of AES, AES Encryption and AES Decryption

Chapter No. 6: Public Key Cryptography and RSA: (06 hours)

Design and principles, Concept of confidentiality and Authentication, RSA algorithm, Other Public Key Crypto Systems, Key Management, Diffie Hellman Key Exchange, Elliptic curve Cryptography

Chapter No. 7: Message Authentication and Hash Functions: (03 hours)

Message Authentication codes, Hash functions, Security of Hash and MAC functions

Chapter No. 8: Digital Signature, Authentication and Hash Functions (03 hours)

Authentication Protocols, Digital signature Standard, DSS Algorithm

Unit III

Chapter No. 9. Electronic Mail Security: (03 hours)

Pretty good privacy, Data Compression, PGP random number generator

Chapter No. 10. IP Security & Web Security (07 hours)

IP security Architecture, Security Associations, Key management , Web security Considerations, Secure Socket layer, Transport layer security, secure electronic transactions

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

1. William Stallings, Cryptography and Network Security-Principles and practices, 3rd, PHI, 2003

2. Atul Kahate , Cryptography and Network Security , TMH, 2003

3. Behrouz A. Forouzan, Cryptography and Network Security, TMH, 2007

References

1. Koeblitz, Introduction to Number theory and Cryptography , Springler, 0000

2. Bruce Schneider, Applied Cryptography, 2nd , John Wiley, 2001

3. Eric Maiwad, Fundamentals of Network security, 2nd , TMH, 2002

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Program: Electronics & Communication Engineering		**Semester: VII**
Course Title: Embedded Linux		**Course Code: 23EECE405**
L-T-P: 0-0-3	**Credits: 3**	**Contact Hours: 6Hrs/week**
ISA Marks: 100	**ESA Marks: --**	**Total Marks: 100**
Teaching Hours: 84 Hrs	**Examination Duration: 3 Hrs**	

Unit I

Chapter 1: Introduction to Linux, Embedded Linux, and Embedded Systems (04 hours)

A brief history of Linux, benefits of Linux, acquiring and Using Linux, Linux components: kernel, system library, and system utilities. Introduction to embedded Linux, and embedded systems

Chapter 2: Cross-Compiling Toolchain and C Library (06 hours)

Cross compiling toolchains, building cross compiling toolchains, contents of toolchains, C libraries, and Crosstool-NG..

Chapter 3: Linux Kernel: Introduction, configuring, compiling, and booting (06 hours)

Linux kernel structure, kernel space vs user space and interfaces between them. Configuring kernel, device tree, cross compiling Linux kernel, installing and booting Linux kernel.

Unit II

Chapter 4: Boot process, firmware, boot loaders (06 hours)

Booting process, boot loaders, U-Boot configuration, installation, and usage.

Chapter 5: File systems and accessing devices (04 hours)

File systems, their role and organization, block file systems. Hardware access using USB, SPI, I2C and PCI. Usage of kernel drivers, device trees, user space interfaces via GPIOs. Building file systems with Busy Box.

Chapter 6: Embedded Development Environment, Tools and Debugging (08 hours)

Introduction to cross-development environment, host system requirements (GCC, GDB, MAKE). Kernel debugging – challenges and techniques. Application debugging – target debugging, remote debugging, and GDB.

Unit III

Chapter 7: Build Systems (08 hours)

Introduction to open source build systems – Scratchbox, and Buildroot.

Books/References:

i. Linux Kernel Development, 3rd Edition, Robert Love, Addison-Wesley, 2010
ii. The Linux Kernel Primer, Claudia Salzberg Rodriguez et al. Prentice Hall, 2005
iii. Essential Linux Device Drivers, Sreekrishnan Venkateswaran, Prentice Hall, 2008
iv. Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, Derek Molloy, Wiley, 2016.
v. Linux Foundation - http://www.linuxfoundation.org/
vi. Linux Kernel HOWTO - www.linuxdocs.org/HOWTOs/Kernel-HOWTO.html
vii. The GNU Operating System - https://www.gnu.org/
viii. Busy Box Project home - www.busybox.net/
ix. The Eclipse Project - www.eclipse.org/
x. Scratch box - www.scratchbox.org/
xi. Build root - www.buildroot.org
xii. Raspberry Pi resources - https://www.raspberrypi.org/
xiii. Beagle Board resources - www.beagleboard.org

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Program: Electronics & Communication Engineering	**Semester: VII**	
Course Title: Design and Analysis of Algorithms	**Course Code: 18EECE409**	
L-T-P: 0-0-3	**Credits: 3**	**Contact Hrs: 06Hrs/Week Hrs**
ISA Marks: 100	**ESA Marks: 00**	**Total Marks: 100**
Total Hours: 42Hrs	**Examination Duration:-**	

Unit I

Chapter No. 1: Framework for Analysis of Algorithm Efficiency (04 hours)

Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-Recursive Algorithms, Mathematical Analysis of Recursive Algorithms.

Chapter No 2: Trees and Graphs (08 hours)

Overview of Trees. AVL Trees. Red – Black Trees. Graphs, DFS and its applications, BFS and its applications. Topological Sorting. Shortest path algorithms. Minimum Spanning Tree.

Chapter No 3: Hashing (03 hours)

Direct Address Table, Hash Table, Hash Function, Collision Resolution Techniques.

Unit II

Chapter No 4: Substring Matching and Sorting Techniques. (08 hours)

Brute-force method, Boyer-Moore – Hoorspool Algorithm, Knuth-Morris-Pratt Algorithm, Bubble sort, selection sort.

Divide and Conquer: insertion sort, merge sort, quick sort and heap sort

Chapter No 5: Greedy Technique (02 hours)

Introduction, Interval Scheduling, Proof Strategies, Huffmann Coding, 0/1 knapsack

Chapter No 6: Dynamic Programming (05 hours)

Introduction and Definition. Memorization, Fibonacci Series, Edit Distance, Longest Increasing Subsequence, Longest Common Subsequence, Matrix multiplication, Coin Change problem, Subset Sum problem.
Unit III **Chapter No 7: Backtracking (05 hours)** Introduction. N-Queens Problem, Generating string permutation, Hamiltonian Cycle. **Chapter No 8: Branch and Bound (05 hours)** Introduction. Travelling Salesman problem, Job Assignment Problem.
Text Books: 1. Data Structures with C -- Seymour Lipschutz, Schaum's Outline Series 2. Introduction to Design and Analysis of Algorithms – Anany Levitin 3rd Edition
Reference Books: 1. Introduction to Algorithms – Thomas H. Cormen 3rd edition 2. Data Structures, Algorithms and Applications In C++ -- Satraj Sahani 3. Data Structures and Algorithms Made Easy – Narshiman Karumunchi, Career Monk

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Program: Electronics & Communication Engineering		Semester: VII
Course Title: Advanced Digital Logic Verification	Course code: 18EECE418	
L-T- P: 0-0-3	Credits: 03	Contact Hrs: 06hrs/week
ISA Marks: 100	ESA Marks: 00	Total Marks: 100
Teaching Hrs: 16 +24hrs	Examination Duration:	

Chapter No. 1. Verification Concepts (08 hours)

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. Language Constructs System Verilog constructs (06 hours)

Data types: two-state data, strings, arrays: queues, dynamic and associative arrays, Structs, enumerated types. Program blocks, module, interfaces, clocking blocks, modports.

Chapter No. 3. Classes & Randomization SV Classes (10 hours)

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. Assertions & Coverage Assertions (08 hours)

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 (08 hours)

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

References:

1. System Verilog LRM
2. Chris Spear, Gregory J Tumbush - SystemVerilog for verification - a guide to learning the testbench language features - Springer, 2012
3. Step-by-Step Functional Verification with SystemVerilog and OVM by Sasan Iman SiMantis Inc. Santa Clara, CA Spring 2008

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

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Program: Electronics & Communication Engineering	**Semester: VII**	
Course Title: CMOS ASIC Design (PD-Digital)	**Course code: 18EECE420**	
L-T- P: 0-0-3	**Credits: 03**	**Contact Hrs: 06hrs/week**
ISA Marks: 100	**ESA Marks: 00**	**Total Marks: 100**
Teaching Hrs: 40+24hrs	**Examination Duration : --**	

Chapter No. 1. Introduction (08 hours)

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 (10 hours)

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 (12 hours)

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 (06 hours)

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 (04 hours)

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 PrimeTime, 2nd edition, 2001.
3. Static Timing Analysis for Nanometer Designs A Practical Approach, J. Bhasker • Rakesh Chadha, Springer Science+Business Media, LLC 2009

Tools: Cadence Innovous, Encounter

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Program: Electronics & Communication Engineering		Semester: VII
Course Title: Microwave & Antenna	Course Code: 23EECE411	
L-T-P: 3-0-0	Credits: 03	Contact Hrs: 3Hrs/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40Hrs	Exam Duration: 03 hrs	

Unit I

Chapter No. 1. Microwave Vacuum Tube Devices (040 hours)

Introduction, Reflex Klystron, Problems.

Chapter No. 2. Microwave Network Theory & Passive Devices (10 hours)

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 (08 hours)

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 (08 hours)

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 (10 hours)

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.

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Program: Electronics & Communication Engineering		**Semester: VII**
Course Title: AUTOSAR	**Course Code: 20EECE406**	
L-T-P : 3-0-0	**Credits: 3**	**Contact Hrs: 3 Hours/Week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40Hrs	**Examination Duration: 3hrs**	

Unit I

Chapter No. 1: AUTOSAR Fundamentals (08 hours)

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 (07 hours)

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 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.

Unit II

Chapter No. 3: Methodology of AUTOSAR and Communication in AUTOSAR (10 hours)

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 (05 hours)

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.

Unit III

Chapter 5: MCAL and ECU abstraction Layer (05 hours)

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 (05 hours)

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

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Program: Electronics & Communication Engineering	**Semester: VII**	
Course Title: Computer Graphics(IITD-Online)	**Course Code: 21EECE425**	
L-T-P: 0-0-3	**Credits: 03**	**Contact Hrs: 03Hrs/Week**
ISA Marks: 100	**ESA Marks: -**	**Total Marks: 100**
Teaching Hrs: 42Hrs	**Exam Duration: 03hrs**	
Prof. Saurabh Saxena, IIT Madras NPTEL 12 Weeks (Starts: 25-07-2022) Exam Date: 29 Oct, 2022 Enrollment Ends: 1 Aug, 2022		

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Program: Electronics & Communication Engineering	**Semester: VII**	
Course Title: Fabrication Techniques for MEMs-based sensors (Swayam)	**Course Code: 22EECE430**	
L-T-P: 0-0-3	**Credits: 03**	**Contact Hrs: 03Hrs/Week**
ISA Marks: 100	**ESA Marks: --**	**Total Marks: 100**
Teaching Hrs: 42Hrs	**Examination Duration: 03hrs**	
Prof. Hardik Jeetendra Pandya, IISc Bangalore NPTEL 12 Weeks (Starts: 25-07-2022) Exam Date: 30 Oct, 2022 Enrollment Ends: 1 Aug, 2022		

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Program: 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	

Program: Electronics & Communication Engineering	Semester: VII	
Course Title: Cryptography & Network Security (Swayam)	Course Code: 22EECE431	
L-T-P: 0-0-3	Credits: 03	Contact Hrs: 03Hrs/Week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs: 42Hrs	Exam Duration: 03hrs	
Prof. Sourav Mukhopadhyay, IIT Kharagpur NPTEL12 Weeks (Starts: 25-07-2022) Exam Date: 29 Oct, 2022 Enrollment Ends: 1 Aug, 2022		

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Program: 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	

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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	

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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	

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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	

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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	

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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	

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Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title:Linear Systems Theory (Swayam)		Course Code:23EECE441

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	

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Program: Bachelor of Engineering (Electronics &Communication Engineering)		Semester: VII
Course Title:Microwave Engineering (Swayam)		Course Code:23EECE442
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	

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Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title:Introduction To Wireless And Cellular Communications (Swayam)		Course Code:23EECE443
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	

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Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title:Cloud Computing (Swayam)		Course Code:23EECE444
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	

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Program: Bachelor of Engineering (Electronics & Communication Engineering)		Semester: VII
Course Title:Introduction to Cyber Security(Swayam)		Course Code:23EECE445
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	

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Program: Electronics & Communication Engineering	Semester: VII	
Course Title: Advanced Computer Graphics(IITD + KLE Tech)	Course Code: 22EECE433	
L-T-P: 0-0-3	Credits: 03	Contact Hrs: 03Hrs/Week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs: 42Hrs	Examination Duration: 03hrs	

Advanced Computer Graphics

Subodh Kumar
Professor,
Department of Computer Science and Engineering,
Indian Institute of Technology Delhi.
subodh@cse.iitd.ac.in

#	Topics	Hours
1	Review of Rasterization and Ray tracing	3.0
2	Rendering acceleration data structures	3.0
3	Applications of Texture mapping	3.0
4	Physically based lighting models, global illumination	6.0
5	Multi-pass shading techniques	3.0
6	Surface design and representation (Implicit and Parametric forms)	6.0
7	Mesh Parameterization	3.0
8	Mesh simplification	3.0
9	Animation	6.0
10	Virtual world design	3.0
11	Volume rendering	3.0

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Program: Electronics & Communication Engineering	Semester: VII	
Course Title: Advanced Computer Vision(**IITD + KLE Tech**)	Course Code: 22EECE434	
L-T-P: 0-0-3	Credits: 03	Contact Hrs: 03Hrs/Week
ISA Marks: 100	ESA Marks: --	Total Marks: 100

Teaching Hrs: 42Hrs	Examination Duration: 03hrs	

Advanced Computer Vision

Chetan Arora,
Associate Professor,
Department of Computer Science and Engineering,
Indian Institute of Technology Delhi.
chetan@cse.iitd.ac.in

#	Topics	Hours
1	Basics of Machine Learning, and Convolutional Neural Networks	1.5
2	Optimization strategies for training deep neural networks	1.5
3	Advanced Architectures for Image Classification (VGGNet, InceptionNet, ResNet, DenseNet, MobileNets etc.)	3.0
4	Techniques for Visualizing CNNs for Image Analysis	3.0
5	Traditional Techniques for Object Detection (Viola-Jones, Parts based models etc.)	3.0
6	Modern Techniques for Object Detection (Single shot and two shot detectors, keypoint based detectors)	4.5
7	Traditional Techniques for Image Segmentation	3.0
8	Modern Techniques for Image Segmentation	4.5
9	Generating Synthetic Images (AR models, VAEs and GANs)	4.5
10	Vision and Language	4.5
11	Learning Models for Geometrical Vision Problems	3.0
12	Object Tracking	3.0
13	Attack and defense techniques for computer vision systems	3.0

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Program: Electronics & Communication Engineering		**Semester: VII**
Course Title: Human Machine Interface		**Course Code: 23EECE428**
L-T-P: 2-0-1	**Credits: 3**	**Contact Hours:4 hrs/week**
ISA Marks: 100	**ESA Marks: --**	**Total Marks: 100**
Teaching Hours: 30Hrs	**Examination Duration: 3 Hrs**	

Unit I

Chapter 1: Introduction to HMI (04 hours)

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

Chapter 2: Automotive HMI (04 hours)

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 (06 hours)

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 (04 hours)

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 (06 hours)

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 (06 hours)

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

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Program: Electronics and Communication Engineering	**Semester: VII**	
Course Title: OOPS using C++	**Course Code: 23EECE421**	
L-T-P: 2-0-1	**Credits: 3**	
ISA: Marks: 100	**ESA Marks: --**	**Total Marks: 100**
Teaching Hrs: 30 + 28 Hrs	**Exam Duration:--**	

Unit I

Chapter 1: Fundamental concepts of object oriented programming (04 hours)

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 (06 hours)

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 (06 hours)

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

Chapter 4: Polymorphism (04 hours)

Virtual functions, Friend functions, static functions, this pointer

Unit III

Chapter 5: Exception Handling (06 hours)

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 (04 hours)

C++ Class Hierarchy, File Stream, Text File Handling, Binary File Handling

Error handling during file operations, Overloading << and >> operators

Books/References:

Text Book

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

References

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

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Program: Electronics & Communication Engineering	Semester: VII	
Course Title: CIPE & EVS	Course Code: 15EHSA401	
L-T-P : Audit	Credits: Audit	Contact Hrs: 32
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 32		Exam Duration: 3 hours

Unit I

Chapter No. 1 Features of Indian Constitution (04 hours)

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, Kesavanand 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 (03 hours)

Relevance of Directive principles of State Policy under Part IV, Fundamental duties & their significance. Sarla Mudgal v. UOI

Chapter No. 3 Union (04 hours)

Union – President, Vice President, Union Council of Ministers, Prime Minister, Parliament & the Supreme Court of India.

Chapter No.4 State (02 hours)

State – Governors, State Council of Ministers, Chief Minister, State Legislature and Judiciary.

Chapter No. 5 Constitutional Provisions for Scheduled Castes & Tribes (02 hours)

Constitutional Provisions for Scheduled Castes & Tribes, Women &Children & Backward classes, Emergency Provisions.

Chapter No. 6 Electoral process (02 hours)

Electoral process, Amendment procedure, 42nd, 44th and 86th Constitutional amendments.

Unit II

Chapter No. 7 Scope & Aims of Engineering Ethics (05 hours)

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 (03 hours)

Intellectual Property Rights (IPRs)- Patents, Copyright and Designs

Chapter No. 9 Ethical perspectives of professional bodies (03 hours)

Ethical perspectives of professional bodies- IEEE, ASME, NSPE and ABET, ASCE etc.

Unit III

Chapter No. 10 Effects of human activities on environment (02 hours)

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 (02 hours)

Environmental Protection – Constitutional Provisions and Environmental Laws in India.

Text Books (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 Publicaitons, 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: 2 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

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: VIII**
Course Title: Introduction to Deep Learning		**Course Code:23EECE422**
L-T-P: 2-0-1	**Credits:3**	**Contact Hours: 4 hrs/week**
ISA Marks:80	**ESA Marks:20**	**Total Marks:100**
Teaching Hours: 30Hrs	**Examination Duration:3Hrs**	

Unit I

Chapter 1: Introduction to Deep Learning (06 hours)

What is Deep Learning?, Applications of deep learning, Differences between machine learning and deep learning, Basics of Neural Networks, Supervised Learning with Neural Networks, Logistic regression as a neural network, Computation graph, shallow neural networks, Deep neural networks

Chapter 2: Hyper-Parameter Tuning, Regularization and Optimization (10 hours)

Basics of Hyper-parameters, Regularization, Need for regularization, dropout regularization, gradient checking, mini-batch gradient descent, exponentially weighted averages and its bias correction, Gradient descent with decay, Adam's optimization algorithm, The problem of local minima, weight initialization in neural networks, Normalizing activations in a network, Fitting Batch norm into a network, Softmax regression, Softmax classifier, Introduction to metric tensors and tensorflow, Basic programs in tensorflow.

Unit II

Chapter 3: Convolutional Neural Networks (12 hours)

Introduction to Computer Vision and Image Processing, 2D Convolutions, Strided convolution, convolution over volume, One layer of a convolution network, ReLu and pooling, Example of a ConvNet, Classic CNN Networks, ResNet architecture, Inception Networks, Transfer learning, Data Augmentation, Basics of Keras, Residual networks, Object Localization, Landmark and object detection, Convolutional implementation of sliding windows, YOLO algorithm, Car detection algorithm using YOLO, One shot learning, Face recognition algorithm.

Chapter 4: Recurrent Neural Networks (04 hours)

Backpropogation through time, RNN model, Types of RNN, Vanishing gradients with RNN, Gated Recurrent Unit, LSTM, Bidirectional RNN, Deep RNN, basics of NLP and Concept of word embedding, speech recognition.

Unit III

Chapter 5: Unsupervised Deep Learning (10 hours)

Concepts of Unsupervised deep learning, RBM (Restricted Boltzman Machine) and auto encoders, structure of Auto encoders, collaborative filtering with RBM, Deep belief networks.

Textbook:

1. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, http://www.deeplearningbook.org, 2016.
2. Neural Networks and Deep Learning by Michael Nielsen.

Reference books:

1. Deep Learning with Python, Francois Chollet, by Manning Publications, 2018.
2. Deep Learning by Microsoft Research
3. Deep Learning Tutorial by LISA lab, University of Montreal

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Program: Bachelor of Engineering (Electronics & Communication Engineering)		**Semester: VIII**
Course Title: Digital Image Processing		**Course Code:23EECE414**
L-T-P: 2-0-1	**Credits:3**	**Contact Hours:4 hrs/week**
ISA Marks:80	**ESA Marks:20**	**Total Marks:100**
Teaching Hours:30Hrs	**Examination Duration:3Hrs**	

Unit I

Chapter 1. Introduction (05 hours)

Introduction to Image processing and Computer Vision. Application domains of Image processing and computer vision. Image acquisition, sampling, quantization, temporal properties of vision.

Chapter 2. Image Formation (05 hours)

Fundamental Concepts of Image Formation: Radiometry, Geometric Transformations, Geometric Camera Models. Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections

UNIT II

Chapter 3. Image Transforms (05 hours)

2D orthogonal and unitary transforms, DFT, DCT, DST, KLT transforms

Chapter 4. Image Enhancement (05 hours)

Histograms modelling, spatial operations, transform operations, multispectral image enhancement

Chapter 5. Image Descriptors and Features (05 hours)

Texture Descriptors, Colour Features, Edges/Boundaries. Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features, Saliency

Unit III

Chapter 6. Filtering and Restoration (05 hours)

Colour Image Processing, Image Segmentation, Image observation models, Inverse and wiener filtering

Textbook:

1. Rafael C. Gonzalez & Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson.
2. NOC | Computer Vision and Image Processing - Fundamentals and Applications (nptel.ac.in)

Reference books:

1. A.K. Jain, ''Fundamentals of Digital Image Processing”, Pearson Education (Asia) Pvt. Ltd.

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Program: Electronics & Communication Engineering		Semester: VIII
Course Title: MEMS		Course Code: 23EECE403
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 30Hrs	Examination Duration: 3 Hrs	

Unit I

Overview of MEMS and Microsystems (03 hours)

Evolution of Microsystems, Miniaturization, Applications of Microsystems in Automotive, Aerospace, Health Care Industry, Industrial Products, Consumer Products and Telecommunications.

Working principles of Microsystems (07 hours)

Micro-sensors: Acoustic wave sensor, Biomedical Sensors and Biosensors, Chemical Sensors Optical Sensors, Pressure Sensors, Thermal Sensors.

Micro-actuation: Actuation Using Thermal Forces, Shape Memory Alloys (SMA), Piezoelectric Crystals and Electrostatic Forces.

Applications of Micro-actuations: Micro-grippers, Micro-motors, Micro-valves, Micro-pumps.

Unit II

Scaling laws in miniaturization (07 hours)

Introduction to scaling, Scaling in Geometry, Rigid-Body Dynamics, Electrostatic Forces, Electromagnetic Forces, Electricity, Fluid Mechanics, Heat Transfer, Numerical problems.

Materials for MEMS and Microsystem (03 hours)

Substrate and Wafers, Active Substrate Materials, Silicon as Substrate Material, Silicon Compounds, Silicon Piezo resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals, Polymers, Packaging Materials.

Unit III

Microsystems Fabrication Processes (05 hours)

Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapor Deposition (CVD), Physical Vapor Deposition (PVD), Etching.

Micro-manufacturing: (05 hours)

Bulk Micro-manufacturing, Surface Micromachining, The LIGA Process.

Text Book:

1. “MEMS and Microsystems– Design and Manufacture”, Tai-Ran Hsu, TMH Edition 2002.

References:

1. "Micro system Design", Stephen D. Senturia, Kluwer Academic Publishers, 2001.
2. "Foundations of MEMS", Chang Liu, Pearson Edition 2012.
3. "RF MEMS:Theory, Design, and Technology", Gabriel M. Rebeiz, John Wiley & Sons Publication, 2003.

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Program: Electronics & Communication Engineering		Semester: VIII
Course Title: Automotive Electronics		Course Code: 18EECO403
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. Introduction to Vehicle Drivelines / Power train Systems (07 hours)

Overview of Automotive industry, ECU Design Cycle: Types of model development cycles (V and Agile), Components of ECU, Examples of ECU on Chassis, Infotainment, Body Electronics and cluster. Introduction to power train, manual and automatic transmissions, automotive axles, 4-wheel and 2-wheel drives, Vehicle braking fundamentals, Steering Control, Overview of Hybrid Vehicles,

Chapter No: 2. Automotive Control Systems Design (07 hours)

Derivation of models and design of control strategies for power train control modules and integration into automotive platforms. Engine control functions, Fuel control, Electronic systems in Engines, Development of control algorithm for EMS with consideration of vehicle performance. Automotive grade microcontrollers: Architectural attributes relevant to automotive applications, Automotive grade processors ex: Renesas, Quorivva, and Infineon.

Chapter No: 3. Automotive Sensors and Actuators (08 hours)

Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Avoiding redundancy, Smart Nodes, Examples of sensors: Accelerometer (knock sensors), wheel speed sensors, Engine speed sensor, Vehicle speed sensor, Throttle position sensor, Temperature sensor, Mass air flow (MAF) rate sensor, Exhaust gas oxygen concentration sensor, Throttle plate angular position sensor, Crankshaft angular position/RPM sensor, Manifold Absolute Pressure (MAP) sensor. Actuators: Engine Control Actuators, Solenoid actuator, Exhaust Gas Recirculation Actuator.

Unit II

Chapter No:4. Automotive Stability and Safety Systems (08 hours)

Passive/active safety systems and design philosophies. Investigation of stability issues associated with vehicle performance and the use of sensors and control system strategies for stability enhancement. Implementation and application to intelligent cruise control, lane departure warning systems, ABS, Traction Control, active steering systems, vehicle dynamic control systems.

Chapter No:5. Automotive communication protocols (07 hours)

Overview of Automotive communication protocols : CAN, CAN FD, SOME/ IP Protocol, LIN , Flex Ray, MOST

Unit III

Chapter No: 6. Overview of ADAS/AV and Functional safety standards (05 hours)

Advanced Driver Assistance Systems (ADAS), Autonomous vehicle basics, sensing, planning and controls for autonomous driving, connected vehicles.

Functional Safety: Need for safety standard-ISO 26262, safety concept, safety process for product life cycle, safety by design, validation.

Chapter No:7. Diagnostics and Reliability (05 hours)

Discussion of legislated state, federal and international requirements. On-board automotive sensors to monitor vehicle operation, typical diagnostic algorithms. Analytical methods for designing fault-tolerant systems and assessing vehicle reliability, including safety critical systems and 'limp-home' modes. Use of handheld scanners and specialized diagnostic equipment to classify faults. Diagnostic protocols: KWP2000 and UDS.

Text Books

1. Ribbens, Understanding of Automotive electronics, 8th edition , Elsevier,2017
2. Denton.T , Automobile Electrical and Electronic Systems, 5th edition, Routledge, 2017
3. Denton.T , Advanced automotive fault diagnosis, 4th edition Routledge, 2016

Reference Books:

1. Ronald K Jurgen, Automotive Electronics Handbook, 2nd Edition, McGraw-Hill,1999
2. JamesD Halderman, Automotive electricity and Electronics, 5th edition, Pearson, 2016
3. Allan Bonnick, Automotive Computer Controlled Systems Diagnostic Tools and Techniques, Elsevier Science,2001
4. Nicholas Navet , Automotive Embedded System Handbook ,2009

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Program: Electronics & Communication Engineering	Semester: VIII

Course Title: Project Work		Course Code: 20EECW402
L-T-P: 0-0-11	Credits: 11	Contact Hours: 2 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 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