National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronic Engineering

Program Name: Electronic Engineering

Program Code: B.Tech With Effect from Academic Year: 2024-2025

Duration of Program: 8 Semesters **Duration: 16 Weeks**

Semester: First

Sr. No	Course Title	Sub.code	Teaching Scheme			Credit (L+T +P)	Examination Scheme												Grand Total
							Theory						Practical						
			L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
								Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	Engineering Physics	1LP01	2	-	2	3	3	**60**	24	**40**	00	100	40	25	10	25	10	50	20	150
2	Engineering Drawing	1LP02	1	-	4	3	3	25	10	25	00	50	20	50	20	50	20	100	40	150
3	Engineering Mathematics-I	1L03	3	1	-	4	3	60	24	40	00	100	40	-	-	-	-	-	-	100
4	Electrical Engineering	1LP04	3	-	2	4	3	60	24	40	00	100	40	25	10	25	10	50	20	150
5	Python Programming	1LP05	2	0	2	3	3	60	24	40	00	100	40	25	10	25	10	50	20	150
6	Engineering chemistry	1L06	3	0	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
	Total		**14**	**1**	**10**	**20**	**-**	**325**	**-**	**225**	**-**	**550**	**-**	**125**	**-**	**125**	**-**	**250**	**-**	**800**

Student Contact Hours Per Week: **40 Hrs.** Medium of Instruction: English

Theory and practical periods of 60 minutes each. Total Marks: **800**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

• Under the theory PA, out of 40 marks, 10 marks are for micro-project assessment/assignment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be conducted during the semester for theassessment of the cognitive domain LOs required for the attainment of the COs.

- **Candidate remaining absent in practical examination will be declare as Absent in Mark List and has to reappear for examination. The marks of the part for which candidate was present willnot be processed or carried forward.**

National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronic Engineering

Program Name: Electronic Engineering

Program Code: B.Tech With Effect from Academic Year: 2024-2025

Duration of Program: 8 Semesters **Duration: 16 Weeks**

Semester: Second

Sr. No	Course Title	Sub. code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total
							Theory							Practical						
			L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
								Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	Engineering mathematics-II	2L07	3	1	-	4	3	60	24	40	00	100	40	-	-	-	-	-	-	100
2	Energy and Environment Engineering	2L08	2	1	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
3	Sports and Yoga	2LP09	-	1	4	3	3	25	10	25	00	50	20	50	20	50	20	100	40	150
4	Electronic devices and Circuits	2LP10	3	-	2	4	3	60	24	40	00	100	40	50	20	50	20	100	40	150
5	Workshop technology	2LP11	-	1	4	3	3	25	10	25	00	50	20	50	20	50	20	100	40	150
6	Communication skills	2LP12	1	1	2	3	3	60	24	40	00	100	40	25	10	25	10	50	20	150
	Total		**9**	**5**	**10**	**20**	**-**	**290**	**-**	**210**	**-**	**500**	**-**	**75**	**-**	**75**	**-**	**250**	**-**	**800**

Student Contact Hours Per Week: **40 Hrs.** Medium of Instruction: English

Theory and practical periods of 60 minutes each. Total Marks: **800**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

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National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronic Engineering

Program Name: Electronic Engineering

Program Code: B.Tech With Effect from Academic Year: 2024-2025

Duration of Program: 8 Semesters **Duration: 16 Weeks**

Semester: Third

Sr. No	Course Title	Sub. code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
							Theory						Practical						
			L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
								Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	Engineering mathematics-III	3L13	3	1	-	4	3	60	24	40	00	100	40	-	-	-	-	-	-	100
2	C/C++ Programming	3LP14	2	1	2	4	3	60	24	40	00	100	40	25	10	25	10	50	20	150
3	Power Electronics	3L15	2	-	-	2	3	60	24	40	00	100	40	-	-	-	-	-	-	100
4	Electronic measurement and instrumentation	3LP16	2	-	2	3	3	60	24	40	00	100	40	25	10	25	10	50	20	150
5	Digital Logic and Circuits	3LP17	2	1	2	4	3	60	24	40	00	100	40	25	10	25	10	50	20	150
6	Linear Electrical Networks	3L18	2	1	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
Total			**13**	**4**	**6**	**20**	**-**	**360**	**-**	**240**	**-**	**600**	**-**	**50**	**-**	**50**	**-**	**50**	**-**	**750**

Student Contact Hours Per Week: **40 Hrs.** Medium of Instruction: English

Theory and practical periods of 60 minutes each. Total Marks: **750**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

• Under the theory PA, out of 40 marks, 10 marks are for micro-project assessment/assignment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be conducted during the semester for theassessment of the cognitive domain LOs required for the attainment of the COs.

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National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronic Engineering

Program Name: Electronic Engineering

Program Code: B.Tech With Effect from Academic Year: 2024-2025

Duration of Program: 8 Semesters **Duration: 16 Weeks**

Semester: Fourth

Sr. No	Course Title	Sub.code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
							Theory						Practical						
			L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
								Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	Control System Engineering	4L19	3	-	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
2	Electromagnetics and Field Theory	4L20	3	1	-	4	3	60	24	40	00	100	40	-	-	-	-	-	-	100
3	Microprocessor and Microcontroller	4LP21	2	-	2	3	3	60	24	40	00	100	40	25	10	25	10	50	20	150
4	Analog Communication	4LP22	2	-	2	3	3	60	24	40	00	100	40	25	10	25	10	50	20	150
5	Analog Electronics	4LP23	3	-	2	4	3	60	24	40	00	100	40	25	10	25	10	50	20	150
6	Signals and Systems	4L24	3	-	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
	Total		**16**	**1**	**6**	**20**	**-**	**360**	**-**	**240**	**-**	**600**	**-**	**75**	**-**	**75**	**-**	**150**	**-**	**750**

Student Contact Hours Per Week: **40 Hrs.** Medium of Instruction: English

Theory and practical periods of 60 minutes each. Total Marks: **750**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

• Under the theory PA, out of 40 marks, 10 marks are for micro-project assessment/assignment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be conducted during the semester for theassessment of the cognitive domain LOs required for the attainment of the COs.

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National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronic Engineering

Program Name: Electronic Engineering

Program Code: B.Tech With Effect from Academic Year: 2024-2025

Duration of Program: 8 Semesters **Duration: 16 Weeks**

Semester: Fifth

Sr. No	Course Title	Sub. code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
							Theory						Practical						
			L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
								Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	Digital Communication	5LP25	2	-	2	3	3	60	24	40	00	100	40	25	10	25	10	50	20	150
2	Transmission Lines and PCB Technology	5LP26	-	1	4	3	3	25	10	25	00	50	20	50	20	50	20	100	40	150
3	Digital signal processing	5LP27	3	-	2	4	3	60	24	40	00	100	40	25	10	25	10	50	20	150
4	Computer Architecture and organization	5L28	2	1	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
5	Artificial intelligence and machine learning	5LP29	2	-	2	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
6	VLSI Design	5LP30	3	-	2	4	3	60	24	40	00	100	40	25	10	25	10	50	20	150
Total			**10**	**2**	**12**	**20**	**-**	**325**	**-**	**225**	**-**	**550**	**-**	**100**	**-**	**100**	**-**	**200**	**-**	**800**

Student Contact Hours Per Week: **40 Hrs.** Medium of Instruction: English

Theory and practical periods of 60 minutes each. Total Marks: **800**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

• Under the theory PA, out of 40 marks, 10 marks are for micro-project assessment/assignment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be conducted during the semester for theassessment of the cognitive domain LOs required for the attainment of the COs.

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National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronic Engineering

Program Name: Electronic Engineering

Program Code: B.Tech With Effect from Academic Year: 2024-2025

Duration of Program: 8 Semesters **Duration: 16 Weeks**

Semester: Sixth

Sr. No	Course Title	Sub. code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
							Theory								Practical				
			L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
								Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	SoC Design and Verification	6LP31	3	-	2	4	3	60	24	40	00	100	40	25	10	25	10	50	20	150
2	Electronic product design Using EDA tools	6LP32	2	-	2	3	3	60	24	40	00	100	40	25	10	25	10	50	20	150
3	Embedded systems and IoT	6LP33	2	1	2	4	3	60	24	40	00	100	40	25	10	25	10	50	20	150
4	Computer networks and Security	6L34	2	1	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
5	Mini project lab	6P35	-	-	6	3	3	-	-	-	-	-	-	50	20	50	20	100	40	100
6	Advanced communication/ Wireless Sensor Networks	6L36	3	-	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
	Total		**12**	**2**	**12**	**20**	**-**	**300**	**-**	**200**	**-**	**500**	**-**	**125**	**-**	**125**	**-**	**250**	**-**	**750**

Student Contact Hours Per Week: **40 Hrs.** Medium of Instruction: English

Theory and practical periods of 60 minutes each. Total Marks: **750**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

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National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronic Engineering

Program Name: Electronic Engineering

Program Code: B.Tech With Effect from Academic Year: 2024-2025

Duration of Program: 8 Semesters **Duration: 16 Weeks**

Semester: Seventh

Sr. No	Course Title	Sub.code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total
							Theory							Practical						
			L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
								Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	MOOC Courses (Elective 1)	7L37	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	MOOC Courses (Elective 2)	7L38	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	Industrial Visit, Employability skill	7LP39	-	2	2	3	-	-	-	-	-	-	-	50	20	50	20	100	40	100
4	Dissertation Phase-I	7LP40	-	-	20	10	-	-	-	-	-	-	-	50	20	50	20	100	40	100
		Total	**-**	**-**	**-**	**20**	**-**	-	-	-	-	-	-	-	-	-	-	-	-	**-**

Student Contact Hours Per Week: **40 Hrs.** Medium of Instruction: English

Theory and practical periods of 60 minutes each. Total Marks: -

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

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List of MOOC Courses (Electives)

Sl. No.	Electives	MOOC Course	Duration	Credit	Offering Platform/Offering Organization
1	**MOOC courses for Elective 1**	Introduction to Industry 4.0 and Industrial Internet of Things	**12 Weeks**	**4**	**NPTEL**
3		Introduction to Machine Learning	**12 Weeks**	**4**	**NPTEL**
4		Robotics: Basics and Selected Advanced Concepts	**12 Weeks**	**4**	**NPTEL**
5		Product design and Manufacturing	**12 Weeks**	**4**	**NPTEL**
6	**MOOC courses for Elective 2**	ARM based SoC Design	**65 Hours**	**3**	**NIELIT Calicut**
8		FPGA Architecture and Programming	**65 Hours**	**3**	**NIELIT Calicut**
9		Fundamentals of VLSI Verification	**65 Hours**	**3**	**NIELIT Calicut**
10		Industrial Electronic Product Design	**65 Hours**	**3**	**NIELIT Calicut**

National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronic Engineering

Program Name: Electronic Engineering

Program Code: B.Tech With Effect from Academic Year: 2024-2025

Duration of Program: 8 Semesters **Duration: 16 Weeks**

Semester: Eighth

Sr. No	Course Title	Sub.code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total
							Theory							Practical						
			L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
								Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	Dissertation Phase-II	8P41	-	-	40	20	-	-	-	-	-	-	-	50	20	50	20	100	40	100
	Total	**-**	**-**	**-**	**40**	**20**	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**

Student Contact Hours Per Week: **40 Hrs.** Medium of Instruction: English

Theory and practical periods of 60 minutes each. Total Marks: -

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Course title:	ENINEERING PHYSICS	Sub code	1LP01			
		Structure	L	T	P	C
			2	0	2	3

Course Objective:	• To equip the students with an understanding of the "Scientific Methods"so that they can use the training beneficially in their higher pursuits. • This course gives a balance account of the fundamentals of Physics aswell as some of recent developments in this area best suited to the Engineering applications in different branches.
Course Outcome:	• The student will be able to understand many modern devices andtechnologies based on lasers and optical fibres. • Student can also appreciate various material properties which are usedin engineering applications and devices. • Master fundamental principles of physics applicable to engineering. • Apply physics concepts to solve complex engineering problems. • Develop proficiency in experimental techniques and data analysis. • Integrate physics knowledge across engineering disciplines for problem-solving. • Enhance communication and teamwork skills for effective collaboration in engineering projects.

Content	No. of hours	ESE Marks (%)
Module 1: Interference and Diffraction:	6	16
Interference in thin film of uniform thickness and non-uniform thickness, Newton's rings, Michel son's interferometer, Fabry-Perot interferometer. Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at circular aperture, plane diffraction grating, determination of wavelength using plane diffraction grating, dispersive power of grating, resolving power of grating.		
Module 2: Electrostatics:	6	16
Gauss's law and its applications, Divergence and Curl of Electrostatic fields, Electrostatic Potential, Boundary conditions, Work and Energy, Conductors, Capacitors, Laplace's equation, Method of images, Boundary value problems in Cartesian Coordinate Systems, Dielectrics, Polarization, Bound Charges, Electric displacement, Boundary conditions in dielectrics, Energy in dielectrics, Forces on dielectrics.		
Module 3: Magnetostatics	6	16
Lorentz force, Biot-Savart and Ampere's laws and their applications, Divergence and Curl of Magneto static fields, Magnetic vector Potential, Force and torque on a magnetic dipole,		
Module 4: Dielectrics materials:	8	18
Magnetic materials, Magnetization, Bound currents, Boundary conditions. Diamagnetic materials, Paramagnetic materials, Ferromagnetic materials, origin of magnetization, Types of magnetic materials-hard materials and soft materials. Dielectrics-Introduction, dielectric constant, polarization, induced dipoles, permanent dipoles,polar and non-polar dielectrics, polarization-an atomic view, types of polarization.		
Module 5: Classical Mechanics	6	16
Review of Newtoninan Mechanics in rectilinear coordinate system, motion in plane polar coordinates. Conservation Principles. Collision problems and centre of mass frame. Rotation about fixed axis. Non-inertial frames and pseudo forces, rigid bossy systems.		
Module 6: Quantum Mechanics/ Physics:	8	18
Two−slit experiment. Dual nature of light; Compton Effect; De-Broglie hypothesis; Davisson-Germer Experiment; Phase and group velocities; Uncertainty principle; Wave-function; Schrodinger wave equation; Particle in a finite and infinite potential well; Tunnel effect. Superposition Principle, Continuity Equation for probability density; Normalization . Expectation values .Eigen values and eigen functions Stationary states, Bound states, Applications in one dimension: Particle in a box, 1-D Finite Potential well, Harmonic oscillator.		

Reference Books:

1) Fiber optic Communication-D.C.Agarwal. Wheeler Publication, New Delhi

2) Solid state electronic devices-Streetman, Prentice Hall India, New Delhi
3) Electronic devices and circuits-Allen Mottershade, Prentice Hall India, New Delhi
4) Fiber optic communication-Keiser. Mc Graw Hill Publication
5) A course in Electrical Engineering Materials – S.P.Seth,P.V.Gupta, Dhanpat Rai Publication,New Delhi.
6) Engineering physics-Gaur and Gupta, S.Chand Publication
7) Engineering physics-Avadhanalu and Kshirsagar, S.Chand Publication

List of Experiments:

1) Determination of radius of curvature of Plano- convex lens by Newton's ring
2) Determination of wavelength by diffraction grating.
3) Study of CRO (amplitude, frequency, phase measurement).
4) Experiments on electromagnetic induction and electromagnetic braking;
5) LC circuit and LCR circuit;
6) Resonance phenomena in LCR circuits;
7) Magnetic field from Helmholtz coil;
8) Measurement of Lorentz force in a vacuum tube.
9) To study different types of Optical fibres.

Course title:	**ENGINEERING DRAWING**	**Sub code**	1LP02			
		Structure	**L**	**T**	**P**	**C**
			1	0	4	3

Course Objective:	• To impart and include proper understanding of the theory of projection. • Improve the visualization skills. • To enable the students with various concepts like dimensioning, conventions and standards related to working drawing in order to become professionally efficient. • To impart the knowledge on understanding and drawing of simple residential/ office building.
Course Outcome:	• Develop proficiency in reading and interpreting engineering drawings and diagrams. • Acquire skills in creating detailed drawings of electronic components, circuits, and systems. • Learn industry-standard drafting techniques and conventions for technical drawings. • Gain knowledge of CAD (Computer-Aided Design) software tools for electronic drafting and modeling. • Enhance visualization and spatial reasoning abilities essential for engineering design and communication.

Content	**No. of hours.**	**ESE Marks (%)**
Module 1 Introduction to engineering drawing:	8	20
Principles of engineering graphics and their significance – drawing instruments and their use – conventions in drawing – lettering – BIS conventions. Dimensioning rules, geometrical construction. Curves used in engineering practice and their constructions: Conic Sections, Special Curves-Cycloids, Epicycloids, Hypocycloids.		
Module 2: Projections of Straight Lines:	8	20

Projections of points in four quadrants, projections of points in reference plane, line parallel to both the plane, line parallel to one plane and perpendicular to the other, line inclined to one plane and parallel to the other, line inclined to both the reference planes, traces of line, use of traces of line in obtaining projections (all four quadrants should be considered).		
Module 3: Projections of planes and solids	8	20
Projections of regular planes, inclined to both planes. Projections of regular solids inclined to both planes. Introduction to solids: prisms, pyramid, cylinder, cone, cube, tetrahedron, sphere, projections of above solids with axis inclined to one plane, projections of above solids with axis inclined to both the planes, projection of composite solids (different arrangement of spheres with above solids).		
Module 4: Development of Surfaces:	8	20
Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts		
Module 5: Orthographic Projections & Isometric views:	8	20
Principles of orthographic projections – conventions – first and third angle projections. Projections of points and lines inclined to both the planes. Orthographic projections of different machine parts, sectional orthographic projections. Introduction to pictorial views, isometric projections and isometric views (Isometric and non-isometric planes).		
Reference Books:		
1) Bhatt N. D., Panchal V. M., "Engineering Drawing", Charotar Publishing House. 2) Dhabhade M. L., "Engineering Graphics", Vol.-I and Vol.-II, Vision Publications, Pune. 3) Mathur, Laxminarayan, "Elements of Engineering Drawing", Jain Publications, New Delhi.		

List of Experiments:

1) Introduction to BIS SP – 46 – 1988.
2) Explanation of various drawing instruments, symbols, RF, Dimensioning, etc.
3) Conversion of pictorial views to orthographic / profile views.
4) Projection of points and lines.
5) Projections of planes.
6) Projections of lines and planes using Auxiliary planes.
7) Projections of solids.
8) Section and development of solids.
9) Intersection of solids.
10) Isometric views.
11) Practice of scales, Representative Factor and dimensioning on some practical exemplaryfigure.

Course title:	**ENGINEERING METHAMATICS-I**	**Sub code**	1L03			
		Structure	**L**	**T**	**P**	**C**
			3	1	0	4
Course Objective:	• To expose student to understand the basic importance of Differential calculus, Integral calculus, Infinite series and Matrix theory in science and engineering.					
Course Outcome:	• The terminal objectives of the course are that, on successfulcompletion of teaching-learning and evaluation activities, a student would be able to identify and analyse the problems by applying the fundamental principles of engineering mathematics. • Develop a strong understanding of calculus and its applications in engineering. • Gain proficiency in differential equations and their relevance to engineering systems. • Apply mathematical methods to analyze and model engineering phenomena. • Acquire problem-solving skills essential for advanced engineering courses and					

	practical applications.

Contents	No. of hours	ESE Marks (%)
Module 1: Differential Calculus:	8	20
Functions of single variable: Limit, continuity and differentiability. Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem, Taylor's theorem with remainders, indeterminate forms, curvature, curve tracing.		
Module 2: Determinants:	8	20
Determinant of a matrix of order one, order two, order three. Properties of determinant, area of triangle, minors and co-factors, adjoint and inverse of a matrix,		
Module 3: Integral Calculus:	8	20
Fundamental theorem of Integral calculus, mean value theorems, evaluation of definite integrals, Applications in Area, length, volumes and surface of solids of revolutions, Improper integrals: Beta and Gamma functions, differentiation under integral sign.		
Module 4: Sequence and Series	8	20
Sequences, Infinite series of real and complex numbers, Cauchy criterion, tests of convergence, absolute and conditional convergence, improper integrals, improper integrals depending on aparameter, uniform convergence, power series, radius of convergence.		
Module 5: Matrices:	8	20
System of linear equations, Augmented matrix, Existence and uniqueness of solution, Gauss elimination method, Elementary row operations, LU decomposition, Row-equivalent systems, Row echelon form, Rank of a matrix, Linear dependence, Consistency of a linear system, Linear combination of solutions, General solution, Types of matrices and their properties, Eigenvalues, Eigen vectors, Eigenvalue problems, Cayley- Hamilton theorem, Similarity of matrices, Diagonalisation, Quadratic form, Reduction to canonical form		

Reference Books:

1) Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons
2) Piskunov, N., Differential and Integral calculus, Mir publishers Moscow (Vol. 1, Vol. 2)
3) Thomas, G.B. and Finney, R.L, Calculus and Analytic Geometry, Addison Wesley Longman
4) Michael D. Greenberg, Advanced Engineering Mathematics, Pearson Education Pvt. Ltd
5) Jain R.K., Iyengar S.R.K, Advanced Engineering Mathematics, Narosa Publishers

Course title:	**ELECTRICAL ENGINEERING**	**Sub code**	1LP04			
		Structure	**L**	**T**	**P**	**C**
			3	0	2	4

Course Objective:	• To enable the students, understand the basic ideas and principles of Electrical Engineering. • To impart knowledge for understanding the details of electrical powersystems, transformers, generators, motors etc.
Course Outcome:	• Acquire the knowledge about circuit analysis by applying KVL KCL and network Theorems. • Analysis of Single Phase AC Circuits, the representation of alternating quantities, and determining the power in these circuits • Understand the different methods for measurement of various electrical quantities. • Acquire knowledge about the constructional details, losses, parameters, and principles of operation of Transformers. • Acquire the knowledge of fundamentals, construction details, working characteristics, and classification of DC motor and induction motor.

Content	No. of hours	ESE Marks (%)
Module 1: Electrical Circuit:	8	20
DC circuits-Ohm's & Kirchoff's laws, mesh and nodal analysis, circuit theorems; Electro-magnetism, Faraday's & Lenz's laws, induced EMF and its uses; Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem Voltage Source (Definition, Characteristics of Practical Source, and Equivalent Current Source), and Star-Delta Transformation. Magnetic Circuit, Flux, MMF, Reluctance, Analogy with Electric Circuits. Simple Calculations for Composite Magnetic Circuits		
Module 2: AC Circuits:	8	20
Periodic Function, Average & R.M.S., Values, Steady State Behaviour with Sinusoidal Excitation, Phasor Representation, Reactance & Impedance, Series & Parallel Circuit, Power Factor, Principle of Generation of Single Phase & Three Phase Voltages, Power in Balanced Three Phase AC System		
Module 3: DC Machine:	8	20
DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor;		
Module 4: Transformers:	8	20
Introduction, Basic Principles, Construction, Phasor Diagram for Transformer under No Load Condition Transformer on Load, Balance of MMF on Sides, Phasor Diagram, Equivalent Circuit, Open Circuit & Short Circuit Test, Voltage Regulation and Efficiency		
Module 5: Power Systems& Electrical Machines:	8	20
Elementary Idea about Power Generation, Transmission and Distribution. Sources of Electrical Power covering, Introduction to Wind, Solar, Fuel cell, Tidal, Geothermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation.		

Reference Books:

1) Hughes, Electrical Technology, Pearson Publishers
2) Theraja B.L., Electrical Technology, S. Chand Publishers
3) Kothari D.P. and NagrathI.J., Theoryand Problems of Basic Electrical Engineering, PrenticeHall India
4) Kulshresta D.C., Basic Electrical Engineering, TMH India
5) Mittle and Mittal, Basic Electrical Engineering, TMH, 2005
6) Tarnekar S.G., and Kharbanda P.K., „A Textbook of Laboratory Course in ElectricalEngineering", Chand S., 2006 (For practical)

List of Experiments:

1) Study and verification of Kirchhoff's laws applied to DC circuits.
2) Verification of Thevenin's Theorem.
3) To Verify Maximum Power Transfer theorem.
4) Study of AC series R-L-C circuit.
5) Determination of B-H curve of a magnetic material.
6) Study of AC parallel R-L-C circuits.
7) Study of balanced 3-phase circuits.
8) Determination of voltage regulation and efficiency of a single-phase transformer by directloading.
9) Study of speed control of a DC motor by field current control and by armature voltage control.
10) Study of reversal of direction of rotation of a 3-phase induction motor.

Course Title:	Python Programming	Sub code:	1LP05			
		Structure:	L	T	P	C
			2	0	2	3

Course Objective:	• To equip students with the necessary programming skills and proficiency in Python to solve computational problems and develop software applications effectively. • To enhance students' problem-solving abilities by applying Python programming concepts to analyze, design, and implement solutions across various domains including engineering, science, and data analytics.
Course Outcome:	• Understand Python syntax and use of Python flow control and Functions. Develop, run and manipulate program by using core data structures like lists, sets, dictionaries, tuples and use of strings handling methods. Develop, run and manipulate python programs using file operations. • Able to understand Data Wrangling. Manipulate one-dimensional and multi-dimensional Numpy arrays, pandas series and data frames. Perform Data Wrangling, data loading, cleaning, transformation, reshaping, pivoting and merging. • Able to understand Data Aggregation, Group Operations, Time series and various python web scrapping. Design the web Application with the help of python programming for IOT application. • Explore the use Matplot lib package for Data Visualization in python and implement the different techniques for plotting graphs. Comprehend the importance of the exploratory data analysis paradigm, Select appropriate data visualization technique for given data. • Explore the use of python programing for IOT system. Installing OS and Designing Systems using Raspberry pi. Implement Various IoT system using Python Programming and raspberry pi.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction to Python	8	20
Installing Python. How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops. Data types and Expressions: Strings, Assignment and Comments, Numeric Data Types and Character Sets, Expressions, Functions and Modules.		
Module 2: Control statements	8	20
Definite Iteration, Formatting Text for Output, Selection, Conditional Iteration. File and Exceptions: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions. Functions: Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions-Generating Random Numbers, The math Module, Storing Functions in Modules		
Module 3: Strings and Text Files:	8	20
Accessing Characters and Substrings in a String, Strings and Number System, String Methods, Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Text Files, Data Encryption, Lists, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples Sequences, Tuples. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects. Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms		
Module 4: – Design with classes	8	20
Classes and Objects, Classes and Functions, Classes and Methods, Working with Instances, Inheritance and Polymorphism. Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, techniques for Designing Classes.		
Module 5: Graphical User Interface	8	20
Behavior of terminal based programs and GUI-based programs, Coding simple GUI-based programs, other useful GUI resources. GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels		

as Output Fields, Radio Buttons, Check Buttons. Simple Graphics and Image Processing: Overview of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing.

Text/Reference Books:

1. Mark Lutz, "Learning Python", O'Reilly Media, 5th Edition, 2016.
2. White, "Hadoop: The Definitive Guide", Third Edition - O'Reilly, 2012.
3. Brandon Rhodes and John Goerzen, "Foundations of Python Network Programming: The Comprehensive Guide to Building Network Applications with Python", Apress, Second Edition, 2016.

List of Experiments:

1. Installation of Python, and learning interactively at command prompt and writing simple programs.
2. Learning the conditions and iterations in Python by writing and running simple programs.
3. Random number generations, and problems based on random numbers.
4. Handling tuples and exercises based on tuples.
5. Functions and files
6. Linear and binary search
7. Handling tokens
8. Finding unique and duplicate items of a list.
9. Matrix addition, multiplications, and unity matrix.
10. Text processing using python 11. Programs related to python libraries like Numpy, Pandas, Scipy etc

Course title:	**ENGINEERING CHEMISTRY**	**Sub code:**	**1L06**			
		Structure:	**L**	**T**	**P**	**C**
			3	0	0	3

Course Objective:

- To present sound knowledge of chemistry fundamentals, enriching students tounderstand the role of Applied Chemistry in the field of science and engineering. To inculcate habit of scientific reasoning to do the task rationally.
- To introduce the students to basic principles of electrochemistry, cell construction and evaluation, electrochemical power sources, the importance of corrosion in metal/alloy and polymer.

Course Outcome:

- Understand the fundamental principles of chemistry and their relevance to engineering applications.
- Apply chemical concepts to analyze and design engineering materials and processes.
- Gain knowledge of corrosion mechanisms and methods for prevention in engineering materials.
- Explore environmental chemistry and its implications for sustainable engineering practices.
- Acquire laboratory skills for conducting chemical experiments and analyzing results in engineering contexts.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Atomic and Molecular Structure	6	18

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Module 2: Electrochemistry	8	18

Conductivity of electrolytes- Specific, molar and equivalent conductivity, Nernst equation for electrode potential, EMF series, hydrogen electrode, calomel electrode, glass electrode, Electrolytic and galvanic cells, cell EMF, its measurement and applications, Weston standard cell, reversible and irreversible cells, concentration cell, electrode (hydrogen gas electrode) and electrolyte concentration cell, concentration cell with and without transference.		
Module 3: Intermolecular forces and potential energy surfaces	6	16
Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.		
Module 4: Periodic Properties	6	16
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.		
Module 5: Solid State	8	16
Types of solids - close packing of atoms and ions - bcc , fcc structures of rock salt - cesium chloride- spinel -normal and inverse spinel's, Stoichiometric Defect, controlled valency & Chalcogen semiconductors, Non-elemental semiconducting Materials, Preparation of Semiconductors-steps followed during the preparation of highly pure materials and further treatments. Semiconductor Devices-p-n junction diode.		
Module 6: Polymer	6	16
Nomenclature, functionality, classification, methods of polymerization, mechanism of polymerization, molecular weight determination-Viscometry, light scattering methods. Plastics-Moulding constituents of a plastics and moulding of plastics into articles. Important thermoplastics and thermosetting resins- synthesis & applications of PVA, FLUON, PC, Kevlar, ABS polymer, phenolic & amino resins, epoxy resins and polyurethanes. Conductive polymers.		

Reference Books

1. P. C. Jain and M. Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 2005.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, 2008.
3. J. D. Lee, Concise Inorganic Chemistry, 5th Edn., Chapman and Hall, London, 1996.
4. S. S. Dara, S. S. Umare, A Text Book of Engineering Chemistry, S. Chand Publishing, 2011.
5. F.W. Billmayer. Textbook of Polymer Science, 3rd Edn, Wiley. N.Y. 1991.
6. A.R. West, Basic Solid State Chemistry, 2nd edition, John Wiley and Sons, 1999.

Course title:	**ENGINEERING MATHEMATICS-II**	**Sub code:**	**2L07**		
		Structure:	**L**	**T**	**P**	**C**
			3	**1**	**0**	**4**

Course Objective:	To provide students with a fundamental understanding of importance of multi variable calculus (Differential calculus & Integral calculus), Vector calculus and ordinary differential equations in engineering.
Course Outcome:	• Understand advanced calculus concepts and their applications in engineering. • Master probability and statistics principles relevant to engineering analysis. • Learn differential equations of engineering importance and their solutions. • Apply mathematical tools to model and analyze complex engineering systems.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Calculus of Functions of Several Variables	8	20
Limit, continuity and differentiability of functions of several variables, partial derivatives and their geometrical interpretation, Tangent plane and normal line. Euler's theorem on homogeneous, functions, Total differentiation, chain rules, Jacobian, Taylor's formula, maxima and minima, Lagrange's method of undetermined multipliers.		

Module 2: Multiple Integrals	8	20
Double and triple integrals, change of order of integration, change of variables, application to area,volumes, Mass, Centre of gravity.		
Module 3: Vector Calculus	8	20
Scalar and vector fields, gradient of scalar point function, directional derivatives, divergence and curl of vector point function, solenoidal and irrotational motion. Vector integration: line, surface and volume integrals, Green's theorem, Stroke's theorem and Gauss divergence theorem (without proof).		
Module 4: Ordinary Differential Equations	8	20
First order differential equations: Exact equation, Integrating factors, Reducible to exact differential equations, Linear and Bernoulli's form, orthogonal trajectories, Existence and Uniqueness of solutions. Picard's theorem, Picard's iteration method of solution (Statements only). Solutions of second and higher order linear equation with constant coefficients, Linear independence and dependence, Method of variation of parameters, Solution of Cauchy's equation, simultaneous linear equations.		
Module 5: Complex Variable-Differentiation	8	20
Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.		
Reference Books		
	1. Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons 2. Piskunov, N., Differential and Integral calculus, Mir publishers Moscow (Vol. 1,Vol. 2) 3. Thomas, G.B. and Finney, R.L, Calculus and Analytic Geometry, AddisonWesley Longman. 4. Michael D. Greenberg, Advanced Engineering Mathematics, Pearson EducationPvt. Ltd 5. Jain R.K., Iyengar S.R.K, Advanced Engineering Mathematics, NarosaPublishers.	

Course title:	**ENERGY AND ENVIRONMENTAL ENGINEERING**	**Sub code**	2L08			
		Structure	**L**	**T**	**P**	**C**
			2	1	0	3
Course Objective:	• To provide students with a fundamental understanding of energy systems and their environmental impact, fostering awareness of sustainable practices and solutions. • To analyze environmental challenges arising from energy utilization and explore engineering solutions to mitigate environmental impacts, promoting a holistic approach to energy and environmental management.					
Course Outcome:	• Principal renewable energy systems • Explore the environmental impact of various energy sources and also theeffects of different types of pollutants. • An understanding the problems of energy distribution, design, plan and execute • To make a thought in terms of scientific and technological advancement in the spirit of a sustainable energy greenhouse • Understand the relationships between natural resources, consumption, population, economics of consumerism, etc in an environmental context					
Content		**No. of hours**	**ESE Marks (%)**			
Module 1: Introduction:		8	20			
Present Energy resources in India and its sustainability - Different type of conventional Power Plant- -Energy Demand Scenario in India-Advantage and Disadvantage of conventional Power Plants –Conventional Vs Non-conventional power generation.						
Module 2: Basics of Solar Energy:		8	20			

Basics of Solar Energy- Solar Thermal Energy- Solar Photovoltaic- Advantages and Disadvantages-Environmental impacts and safety.		
Module 3: Wind, Biomass, Geothermal conversions and resources:	8	20
Power and energy from wind turbines- India's wind energy potential- Types of wind turbines- Offshore Wind energy- Environmental benefits and impacts. Biomass resources-Biomass conversion Technologies- Feedstock pre-processing and treatmentmethods- Bioenergy program in India-Environmental benefits and impacts. Geothermal Energy resources –Ocean Thermal Energy Conversion – Tidal.		
Module 4: Air Pollution and Greenhouse gases :	8	20
Air pollution- Sources, effects, control, air quality standards, air pollution act, air pollution measurement. Water pollution-Sources and impacts, Soil Pollution-Sources and impacts, disposal of solid waste. Greenhouse gas effect, acid rain. Noise pollution. Pollution aspects of various power plants. Fossilfuels and impacts, Industrial and transport emissions- impacts.		
Module 5: Social Issues related to Environment:	8	20
From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Climate change, global warming, acid rain, ozone layer depletion and Eutrophication, Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.		
Reference Books:		

1) Boyle, G. 2004. Renewable energy: Power for a sustainable future, Oxford University press.
2) B H Khan, Non-Conventional Energy Resources-The McGraw –Hill Second edition.
3) G. D. Rai, Non-conventional energy sources, Khanna Publishers, New Delhi, 2006.
4) Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Prentice Hall, 2003.

Course title:	**Sports and Yoga**	**Sub code:**	**2LP09**			
		Structure:	**L**	**T**	**P**	**C**
			0	**1**	**4**	**3**

Course Objective:	• To maintain students' mental and physical wellness upright and develop ability in them to cope up with the stress arising in the life. • To create space in the curriculum to nurture the potential of the students in sports/games/yoga etc. • To introduce a practice oriented introductory course on the subject. More involved / advanced course may come up in subsequent years of study.
Course Outcome:	• Enhance physical fitness, stamina, and overall well-being through regular participation in sports activities. • Develop teamwork, leadership, and communication skills through team sports and group exercises. • Cultivate mindfulness, stress management, and relaxation techniques through the practice of yoga. • Promote a healthy lifestyle and balance between academic studies and physical activity. • Understand the importance of sports and yoga in maintaining mental and physical health for optimal performance in academic and professional pursuits.

Content	**No. of hours**	**ESE Marks (%)**

Module 1: Introduction to Sports Science and Yoga	8	20
Overview of sports science and its applications in engineering, Introduction to yoga, its history, and benefits, Basic principles of sports training and conditioning, Introduction to various yoga asanas (poses) and their significance		
Module 2: Anatomy and Physiology in Sports and Yoga	8	20
Understanding human anatomy and physiology related to sports performance, Effects of exercise and yoga on various systems of the body, Biomechanics of movement in sports and yoga, Yoga anatomy: Understanding the alignment and engagement of muscles in asanas		
Module 3: Sports Training and Techniques	8	20
Principles of sports training: Strength, endurance, speed, and flexibility, Training methodologies and periodization in sports, Techniques for enhancing athletic performance, Introduction to sports-specific drills and exercises, Application of yoga asanas for improving athletic performance and preventing injuries		
Module 4: Sports Psychology and Mindfulness	8	20
Understanding the psychological aspects of sports performance, Mental preparation and goal setting in sports, Stress management techniques for athletes, Introduction to mindfulness and its application in sports and engineering, Incorporating mindfulness practices into daily routine for improved focus and concentration		
Module 5: Applied Sports Science and Yoga in Engineering	8	20
Integration of sports science principles in engineering design, Biomechanical analysis of sports equipment and technologies, Case studies on the application of sports science in engineering projects, Designing ergonomic workspaces and equipment for athletes and engineers, Practical sessions combining sports activities, yoga, and engineering projects		

Reference Books

1. "Introduction to Sports Science" by Robert Weinberg and Daniel Gould
2. "Essentials of Strength Training and Conditioning" by NSCA - National Strength & Conditioning Association
3. "Biomechanics of Sport and Exercise" by Peter McGinnis
4. "Yoga Anatomy" by Leslie Kaminoff and Amy Matthews
5. "Anatomy and Physiology for Health Professionals" by Jahangir Moini
6. "Sports Training Principles" by Frank Dick
7. "The Psychology of Enhancing Human Performance" by Frank L. Gardner and Zella E. Moore
8. "Mind Gym: An Athlete's Guide to Inner Excellence" by Gary Mack
9. "Mindfulness in Plain English" by Bhante Henepola Gunaratana
10. "Engineering Biomechanics: Mechanics and Design Applications in Musculoskeletal Systems" by D. Gordon E. Robertson and Graham E. Caldwell

list of Experiments

11. Hands-on practice sessions focusing on various yoga asanas such as Sun Salutation, Warrior poses, and balancing poses.
12. Emphasis on correct alignment, breath awareness, and relaxation techniques.
13. Practical training sessions in different sports disciplines like cricket, football, volleyball, or athletics.
14. Focus on improving specific skills such as batting techniques, dribbling skills, or throwing techniques.
15. Conducting fitness assessments including measurements of flexibility, strength, endurance, and cardiovascular fitness using standardized protocols.
16. Analysis of fitness test results to identify areas for improvement and design personalized fitness programs.
17. Interactive sessions exploring the philosophical principles of yoga such as the Eight Limbs of Yoga, Karma Yoga, and Bhakti Yoga.
18. Guided meditation practices to cultivate mindfulness, concentration, and inner peace.
19. Practical sessions on sports nutrition focusing on meal planning, hydration strategies, and nutrient timing for optimal performance and recovery.
20. Hands-on experience in preparing nutritious meals and snacks tailored to athletes' dietary needs.

Course title:	Electronics Devices and Circuits	Sub code:	2LP10			
		Structure:	L	T	P	C
			3	0	2	4

Course Objective:	• This course aims to provide students with a foundational understanding of basic semiconductor devices, including their operating principles, characteristics, and diverse applications in electronic circuits and systems. • Students will gain proficiency in analyzing and designing simple diode circuits, enabling them to comprehend the behavior of diodes in various configurations and apply this knowledge to practical circuit design scenarios. • Through this course, students will develop a comprehensive understanding of PN junction behavior within the context of circuit-level analysis. They will explore the pivotal role of PN junctions in the operation of diodes and other active semiconductor devices, facilitating deeper insights into electronic device behavior and performance.
Course Outcome:	• Understand the principles and operating characteristics of electronic devices such as diodes, transistors, and integrated circuits. • Analyze and design electronic circuits using various semiconductor devices for different applications. • Gain proficiency in device modeling, simulation, and characterization techniques. • Explore emerging electronic devices and their potential applications in modern technologies. • Develop troubleshooting skills for diagnosing and rectifying electronic device-related problems in circuits and systems.

Content	No. of hours	ESE Marks (%)
Module 1: Basic Understanding of Semiconductor Devices	8	20
Introduction to Quantum Theory of Solids: Basic principles of quantum mechanics, Schrodinger equation and its applications, Atoms and formation of energy bands, electrical conduction in solids, density of tates functions, bonding forces and energy bands in solids. Semiconductor in Equilibrium: charge carriers in semiconductors, carrier concentrations, dopant atoms and energy levels, intrinsic and extrinsic semiconductors; charge neutrality, Fermi energy level.		
Module 2: Power devices & Switching Devices	8	20
Carrier Transport Phenomena: Carrier drift, diffusion, graded impurity distribution, Hall Effect, scattering in semiconductors, velocity- electric field relations, high field transport charge injection and quasi Fermi levels. Non-Equilibrium Excess Carriers in Semiconductors: Carrier generation and recombination, characteristics of excess carriers, excess carrier lifetime, introduction to surface effects.		
Module 3: PN Junction diode and Optoelectronics devices	8	20
PN junction and hetero-structures: basic structure and principle of operation, pn junction under bias, junction capacitance, steady state conditions, transient and ac conditions, reverse bias breakdown, metal semiconductor junctions.Introduction to Optoelectronic Devices, Overview of optoelectronics ,Historical background, IMPORTANCE AND APPLICATIONS: photodiode, LED, Emerging optoelectronics Technology, Photonic Integrated Circuits.		
Module 4: Bipolar junction transistor	8	20
Bipolar Junction Transistors: Fundamental operation, amplification with BJTs, generalized biasing and equivalent circuit models, non-ideal effects, switching.		
Module 5: Field Effect Transistor	8	20
Field – Effect Transistors: Transistor operations. JFET, Metal Semiconductor FET, MISFET, MOSFET and their operations, device characteristics, non-ideal effects, CV characteristics, equivalent circuits, carbon nano tube FET and it's applicationHEMTS.		

Reference Books

	1. Electronic devices and Circuit Theory", "R. Boylestad", "Pearson Education", 9thEdition 2. "Electron devices", "S. Poornachandra, Sasikala", "Scitech", 2nd Edition 3. "Electronic Devices and Circuits", "Millman Halkias", "TMH", 2000 4. "Electronic Devices and Circuits", "DavidA.Bell", "PHI", 4thEdition
List of Experiments	
	5. **Characterization of Semiconductor Materials:** Perform experiments to understand the electrical properties of semiconductor materials such as silicon and germanium. Measure parameters like resistivity, mobility, and carrier concentration. 6. **PN Junction Diode Characteristics:** Study the I-V characteristics of a PN junction diode under forward and reverse bias conditions. Determine parameters like threshold voltage, forward and reverse bias currents, and ideality factor. 7. **Diode Rectifier Circuits:** Construct and analyze various diode rectifier circuits such as half-wave, full-wave bridge, and center-tapped full-wave rectifiers. Measure output voltage, ripple factor, and efficiency. 8. **Zener Diode Characteristics:** Investigate the voltage-regulating properties of Zener diodes. Measure the breakdown voltage and dynamic resistance of Zener diodes under different load conditions. 9. **Bipolar Junction Transistor (BJT) Characteristics:** Study the DC and AC characteristics of NPN and PNP bipolar junction transistors. Measure parameters like DC current gain (β), collector current vs. collector-emitter voltage (IC- VCE) characteristics, and output characteristics. 10. **BJT Amplifier Circuits:** Design and analyze common-emitter and common-base amplifier circuits using bipolar junction transistors. Measure parameters like voltage gain, input/output impedance, and frequency response. 11. **Field Effect Transistor (FET) Characteristics:** Investigate the DC and AC characteristics of both JFET and MOSFET transistors. Measure parameters like drain current vs. drain-source voltage (ID-VDS), transconductance, and output conductance. 12. **FET Amplifier Circuits:** Design and analyze common-source and common-drain amplifier circuits using field-effect transistors. Measure parameters like voltage gain, input/output impedance, and frequency response. 13. **Power Devices & Switching Devices:** Experiment with power semiconductor devices such as thyristors (SCRs), power MOSFETs, and IGBTs. Analyze their switching characteristics, turn-on and turn-off times, and power handling capabilities. 14. **Optoelectronic Devices:** Study the characteristics and applications of optoelectronic devices such as light-emitting diodes (LEDs), photodiodes, and phototransistors. Measure parameters like emission wavelength, forward voltage drop, and responsivity.

Course title:	**WORKSHOP TECHNOLOGY**	**Sub code:**	**2LP11**			
		Structure:	**L**	**T**	**P**	**C**
			0	**1**	**4**	**3**
Course Objective:	To develop the technical skills of creating entities from raw materials. To give "hands on" training and practice to students for use of various tools, devices, equipment and machines. To develop ability to understand, plan and implement various processes and operations to be performed on the raw material to create object of desired shape and size.					
Course Outcome:	• Acquire practical skills in using workshop tools and machinery for basic metalworking processes. • Understand safety protocols and practices essential for working in workshop environments. • Learn fabrication techniques including welding, machining, and casting for manufacturing components. • Gain knowledge of different materials, their properties, and selection criteria for engineering applications. • Develop problem-solving abilities through hands-on experience in assembling and disassembling mechanical components and systems.					

Content	No. of hours	ESE Marks (%)
Module 1: Fitting	8	20
Use and setting of fitting tools for chipping, cutting, filing, marking, centre punching, drilling, tapping.Term work to include one job involving following operations: filing to size, drilling and tapping.		
Module 2: Carpentry	8	20
Use and setting of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood tuning and modern wood turning methods. Term work to include one carpentry job involving ajoint and report on demonstration of a job involving wood tuning.		
Module 3: Electrical and Electronics	8	20
Introduction to basic electrical devices and its measurement. Introduction to basic knowledge of electronics component.		
Module 4: Welding	8	20
Use and setting of tools and equipment's for edge preparation for welding jobs and Arc welding fordifferent job like, Lap welding of two plates, butt welding of plates.		
Module 5: Machining, CNC Machines & Foundry.	8	20
At least one metal tuning job is to be demonstrated. One job on CNC Lathe and CNC Milling machine to bedemonstrated. At least one demonstration of mould making.		
Reference Books		
1. S K Hajra, CHoudhury, A K Hajra, CHoudhury, & Nirjhar Roy, Elements ofWorkshop Technology, Vol. I & II. 2. B S Raghuwanshi, A Course in Workshop Technology, Vol. 1 & II. 3. W A .l Chapman, Workshop Technology, Part I, ll & III		

list of Experiments
1. Wood sizing exercise in planning, marking, sawing, chiselling and grooving to make 1. Half lap joint 2. Cross lap joint
2. Exercise in arc welding for making 1. Lap joint 2. Butt joint
3. Preparation of sand mould for the following 1. Flange 2. Anvil
4. Preparation of joints, markings, cutting and filling for making 1. V-joint 2. T-joint
5. Making of small parts using sheet metal 1. Tray 2. Funnel

Course title:	COMMUNICATION SKILL	Sub code:	2LP12			
		Structure:	L	T	P	C
			1	1	2	3

Course Objective:	• The primary objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for academic and social needs. • To impart to the students the skills that they need in their academic, and later in their professional pursuit. To train the students to adopt an innovative approach to English language teaching and learning.
Course Outcome:	• Understand the principles and technologies behind various communication systems including analog and digital transmission. • Analyze and design communication networks using modulation techniques, multiplexing, and error control coding. • Gain proficiency in using software tools for simulating and analyzing communication systems and protocols. • Explore emerging technologies such as wireless communication, optical communication, and satellite communication. • Develop practical skills in configuring and troubleshooting communication systems and networks.

Content	No. of hours	ESE Marks (%)
Module 1: Communication & Listening	8	20
An introduction - Its role and importance in the corporate world, Tools of communication, Barriers, Levels of communication, English for Specific purposes and English for technical purposes, Listening process & practice, Exposure to recorded & structured talks, class room lectures, Problems in comprehension & retention, Note-taking practice, Listening tests- Importance of listening in the corporate world.		
Module 2: Reading & Speaking	8	20
Introduction of different kinds of reading materials: technical & non-technical, Different reading strategies: skimming, scanning, inferring, predicting and responding to content, Guessing from context, Note making, Vocabulary extension. Barriers to speaking, Building self-confidence & fluency, Conversation practice, Improving responding capacity, Extempore speech practice, Speech assessment.		
Module 3: Writing	8	20
Effective writing practice, Vocabulary expansion, Effective sentences: role of acceptability, appropriateness, brevity & clarity in writing, Cohesion & coherence in writing, Writing of definitions, descriptions& instructions, Paragraph writing, Introduction to report writing.		
Module 4: Engineering Ethics	8	20
What is profession? Engineering and Professionalism, Models of Professionalism, Types of Ethics or Morality, Engineering Ethics, Variety of moral issues, Responsibility in Engineering, Engineering Standards, The Standard Care, The Positive face of Engineering Ethics, The Negative Face of Engineering Ethics, Blame-Responsibility and Causation types of inquiry moral dilemmas, moral autonomy, The problems of Many Hands, Kohlburg's theory, Gilligan's theory Impediments to Responsible Action.		
Module 5: Safety & problem Framing	8	20
Engineering as social experimentation, Framing the problem, Determining the facts codes of ethics, clarifying Concepts, Application issues, Common Ground, General principles, Utilitarian thinking respect for persons, Engineer's Responsibility for Safety, Social and Value dimensions of Technology, TechnologyPessimism, The Perils of Technological Optimism, The Promise of Technology , Computer, Technology Privacy and Social Policy, Honesty, Integrity & Reliability, Risk, Safety and Liability in Engineering, Risk Benefit Analysis – Collegiality and loyalty.		

Reference Books

	1. Krishna Mohan and Meenakshi Raman (2000) Effective English Communication,Tata McGraw Hill, New Delhi. 2. Meenakshi Raman and Sangeetha Sharma (2006) Technical Communication, OxfordUniversity Press, New Delhi. 3. M. Ashraf Rizvi (2005) Effective Technical Communication, Tata McGraw-Hill,New Delhi. 4. Christopher Turk (1985) Effective S peaking, E & FN Spon, London 5. Golding S.R. (1978) Common Errors in English Language, Macmillan. 6. Mike Martin and Roland Schinzinger, "Ethics in Engineering" McGraw Hill 7. Charles E Harris, Micheal J Rabins, "Engineering Ethics, Cengage Learning 8. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists andEngineers, Oxford University Press 9. Caroline Whitback Ethics in Engineering Practice and Research, CambridgsUniversity Press.
List of Experiments	
	1. Conduct workshops focusing on public speaking techniques, including voice modulation, body language, and speech organization. 2. Organize group discussion sessions on engineering-related topics to improve students' ability to express their ideas articulately and persuasively. 3. Assign students to prepare and deliver technical presentations on engineering topics relevant to their specialization. 4. Conduct mock job interviews to help students develop effective communication skills for professional settings. 5. Assign students to write technical reports on engineering projects or research findings. 6. Provide guidance on writing professional emails for various purposes, such as inquiry, collaboration, and project management. 7. Explore the importance of cross-cultural communication in engineering projects with diverse team members and stakeholders. 8. Conduct negotiation and conflict resolution simulations to help students develop interpersonal communication and problem-solving skills. 9. Organize sessions where students present technical posters summarizing their research projects or engineering designs. 10. Arrange networking events where students can interact with professionals from the engineering industry, academia, and related fields.

Course title:	**ENGINEERING MATHEMATICS - III**	**Sub code:**	**3L13**			
		Structure:	**L**	**T**	**P**	**C**
			3	**1**	**0**	**4**
Course Objective:	● To Explain the Importance of Numerical Methods in Solving Differential Equations, Integrations, and Algebraic Equations ● To Explain the Significance of Laplace and Z Transforms and Their Use in Solving Differential and Difference Equations. ● To Apply Different Statistical and Curve Fitting Techniques to Gain Insights from Data. ● To Describe the Theory of Complex Variables					
Course Outcome:	● Master advanced mathematical techniques including vector calculus and complex analysis for engineering applications. ● Apply Laplace transforms and Numerical methods to solve differential equations arising in engineering problems. ● Develop proficiency in numerical methods for solving Complex Variable Integration problems. ● Explore probability and statistics concepts relevant to engineering decision-making and data analysis. ● Utilize mathematical modeling to analyze and solve real-world engineering problems in various disciplines.					

Content	No. of hours	ESE Marks (%)
Module 1: Numerical Method	8	20
Lagrange's interpolation formula, Numerical differentiation, solution of ordinary differential equation byPicard's method, Taylor 's series method, Euler's modified method and Runge- Kutta method.		
Module 2: Laplace Transform	8	20
Laplace Transform, Definition, and Properties, Laplace transform of elementary function, derivatives,integrals. Inverse Laplace transforms convolution theorem solution of LDE by Laplace Transform.		
Module 3: Statistics	8	20
Measures of central tendency, Measures of dispersion, Moments, skewness, Kurtosis. Correlation,Coefficient of Correlation, lines of regression of bivariate data, fitting of curve, least square principle.		
Module 4: Complex Variable- Integration	8	20
Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.		
Module 5: Z Transform &Vector Calculus	8	20
Z- Transform, Z-transform of elementary function & properties. Inverse Ztransforms. Solution of differenceequation by Z-transforms. Vector calculus, differention, gradient, divergence, curl of vector function. Vector integration. Green'sTheorem, stoke's theorem, Gauss divergence theorem. Irrorational & solenoidal fields.		
Reference Books		
	1. P.N. Wartikar and J.N.Wartika, A Text Book of Engineering Mathmatics (Vol. I &II)	
	2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publicatons, New Delhi	
	3. Erwin Kreyszing, Advanced Engineering Mathematics, Willey Eastern Ltd.	

Course title:	**C/C++ PROGRAMMING**	**Sub code**	3LP14			
		Structure	**L**	**T**	**P**	**C**
			2	1	2	4

Course Objective:	• To introduce basics of programming and develop logical thinking ofstudents. • To help students understand how to model real world problems into the software and develop practical programming skills of students. • To implement mathematical statistical, applications into programming.
Course Outcome:	• Master the syntax, semantics, and basic programming constructs of the C/C++ languages. • Develop problem-solving skills through algorithmic thinking and programming exercises. • Understand memory management, pointers, and data structures for efficient programming. • Gain proficiency in modular programming, debugging, and testing techniques. • Apply object-oriented programming principles to design and implement software solutions for engineering problems.

Content		**No. of hours**	**ESE Marks(%)**
Module 1: Introduction:		8	20

Flow charts, data types and storage classes, scope of variables, arithmetic operators, assignment, conditional, arithmetic expressions, enumerated data types, decision making, branching, looping, Switch concept, function and parameter passing, recursive functions, macros.		
Module 2: Basic programming algorithms:	8	20
Programs to illustrate basic language constructs in C like - Factorial, Sine/cosine and other mathematical series, Fibonacci series, calculating square-root of a number, calculating GCD of 2 integers (Euclid's method and otherwise), Calculating LCM of 2 integers and similar such programs.		
Module 3: Arrays and applications in C language:	8	20
Introduction to one dimensional and 2-D array with examples. Representing a polynomial using 1-D array and polynomial operations, use of 2-D array to represent a matrix and matrix operations. Character arrays (strings): String related functions (strlen, strcpy, strcat, strcmp, atoi, itoa, reverse, strstr etc) and their function definitions. Searching and Sorting methods: Selection sort, Bubble sort,Insertion sort, Linear and binary search, partitioning an array, merging of 2 sorted arrays. Introduction to "Divide and Conquer" via Mergesort and Quicksort.		
Module 4: Structures, Unions and Pointers in C language:	8	20
Basic concept, array of structures and its applications. Introduction (declaration and initialization), pointers and arrays, concept of dynamic memory allocation, use of pointers to represent variable- sized 1-D and 2-D arrays, pointers to structures.		
Module 5: C++ programming concepts	8	20
Introduction to Object Oriented Concepts, Features of Object-oriented programming (OOP). Classes and Objects: Creating a Class, The Self Variable, Constructor, Types of Variables, Namespaces, Types of Methods, Encapsulation, Module Packages. Inheritance and Polymorphism: Constructors in Inheritance, The Super Function, Types of Inheritance, Polymorphism, Abstract classes and Interfaces.		

Reference Books:

1) Kerninghan; Ritchie, "C programming Language", PHI
2) Theraja B.L., Electrical Technology, S. Chand Publishers
3) Balguruswamy, "Programming in ANSI C", Tata Mcgraw Hill Publishing
4) Kakde and Deshpande, "C and data Structure", Charles River Media Publisher
5) Dromey R G, "How to Solve it by Computer", PHI
6) "Programming in C++ (A Practical Approach)", C. S. Sharma Publisher, Oxford University Press

List of Experiments:

1) Write a Program to calculate and display the volume of a CUBE having its height (h=10cm),width (w=12cm) and depth (8cm).
2) Write a program to take input of name, roll no and marks obtained by a student in 5 subjectseach have its 100 full marks and display the name, roll no with percentage score secured.
3) Simple Arithmetic Operation.
4) Write a C program to check whether a number is even or odd using ternary operator.
5) Write a C program to find the sum of individual digits of a positive integer.
6) Write a C program to print the numbers in triangular form.
7) Write a C program to find the second largest integer in a list of integers.
8) Write C programs that use both recursive and non-recursive functions.
9) Write a C program to perform arithmetic using Switch Statement.
10) Write a C program to perform factorial.
11) Write a C program to print Fibonacci no.
12) Write a Simple Calculator Program using C++
13) Write a student database management Program using C++

Course title:	**Power Electronics**	**Sub code:**	**3L15**			
		Structure:	**L**	**T**	**P**	**C**

	2	**0**	**0**	**2**

Course Objective:	• This course aims to explore the fundamental characteristics and operational principles of various semiconductor devices, providing students with a comprehensive understanding of their behavior and applications in electronic circuits and systems. • Students will develop proficiency in analyzing different types of power electronic converters, including their topologies, control strategies, and performance characteristics, enabling them to evaluate their suitability for various power conversion applications • Students will gain practical experience in applying different types of power electronic converters in real-world scenarios, facilitating their ability to design, implement, and troubleshoot power conversion systems effectively.
Course Outcome:	• Understand the principles and characteristics of power semiconductor devices and their applications in electronic power conversion. • Analyze and design power electronic circuits for various applications including rectification, inversion, and conversion. • Gain proficiency in control techniques for regulating voltage, current, and power in power electronic systems. • Explore the integration of power electronics in renewable energy systems, electric vehicles, and industrial applications. • Develop practical skills in simulation, testing, and troubleshooting of power electronic circuits and systems.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Power Electronic Converters	8	20
Phase controlled (AC/DC), 1-phase/3-Phase, Semi/full/dual; Analysis and performance with passive load, Typical control circuit; Harmonics and power factor; Voltage controllers (AC/DC), Typical control circuits for integral control/phase control strategies, Cycloconverter.		
Module 2: Chopper	8	20
Basic chopper classification, Basic chopper operation, Control strategies, Chopper configuration, Thyristorchopper circuit, Source filter		
Module 3: Inverter	8	20
Classification of inverter, Single Phase: Half bridge voltage source inverters, Full bridge inverter, Performance parameter of inverter, Voltage control of inverter, PWM inverter, Three phase inverter,Classification of Resonant Converter: Series resonant inverters, Parallel inverter, Current source Inverter, and Harmonic reduction.		
Module 4: Control of DC Drives and AC drives	8	20
Criteria for selecting drive components, Basic characteristics of DC and its equivalent circuit, Methods of DC motor control schemes for DC motor speed control, DC drives, and adjustable speed DC drive. Single phase drives/Three phase drives, DC-DC converter drives, PLL drives, Closed loop control of DC drives, Basic principles of operation and its characteristics, Speed control method, Closed loop control of inductionmotor drives, Adjustable AC drives.		
Module 5: **Power Electronics Application**	8	20
Battery charging regulator, Flasher circuits, Protective SCR circuits, Ring counter, Time delay circuits, UPS, SMPS, Static relay, Emergency lightening system, Single phase preventer, Servo controlled voltage stabilizer, Temp Controller, Static circuit breaker, Renewable energy sources and energy storage system to the utility grid.		

Reference Books

	1	P.C. Sen , " Power Electronics ", Tata McGraw Hill
	2	M.H. Rashid , " Power Electronics " , John Wiley & Sons
	3	General Electric, " SCR manual "
	4	G. K. Dubey, S. R Doradle, " Thyristorised Power Controller "
	5	J. M. Jalnekar and N. B. Pasalkar, " Power Electronics " Technical Publication

	6	Ned Mohan, T.M. Undeland and W.P. Robbins, " Power Electronics: Converters,Applications and Design", John Wiley, Singapore, 1994
	7	M D Singh and K. B Khanchandani, " Power Electronics ", Tata McGraw Hill
	8	B.K.Bose, "Power Electronics & A.C. Drives", Prentice Hall, 1986.

Course title: Electronic Measurement and Instrumentation	**Subject code: 3LP16**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objective:	The primary objective of this course is to provide students with a comprehensive understanding of the fundamental principles underlying various measuring instruments. Through theoretical lectures, practical demonstrations, and hands-on laboratory exercises, students will explore the underlying concepts and operational mechanisms of a wide range of measuring instruments used in electronic engineering.
Course Outcome:	• Understand the principles and operation of electronic measuring instruments used for electrical and electronic parameters. • Learn techniques for accurate measurement, calibration, and error analysis in electronic circuits and systems. • Gain proficiency in the design and implementation of instrumentation systems for various engineering applications. • Explore advanced topics such as sensors, transducers, signal conditioning, and data acquisition systems. • Develop practical skills in laboratory experiments, data acquisition, and analysis using modern instrumentation tools and techniques.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Fundamentals of Electronic Measurement and Instrumentation	8	20
Necessity of electronic Measurement , Block diagram of electronic measurement system,Types of Measurements, Function of instruments and measurement systems, Applications ofmeasurement system, Elements of measurement system, Types of instruments, Theory of errors ,Accuracy and Precision, Types oferrors, Statistical analysis , probability of errors, Limiting errors,Standards of measurement.		
Module 2: Electromechanical Instruments and AC, DC Bridges	8	20
Construction of Galvanometer, Suspension Galvanometer, Torque and deflection Galvanometer, PMMC mechanism, DC voltmeter; AC voltmeters; Peak, average and true RMS voltmeters; Digital Millimetres; Ammeters, Ohm-meters and their design' AC indicating instruments, Watt-hour meter; Power factor meter. DC Bridges : Wheatstone Bridge, Kelvin Bridge. AC Bridges and their applications: Maxwell's Bridge, Hay's Bridge, Schering Bridge, Desauty's Bridge, Wein Bridge, Detectors for AC bridges.		
Module 3: Transducers and sensors	8	20
Static and dynamic characteristics of Transducer , Classification of transducers, Capacitive transducer, Inductive transducer, Resistive transducer, Displacement Transducer, LVDT, RVDT, Strain Gauge, RTD, Optical Transducers, Hall effect transducer, Piezoelectric transducers, Transducers for measurement of Pressure, Temperature, Level, Displacement, Flow.Sensors and its types. Thermoelectric Sensors: Thermocouples, Piezoelectric Sensors, Pyroelectric Sensors, Electrochemical. Sensors, Acoustic Temperature Sensors, Nuclear Thermometer, Magnetic Thermometer, SemiconductorTypes, Thermal Radiation, Quartz Crystal, NQR, Spectroscopic Noise Thermometry, Heat Flux Sensors. Position Encoders, Resonant Sensors, SAW Sensors, Sensors Based On Semiconductor Junctions, Sensors Based On MOSFET Transistors,Charge-Coupled And CMOS Image Sensors, Fiber-Optic Sensors, Ultrasonic-Based Sensors, Biosensors, Proximity Sensors: Typical Sensor Characteristics, Technologies ForProximity Sensing, Electro-Optical Sensors, Capacitive Sensors, Magnetic Sensors.		
Module 4 Signal generator and Signal Analyzer	8	20
CRO: Types, Dual trace, High frequency, sampling and storage oscilloscopes, Applications of CRO.Signal Generators: Introduction, Sine-wave generator, standard signal generators, Audio frequency signal generation, RF generator, Pulse generator, Function generator. Construction and operation of Signal analyzer, Wave analyzer, Harmonic Distortion analyzer, Spectrumanalyzer and Logic analyzer; Signal conditioning and its necessity, process adopted in		
Module 5: Data Acquisition System	8	20

Signal conditioning,Functions of ,Signal conditioning, AC/DC Conditioning systems, Dataconversion: ADC, DAC, Generalized data acquisition system: single channel and multi-channel DAS.

Reference Books

1. A.D. Helfrick and W.D. Cooper: "Modern Electronic Instrumentation and MeasurementTechniques", PHI Publications.
2. A.K. Sawhney : "Electrical and Electronic Measurement and Instrumentation", DhanpatRai & Sons Publications
3. S.S. Kalsi : "Electronics Measurements", Mc Graw Hill Publications.
4. B.H. Oliver and J.M Cage : "Electronics Measurement and Instrumentation", Mc GrawHill Publications

List of Experiments

1.	Displacement measurement using LVDT
2.	Force/ Pressure measurement using Strain Gauge
3.	Study of Data Acquisition System
4.	Study of Lab VIEW software
5.	Study of Lab VIEW projects, SubVIs, Block Diagram, Front Panel
6.	Use of Loops, Case Structure, Sequence, Timing, Formula Node, Expression Node
7.	Use of Arrays and Clusters
8.	Study of Lab VIEWs Visual display
9.	Exploring String and File I/O
10	Data Acquisition in Lab VIEW

Course title:	**Digital Logic and Circuits**	**Sub code:**	**3LP17**			
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**2**	**4**

Course Objective:

- This course aims to provide students with a foundational understanding of digital electronics, including various number systems such as binary, decimal, and hexadecimal, and methods for conversion between them.
- Students will learn to design and construct basic logic gates such as AND, OR, and NOT gates, as well as universal logic gates like NAND and NOR gates, enabling them to understand the fundamental building blocks of digital circuits.
- Through theoretical study and practical exercises, students will delve into Boolean algebra and learn different methods for simplifying Boolean expressions, empowering them to analyze and optimize digital logic circuits effectively.
- Students will explore sequential logic circuits and gain insight into the operation of flip-flops, including D, JK, and T flip-flops. They will learn to design and construct sequential circuits for various applications, fostering a deeper understanding of digital system design.
- Through hands-on experimentation and theoretical study, students will investigate programmable logic devices (PLDs), shift registers, counters, and memory devices. They will learn about their architecture, functionality, and applications in digital systems, preparing them for practical implementation in real-world engineering projects.

Course Outcome:

- Understand the fundamentals of digital logic gates, Boolean algebra, and logic minimization techniques.

	• Analyze and design combinational and sequential logic circuits for digital systems. • Gain proficiency in implementing digital circuits using standard integrated circuit families such as TTL and CMOS. • Explore advanced topics including synchronous and asynchronous sequential circuits, memory elements, and programmable logic devices. • Develop practical skills in circuit simulation, design verification, and troubleshooting using software tools and laboratory experiments.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Number System & Codes	8	20
Number systems and their inter-conversion, Binary Arithmetic (Addition, Subtraction, Multiplication and Division), Diminished radix and radix compliments, BCD codes, Excess-3 code, Gray code, Hammingcode, error detection and correction.		
Module 2: Logic Gates & Logic Families	8	20
Digital Logic Gates, Various Logic Families like RTL, DTL, TTL and ECL, I2L, working and their characteristics, MOS and CMOS devices, TTL CMOS Interfacing, IEEE/ANSI-representation of LogicFamilies. . A to D and D to A converter circuits.		
Module 3: Combinational Logic Designs	8	20
Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Canonical and Standard forms-map method, Two, Three, Four and Five variable maps, Sum of products and Product of Sums Simplification, NAND and NOR implementation, incompletely specified functions, Ex-OR functions, K map using 2 variable ,3 variable,and 4 variables.Binary adder and subtractor, Multiplexers, Encoder Decoders/De-multiplexers, Read Only Memory, Programmable Logic Arrays, Programmable Array Logic, Implementation of Combinatorial Logic using these devices.		
Module 4: MSI and PLD Components	8	20
Read Only Memory, Programmable, Logic Arrays, Programmable Array Logic, Implementation of Combinatorial Logic using these devices.		
Module 5: Sequential Logic Design and FSM	8	20
Introduction, S-R Flip-flops, JK flip-flop, D flip-flop, T flip-flop, master slave flip-flop. Flip-flop excitation Table, Inter conversion of flip-flop, Classification of sequential circuits, Register and Counter circuits Introduction to Finite State Machines, State diagrams; Design of Mealy FSM; Design of Moore FSM, Designof IC based counter circuits using 7490.7492,74192,74190 etc		

Reference Books

	1	Digital Design: M. Morris Mano, Prentice Hall of India.
	2	Modern Digital Electronic: R.P.Jain (TMH)
	3	Digital Principle and Applications Malvino and Leach- (TMH)
	4	Modern Digital Systems Design: Cheung (WPC)
	5	Fundamentals of Digital Electronics: Anand Kumar (PHI)
	6	Subrata Ghosal, "Digital Electronics," Cengage publication, 2nd edition, 2018
	7	A. K. Singh, "Foundation of Digital Electronics & Logic Design," New Age Int.Publishers.
	8	D.V. Hall, "Digital Circuits and Systems," Tata McGraw Hill, 1989.
	9	W.H. Gothmann, "Digital Electronics- An Introduction to Theory and Practice," PHI, 2nd edition, 2006.

list of Experiments

	1	Introduction to digital electronics lab- nomenclature of digital ICs, specifications,study of the data sheet, Concept of VCC and ground, verification of the truth tables of logic gates using TTL ICs.
	2	Implementation of the given Boolean function using logic gates in both SOP and POS forms.

	3	Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
	4	Implementation and verification of Decoder using logic gates.
	5	Implementation and verification of Encoder using logic gates.
	6	Implementation of 4:1 multiplexer and 1:4 de-multiplexer using logic gates.
	7	Design of A-D and D-A converter.
	8	Implementation of 4-bit parallel adder using 7483 IC.
	9	Design, and verify the 4-bit synchronous counter.
	10	Design, and verify the 4-bit asynchronous counter.
	11	Implementation of Mini Project using digital integrated circuits and other components.

Course title:	**Linear Electrical Networks**	**Sub code:**	**3L18**			
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**

Course Objective:	• This course aims to provide students with a solid foundation in circuit analysis principles, covering essential concepts such as voltage, current, resistance, and basic circuit laws. • Students will learn to analyze and solve DC circuits using Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL), enabling them to determine voltage and current distributions in complex circuits. • Through theoretical study and practical exercises, students will develop proficiency in analyzing AC circuits using KVL and KCL principles, facilitating the analysis of alternating current behavior in electrical circuits. • Students will learn various circuit analysis theorems such as Thevenin's theorem, Norton's theorem, and Superposition theorem, and apply them to solve complex network problems efficiently. • This course will enable students to analyze the frequency response of circuits and establish correlations between time domain and frequency domain responses, providing insights into circuit behavior across different domains. • Through theoretical study and practical design exercises, students will learn to design and implement various types of filter networks including low pass, high pass, band pass, and band elimination filters, catering to specific frequency domain requirements in practical applications.
Course Outcome:	• Understand the principles of linear circuit analysis including Ohm's Law, Kirchhoff's Laws, and network theorems. • Analyze and solve linear electrical networks consisting of resistors, capacitors, inductors, and independent sources. • Gain proficiency in analyzing AC circuits using phasor techniques, impedance, and admittance concepts. • Explore the behavior of linear networks under sinusoidal steady-state conditions and transient responses. • Develop problem-solving skills for analyzing and designing linear electrical networks for various engineering applications.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Basic concept of circuit theory & Network Theorems	8	20

Review of circuit analysis using Kirchoff's laws, nodal and mesh analysis, solution by classical method and Laplace transform, concept of independent and dependent sources, analysis of special signal waveforms, and duality of networks, Brief review of Signals and Systems. Superposition and Reciprocity theorem, Thevenin's and Norton's theorem, Millman's theorem, maximum power transfer theorem, compensation, Tellegan's theorem, analysis of circuits using theorems.		
Module 2: Transient Analysis of Networks	8	20
Network elements, Transient response of R-L, R-C, R-L- C for DC and sinusoidal excitation, Initial condition, Solution using differential equation approach and Laplace transform method. Behaviors of series and parallel resonant circuits		
Module 3: RLC circuit and Resonance	8	20
Laplace transforms and properties: Partial fraction, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace. Resonance conditions, quality factor,		
Module 4: Two Port Networks and Graph theory	8	20
Two Port Networks, Graph theoretic analysis for Large scale networks, Formulation and solution of network graph of simple networks, State space representation, Analysis using NGSPICE.		
Module 5: Passive Filter Design	8	20
Butter worth and Chebyshev approximations, Normalized specifications, Frequency transformations, Frequency and impedancede-normalisation, Types of frequency selective filters, Linear phase filters.		

Reference Books

	1	"Network and systems" by D.Roy - Choudhary
	2	"Circuit Analysis - with computer applications to problem solving" by Someshwar C. Gupta, Jon W. Bayless, Behrouz Peikari.
	3	Franklin F. Kuo, "Network Analysis and Synthesis ", John Wiley.
	4	Vanvalkenburg, "Network Analysis ", Printice Hall of India Pvt. Ltd., New Delhi, 1994.
	5	A William Hayt, "Engineering Circuit Analysis," 8th Edition, McGraw-Hill Education.
	6	A. Anand Kumar, "Network Analysis and Synthesis," PHI publication, 2019.
	7	Sudhakar, A., Shyammohan, S. P., "Circuits and Network," Tata McGraw-Hill New Delhi, 1994.

Course title:	**Control System Engineering**	**Sub code:**	**4L19**			
		Structure:	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objective:

- To introduce different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
- To employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions and identify the needs of different types of controllers and compensator toascertain the required dynamic response from the system.
- Formulate different types of analysis in frequency domain to explain the nature of stability of the system.

Course Outcome:	Understand the principles and concepts of control systems including feedback, stability, and performance criteria. Analyze and design control systems using various techniques such as root locus, frequency response, and state-space methods. Gain proficiency in modeling dynamic systems and obtaining transfer functions for control system design. Explore the application of control systems in engineering disciplines such as robotics, aerospace, and industrial automation. Develop practical skills in implementing control algorithms, tuning controllers, and analyzing system responses through simulations and experiments.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Introduction to Control Systems	8	20
Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems –Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.		
Module 2: Time Response of feedback control systems	8	20
Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).		
Module 3: Stability analysis	8	20
Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.		
Module 4: Frequency domain analysis and stability	8	20
Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded) Introduction to lead, lag and lead-lag compensating networks (excluding design).		
Module 5: Introduction to Digital Control System	8	20
Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diagonalization.		

Reference Books

	2	Control systems, K.R. Varmah, McGraw hill
	3	Control System Engineering, D. Roy Chowdhuri, PHI
	4	Digital Control system, B.C. Kuo, Oxford University Press.
	5	Control System Engineering, I. J. Nagrath& M. Gopal. New AgeInternational Publication
	6	Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education

Course title:	**Electromagnetics and Field Theory**	**Sub code:**	**4L20**			
		Structure:	**L**	**T**	**P**	**C**
			3	**1**	**0**	**4**

Course Objective:	• To provide basic skill required to understand and develop applications relatedto Signals. • To enrich strong foundation on systems in modern communication • To develop an understanding on Electromagnetic waves and radiating systems • To develop a strong understanding on Antennas
Course Outcome:	• Understand the fundamental principles of electromagnetic fields and their interactions in various mediums. • Analyze and solve electromagnetic problems using Maxwell's equations and boundary conditions. • Gain proficiency in understanding wave propagation, transmission lines, and antenna theory. • Explore applications of electromagnetic theory in wireless communication, microwave engineering, and photonics. • Develop problem-solving skills for designing and analyzing electromagnetic devices and systems.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Vector calculus	2	5
Orthogonal Coordinate System, Transformations of coordinate systems; Del operator; Gradient,Divergence, Curl - their physical interpretations; Laplacian operator.		
Module 2: Electrostatics	8	20
Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Electric dipole, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.		
Module 3: Magneto statics & Maxwell's Equations	10	25
Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields,Magnetic torque and moment, Magnetic dipole, Inductances and Magnetic Energy, Illustrative Problems. Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.		
Module 4: EM Wave Characteristics	10	25
Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics,Polarization,Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Pointing Vector, and Pointing Theorem – Applications, Power Loss in a Plane Conductor, Illustrative Problems		
Module 5: **Transmission Lines & Antennas**	10	25
Transmission Lines: Types, Transmission line parameters (Primary and Secondary), Transmission line equations, Input impedance, Standing wave ratio & power, Smith chart & its applications, Applications oftransmission lines of various lengths, Micro- strip transmission lines – input impedance, Illustrative Problems. Antenna Concepts, Antenna Characteristic; Hertzian dipole (Radiation Fields, Radiation Resistance, Radiation patterns, Directive Gain); Properties and typical applications of Half-wavedipole, Loop antenna, parabolic reflector anteena Horn antenna, Yagi-Uda array, Array Antennas: End fire and Broadside array		

Reference Books

1	Principles of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.
2	Electromagnetic Field Theory & Transmission Lines, G.S.N. Raju, Pearson Education
3	Electromagnetic Waves Shevgaonkar, Tata-McGaw-Hillr –R K

	4	Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India
	5	Fields & Waves in Communication Electronics, S. Ramo, J. R. Whinnery& T. VanDuzer, John Wiley
	6	Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
	7	Electromagnetics, 2ed Edition – J. A. Edminister, Tata-McGraw-Hill.
	8	Engineering Electromagnetics, 7th Edition-W.H.Hayt& J. A. Buck, Tata-McGraw-Hill

Course title:	**Microprocessor and Microcontroller**	**Sub code:**	**4LP21**			
		Structure:	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objective:	This subject deals about the basic 16-bit (8086) processor and an 8-bit (8051) controllers, their architecture, internal organization and their functions, interfacing an external device with the processors/ controllers.
Course Outcome:	• Understand the architecture, instruction set, and operation of microprocessors and microcontrollers. • Analyze and design digital systems using assembly language programming for microprocessors. • Gain proficiency in interfacing peripheral devices and implementing input/output operations. • Explore embedded system design concepts including real-time operating systems and software development tools. • Develop practical skills in programming, debugging, and testing microcontroller-based systems for various applications.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: 8086 Architecture	8	20
Introduction to advanced microprocessors, 8086 internal architecture, Memory, Organization, Addressing modes, Accessing immediate & Register data, Memory accessing. 8086 minimum/maximum mode system, Real and Protected modes of operation, Address translation, Memory organization, Paging.		
Module 2: 8086 Instruction Set	8	20
8086 data transfer instructions, Arithmetic instructions, Bit manipulation instructions, String instructions, Conditional & Unconditional branch instructions, Processor control instructions, Overview of 8086 interrupts responses, 8086 interrupt types, Examples, Hardware interrupt applications, Multiple interrupts, 8259 a interrupt controller, Examples using 8259 A with 8088.		
Module 3: Keyboard & Display interfacing	8	20
Keyboard interfacing, interfacing LED displays, 8279 keyboard/ display controller, Block diagram, Pin description, Functional description, Software operation, Interface considerations, Circuit connections with 8086.		
Module 4: Advanced Microprocessors	8	20
Introduction to Pentium and Pentium pro architectures: RISC concepts, BUS operation, Super scalararchitecture, Pipelining Introduction to Pentium II, Pentium III and Pentium 4 processors. RISC Architecture : Properties of RISC Systems Comparison with CISC architecture.		
Module 5: Introduction to Microcontrollers	8	20
Study of micro controller (MCS 51 family- 8051) - Architecture - Comparison of various families of 8 bit micro controllers. System design techniques interfacing of LCD, Stepper motor, Keyboard and ADC /DAC using microcontrollers. Study of micro controller 8096 - Architecture, Typical application in automotive and other industries, Introduction to super pipelined super scalar architectures of microcontrollers.		
Reference Books		

	1	D. Hall, " Microprocessor and Interfacing (8086), 2nd ed, TMH
	2	Gibson, " Microprocessor and Interfacing", 2nd edition, PHI
	3	Triebel and Singh, " The 8088 and 8086 Microprocessors : Programming, Interfacing,software, Hardware and Applications ", PHI
	4	Brey, " Intel Microprocessors, 8086 to Pentium and Pentium pro processor:Architecture, Programming and interfacing", 4th edition, PHI / Pearson
	5	Ajay Deshmukh, "Microcontrollers (Theory and Applications) –TMH
	6	M.A. Mazidi&J.G.Mazidi, The 8051 Microcontroller and Embedded systems 3rdIndian reprint, Pearson Education.
list of Experiments		
	1	Microprocessor 8086 based development system
	2	Simple arithmetic programs
	3	Array manipulation programs
	4	Code conversion programs
	5	LED Bank interface
	6	ADC ,DAC interface
	7	Stepper Motor interface
	8	Programming exercises in c and assembly language covering program and data memory
	9	i/o port, Peripheral and external interrupt, power saving modes
	10	Interfacing of devices like keys, relays, leads, seven segment, LCD Module, Matrix keyboard etc.

Course title:	**Analog Communication**	**Sub code:**	**4LP22**			
		Structure:	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objective:	• This course aims to provide students with a comprehensive understanding of the fundamental principles and components of analog communication systems, covering topics such as modulation, demodulation, and transmission techniques. • Students will learn to analyze and evaluate different analog modulation and demodulation techniques, including amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM), enabling them to comprehend their applications and performance characteristics. • Through theoretical study and practical demonstrations, students will gain insight into the operation of various transmitters and receivers used in analog communication systems, facilitating their understanding of signal generation, transmission, reception, and signal processing techniques. • This course will enable students to understand the effects of noise on analog communication systems and its impact on signal quality, signal-to-noise ratio (SNR), and system performance, empowering them to mitigate noise-induced distortions and enhance system reliability. • Students will acquire knowledge about information theory and capacity concepts in analog communication systems, including channel capacity, bandwidth considerations, and transmission efficiency, enabling them to optimize system design and performance for efficient information transmission.

Course Outcome:	• Understand the principles of analog modulation techniques including amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM). • Analyze the performance of analog communication systems in terms of signal-to-noise ratio, bandwidth, and distortion. • Gain proficiency in designing and implementing analog communication systems including transmitters, receivers, and transmission lines. • Explore advanced topics such as frequency synthesis, phase-locked loops, and noise reduction techniques in analog communication. • Develop practical skills in laboratory experiments, simulation, and testing of analog communication systems using modern instruments and tools.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Basics of Amplitude Modulation	8	20

Elements of communication systems, Information, Messages and Signals, Modulation, Modulation Methods, Modulation Benefits and Applications. Amplitude Modulation & Demodulation: Baseband and carrier communication, Amplitude Modulation (AM), Rectifier detector, Envelope detector, Double sideband suppressed carrier (DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Frequency mixer, sideband and carrier power of AM, Generation of AM signals, Quadrature amplitude modulation (QAM), Single sideband (SSB) transmission, Time domain representation of SSB signals & their demodulation schemes (with carrier, and suppressed carrier), Generation of SSB signals, Vestigial sideband (VSB) modulator & demodulator, Illustrative Problems.

Module 2: Angle Modulation &Demodulation	8	20

Concept of instantaneous frequency, Generalized concept of angle modulation, Bandwidth of angle modulated waves – Narrow band frequency modulation (NBFM); and Wide band FM (WBFM), Phase modulation, Verification of Frequency modulation bandwidth relationship, Features of angle modulation, Generation of FM waves – Indirect method, Direct generation; Demodulation of FM, Band pass limiter, Practical frequency demodulators, Small error analysis,

Module 3: Noise in Communication Systems	8	20

Types of noise, Time domain representation of narrowband noise, Filtered white noise, Quadrature representation of narrowband noise, Envelope of narrowband noise plus sine wave, Signal to noise ratio & probability of error, Noise equivalent bandwidth, Effective noise temperature, and Noise figure, Baseband systems with channel noise, Performance analysis (i.e. finding SNR expression) of AM, DSB-SC, SSB-SC,FM, PM in the presence of noise, Illustrative Problems.

Module 4: Analog pulse modulation schemes	8	20

Pulse amplitude modulation – Natural sampling, flat top sampling and Pulse amplitude modulation (PAM)& demodulation, Pulse-Time Modulation – Pulse Duration and Pulse Position modulations, and demodulation schemes, PPM spectral analysis, Illustrative

Module 5: Radio Receivers	8	20

Pre-emphasis, & De-emphasis filters, FM receiver, FM Capture Effect,. Carrier Acquisition- phased locked loop (PLL), Costas loop, Frequency division multiplexing (FDM), and Super-heterodyne AM receiver, Sensitivity and selectivity , selection of IF ,Illustrative Problems.

Reference Books

1	B. P. Lathi, "Modern Digital and Analog Communication Systems," Oxford Univ. press, 3rd Edition, 2006
2	Sham Shanmugam, "Digital and Analog Communication Systems", WileyIndia edition, 2006.
3	A. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction toSignals & Noise in Electrical Communication", McGraw-Hill International Edition, 5th Edition, 2010.
4	Simon Haykin, "Communication Systems", Wiley-India edition, 3 rd edition, 2010.
5	Herbert Taub& Donald L Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 3rd Edition, 2009.
6	George Kennedy and Bernard Davis, "Electronics & Communication System", TMH,2004.

list of Experiments

	1	Amplitude modulation and demodulation
	2	Frequency modulation and demodulation.
	3	Characteristics of Mixer
	4	Pre-emphasis & de-emphasis.
	5	Pulse Amplitude Modulation and demodulation
	6	Pulse Width Modulation and demodulation
	7	Pulse Position Modulation and demodulation
	8	Radio Receiver measurements – Sensitivity, Selectivity, & Fidelity
	9	Sampling Theorem – verification
	10	Time division multiplexing.

Course title:	**ANALOG ELECTRONICS**	**Sub code:**	**4LP23**			
		Structure:	**L**	**T**	**P**	**C**
			3	**0**	**2**	**4**

Course Objective:	• To impart foundational knowledge and understanding of electronic circuits and devices operating in continuous time domain, emphasizing analysis, design, and application of analog circuits. • To equip students with skills to analyze, design, and troubleshoot analog electronic circuits commonly used in various engineering disciplines, fostering critical thinking and problem-solving abilities.
Course Outcome:	• Understand the principles and characteristics of analog electronic devices such as diodes, BJTs, and FETs. • Analyze and design analog electronic circuits including amplifiers, oscillators, and filters. • Gain proficiency in biasing techniques, small-signal analysis, and frequency response of analog circuits. • Explore advanced topics such as feedback amplifiers, operational amplifiers, and voltage regulators. • Develop practical skills in circuit simulation, prototyping, and testing of analog electronic circuits for various applications.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Diode and its circuit Transistor Biasing	8	20
Wave Shaping Circuits a) General idea about different wave shapers b) RC and RL integrating and differentiating circuits with their applications c) Diode clipping and clamping circuits and simple numerical problem on the circuits, Transistor biasing and basic characteristics: Operating point, Bias stability, Different biasing arrangements, stabilization, Thermal runway and thermal stability, Small signal low frequency amplifiers, analysis of generalized amplifier models, Transistor hybrid models, Determination and measurement of hparameters, analysis of transistor amplifier circuits using h-parameters		
Module 2: Frequency response	8	20
Low frequency response of amplifiers: Cascading transistor amplifiers, calculations for different amplifier configurations, Emitter follower, Miller's theorem, Cascode transistor configurations, few configurations of high frequency response, Basic overview on difference and power amplifiers. Large Signal Amplifier a) Difference between voltage and power amplifiers b) Importance of impedance matching in amplifiers c) Class A, Class B, Class AB, and Class C amplifiers d) Single ended power amplifiers, push-pull amplifier, and complementary symmetry push-pull amplifier		
Module 3: Operational amplifier	8	20

The difference amplifier and the ideal operational amplifier models, concept of negative feedback and virtual short; Analysis of simple operational amplifier circuits; Basic building blocks of op-amp, DC level shifter, Output stage. Review of Op-amp parameters, Frequency response, offset nulling techniques, inverting, non-inverting configurations. Summing amplifier, Difference amplifier, Instrumentation amplifier and applications, Integrator, Differentiator and applications. V to I and I to V converter, Comparators, Limitations of Op-amp as Comparator, Schmitt trigger, Precision rectifiers, Peak detector.

Sine wave generators, Multi vibrators, Triangular wave generators, Saw tooth generators, V to F and F to V, converters, All types of filter responses, First order active filters LP and HP,BPF, band reject and bi quad filters, sensitivity analysis.

Module 4: Feedback amplifier and Oscillator	8	20

Feedback and operational amplifiers: Feedback concept, positive and negative feedback, different feedback configurations Sinusoidal Oscillators a) Use of positive feedback b) Barkhausan criterion for oscillations c) Different oscillator circuits- tuned collector, Hartley Colpitts, phase shift, Wien's bridge, and crystal oscillator. Their working principles and simple numerical problems d) Series and parallel resonant circuits and bandwidth of resonant circuits e) Single and double tuned voltage amplifiers and their frequency response characteristics.

Module 5: Design and Synthesis of Digital Systems	8	20

Multivibration Circuits a) working principle of transistor as switch b) Concept of multi-vibrator: astable, monostable, and bistable and their applications c) Block diagram of IC555 and its working d) IC555 as monostable and astable multivibrator.Regulated DC Power Supplies a) Concept of DC power supply. Line and load regulation, Concept of fixed voltage, IC regulators (like 7805, 7905), and variable voltage regulator like (IC 723) c) Idea of SMPS.

Reference Books

	1	RamakantGaikwad, "Op-amps and Linear integrated circuits", PHI
	2	D.RoyChoudhary, Shail Jain, Linear Integrated Circuits, New Age International
	3	Bowans, "Digital Instrumentation", TMH Publications
	4	Waller C. Bosshart , "PCB Design & Technology", TMH
	5	Bert Haskell, "Portable Electronics Product Design and Development", MGH Publication
	6	William Flecther, " An Engineering Approach to Digital Design", PHI

list of Experiments

	1	Study of Diode as clipper & clamper
	2	Summing amplifier / subtractor
	3	Integrator/ Differentiator
	4	Frequency response of active filter (LP/HP/BP)
	5	Voltage regulator ICs LM723
	6	Voltage to Frequency converter
	7	Waveform generator 8038 etc.
	8	Study of Zener diode as a voltage regulator
	9	Inverting amplifier and Non-inverting amplifier
	10	Digital to Analog converter

Course title:	Signals and Systems	Sub code:	4L24			
		Structure:	L	T	P	C
			3	0	0	3

Course Objective:	• This course aims to provide students with a comprehensive understanding of signals and systems, covering fundamental concepts such as signal classification, system properties, and mathematical representations. • Students will learn to analyze signals and systems in both continuous and discrete domains using time domain and frequency domain methods, including techniques such as convolution, Fourier analysis, and Laplace transforms, enabling them to characterize and manipulate signals and systems effectively. • Through theoretical study and practical exercises, students will gain insight into the stability of systems by examining the concept of Region of Convergence (ROC) in the context of signal and system analysis, enabling them to assess system stability and robustness. • This course will familiarize students with various transform techniques used in the analysis of signals and systems, including Fourier transforms, Laplace transforms, and Z-transforms, providing them with versatile tools for signal representation, analysis, and manipulation across different domains.
Course Outcome:	• Understand the fundamentals of signals, systems, and their mathematical representations. • Analyze linear time-invariant (LTI) systems using convolution, Fourier analysis, and Laplace transforms. • Gain proficiency in analyzing signals and systems in both time and frequency domains. • Explore applications of signal and system theory in communication, control, and signal processing. • Develop problem-solving skills for designing and analyzing linear systems and filters for various engineering applications.

Content	No. of hours	ESE Marks(%)
Module 1: Basics of Signals and LTI systems	8	18
Continuous Time and Discrete Time signals, Exponential and Sinusoidal Signals, Unit Impulse and Unit Step Functions, Continuous and Discrete Time Systems, basic System Properties. LINEAR TIME INVARIANT SYSTEMS: Discrete Time LTI Systems, Continuous Time LTI Systems, properties of LTI Systems, causal LTI Systems Described by Difference equations		
Module 2: Fourier series representation of periodic signals	8	18
Response of LTI systems to Complex Exponentials, Fourier series Representation of CT periodic Signals, properties of CT Fourier Series, Fourier Series representation of DT periodic Signals, properties of DFS, Fourier series and LTI Systems, Filtering, Examples of CT filters, Examples of DT filters		
Module 3: Continuous time Fourier transform	8	18
Representation of a periodic Signals by continuous FT, FT of periodic signals, convolution and multiplication property of continuous FT, systems characterized by Linear Constant Coefficient Differential Equations. Magnitude and phase representation of FT, Magnitude and phase response of LTI systems, Time domain and Frequency domain aspects of ideal and non-ideal filters.		
Module 4: Laplace Transform	6	16
Definition-ROC-Properties-Inverse Laplace transforms-the S-plane and BIBO stability-Transfer functions-System Response to standard signals-Solution of differential equations with initial conditions.		
Module 5: Discrete Time Fourier Transform (DTFT) And Discrete Fourier Transform (DFT):	6	16
SAMPLING: Sampling theorem, Impulse sampling, sampling with zero order Hold, Reconstruction of signalfrom its samples using interpolation, Effect of under sampling. Properties of DTFT and DFT, convolution property, multiplication property, Duality, Systems characterized by Linear Constant Coefficient Difference Equations.		
Module 6: Z-Transform	4	14
Z-transform, Region of convergence and its properties, Inverse Z transform, properties of ZT, Analysis andcharacterization of LTI systems using ZT, LTI Systems, System function algebra and block diagram representations.		

Reference Books		
	1	Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems PrenticeHall India, 2nd Edition, 2009.
	2	John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles,Algorithms, and Applications, 4th Edition, PHI, 2007.
	3	B.P. Lathi, ―Signals, Systems & Communications‖, 2009,BS Publications.
	4	Simon Hykin , " Signals and Systems", John Wiley
	5	Robert A. Gable, Richard A. Roberts, Signals & Linear Systems, 3rd Edition, JohnWiley, 1995.
	6	Harish Parthasarathy,"Signals and Systems" JK International Second Edition.
	7	HWEI P.HSU Schaum's, " Signals and Systems" TMH
	8	M.J.Roberts,"Signals and Systems" TMH Ed 2003

Course title:	**Digital Communication**	**Sub code:**	**5LP25**			
		Structure:	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objective:	• Understanding the Key Modules of Digital Communication Systems with Emphasis on Digital Modulation Techniques • Designing Systems Involving Randomness Using Mathematical Analysis and Computer Simulations. • Learning about Theoretical Bounds on the Rates of Digital Communication Systems and Representing Digital Signals Using Several Modulation Methods • Drawing Signal Space Diagrams, Computing Spectra of Modulated Signals, and Applying Redundancy for Reliable Communication.
Course Outcome:	• Understand the principles and techniques of digital modulation and demodulation schemes. • Analyze and design digital communication systems using modulation techniques such as ASK, FSK, PSK, and QAM. • Gain proficiency in error detection and correction codes for reliable digital communication. • Explore advanced topics including spread spectrum communication and multiple access techniques. • Develop practical skills in simulation, implementation, and performance analysis of digital communication systems using software tools and laboratory experiments.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Random Variables and Random Process	8	20
Deterministic and Random Signal: Types of random variables, cumulative distribution function and probability density functions, Standard distributions: Gaussian, exponential, Rayleigh, uniform, Bernoulli, binominal, Poisson, discrete uniform and conditional distributions. Functions of one random variable: distribution, mean, variance, moments and characteristics functions. Random Processes: Random processes, stationary processes, mean and covariance functions, periodicity, linear filtering of random processes, power spectral density, examples of random processes: white noise process and white noise sequence, Gaussian process, Poisson process, Markov process.		
Module 2: Digital communication and modulation basics	8	20
Band pass and Low pass signal, Introduction to Digital communication systems, Pulse code modulation , differential pulse code modulation, delta modulation, adaptive delta modulation, PSD of Line Codingschemes, Pulse shaping, Scrambling, Eye diagram, Gram-Schmidt orthogonalization scheme.		

Module 3: Digital Modulation Techniques	8	20
Modulation and Demodulation of Digital modulation schemes-ASK, FSK, PSK, DPSK, QPSK andConstellation diagram. Introduction to M-ary communication.		
Module 4: Digital Communication Through Band LimitedChannels and Digital Receiver	8	20
Characteristic and signal Design of band Limited Channels. Optimum Receiver for Channel with ISI and AWGN. Linear Equalization, Decision Equalization, Adaptive Equalization. Introduction of Multichannel and Multicarrier System. Optimum threshold detection, Concept of Matched Filters, BER analysis of BASK, BFSK, BPSK, Modelof Spread Spectrum Digital Communication. Direct Sequence Spread Spectrum Signal (DS-SS), Frequency Hopped Spread Spectrum Signal (FH-SS).		
Module 5: Information theory and Coding	8	20
Discrete Source models – Memoryless and Stationary, Mutual Information, Self-Information, Conditional Information, Average Mutual Information, Entropy, Entropy of the block, Conditional Entropy, Information Measures for Analog Sources. Review of probability theory Entropy Mutual information Data compression Huffman coding Asymptotic equipartition property Universal source coding Channel capacity Differential entropy Block codes and Convolutional codes.		

Reference Books		
	1	John G. Proakis & Masoud Salehi, "Digital Communications", 5th Edition, McGraw Hill
	2	B.P. Lathi, "Modern Digital and Analog Communication Systems", 4th Edition,Oxford University Press
	3	H. Taub, D L Schilling, Gautam Saha, "Principles of Communication", 4th Edition, McGraw Hill
	4	Singh & Sapre, Analog & Digital Communication Systems, 3th Edition, McGraw Hill
	5	John G. Proakis,"Communication Systems Engineering 2nd Edition, Pearson Education, 2015
	6	(Schaum's Outline Series) H P HSU & D Mitra, "Analog and Digital Communications", McGraw Hill 3rd Edition
	7	Bernard Sklar, Digital Communications, Pearson Education
	8	Simon Haykin, "Communication Systems", 5th Edition, Wiley India
list of Experiments		
	1	Design and Generation of random binary signals
	2	Study of impairments of signals generated in experiment 1 on passing through a simulated channel by observing Eye Pattern.
	3	Generation Unipolar NRZ, Polar NRZ, Unipolar RZ and Polar RZ line codes.
	4	Generation Manchester and AMI line codes
	5	Conversion of analogue signal into PCM format and its study
	6	Design and implementation of Delta Modulator for analogue signals
	7	Design, implementation and study of BASK Modulator and demodulator
	8	.Design, implementation and study of BPSK Modulator and demodulator
	9	Design, implementation and study of BFSK Modulator and demodulator
	10	Design, implementation and study of multiplexer and de-multiplexer of digital signals using TDM.
	11	study of spread spectrum signal

Course Title:	Transmission Lines and PCB Technology	Sub code:	5LP26			
		Structure:	L	T	P	C
			0	1	4	3

Course Objective:	• Learning PCB Fundamentals, Types, and Classifications. • Learning the design rules for Analog, digital and mixed signal electronic circuits. • Learning about Transient, AC Sweep, DC Sweep and operation point simulation for various electronic circuits. • Learning about PCB design and manufacturing process flow for SSB (Single sides boards) & DSB(Double sided Boards).
Course Outcome:	• Able to do analysis of various electronic circuits. • Design the Schematics and PCB layout for SSB(Single sides boards) &DSB(Double sided boards). • Perform Artwork generation using Film master equipment. • Generate various PCB Manufacturing files and drill files required for PCBfabrication.

Content	No. of hours	ESE Marks(%)
Module 1: Transmission Lines	8	20

Introduction to Transmission Lines: Definition and importance of transmission lines, Classification of transmission lines (open-wire, coaxial, microstrip, etc.), Parameters of transmission lines: resistance, inductance, capacitance, and conductance. Basics of Transmission Line Equations: Derivation of Telegrapher's equations. Characteristics of transmission lines: velocity of propagation, characteristic impedance, attenuation constant, and phase constant. RC Transmission Lines: Analysis of RC transmission lines, Determination of characteristic impedance and propagation constant for RC lines, Reflection and transmission coefficients for RC lines. RCC Transmission Lines: Introduction to RCC transmission lines, Analysis of RCC transmission lines considering resistive, capacitive, and conductive effects, Calculation of characteristic impedance and propagation constant for RCC lines. Infinite Transmission Lines and Control Impedance: Infinite transmission lines: reflectionless lines, matched lines, and quarter-wavelength lines, Design considerations for control impedance, Applications and examples of transmission line designs, Problem-solving sessions and review of key concepts.

Module 2: Introduction to PCB Design, tools and techniques	12	30

Overview of PCB technology and its applications. Introduction to PCB design software (e.g., Cadence Allegro / Orcad / Altium Designer) ,Understanding PCB design considerations: size, shape, layers, and component placement ,Basics of schematic capture and PCB layout design ,Design rules and constraints for signal integrity, power distribution, and thermal management, In-depth exploration of PCB design software features and tools,Practical exercises in schematic design and PCB layout using industry-standard software ,Advanced techniques for component placement, routing, and copper pour ,Designing for manufacturability (DFM) and assembly (DFA) ,Introduction to Design for Testability (DFT) principles.

Module 3: PCB Manufacturing process	8	20

Overview of PCB manufacturing processes: substrate selection, imaging, etching, and drilling Understanding PCB fabrication technologies: subtractive, additive, and semi-additive processes ,Quality control and inspection techniques during manufacturing ,Environmental considerations in PCB manufacturing ,Case studies and real-world examples of PCB manufacturing challenges and solutions

Module 4: PCB assembly techniques.	6	20

Introduction to surface-mount technology (SMT) and through-hole technology (THT) ,Component selection, procurement, and inventory management Soldering techniques: hand soldering, reflow soldering, wave soldering PCB assembly equipment and machinery: pick-and-place machines, solder paste printers, reflow ovens ,Testing and inspection methods during PCB assembly: visual inspection, automated optical inspection (AOI), in-circuit testing (ICT)

Module 5: PCB testing and quality assurance	6	10

Introduction to PCB testing methodologies: functional testing, boundary scan testing, flying probe testing Designing and implementing test fixtures and procedures Reliability testing and failure analysis techniques Quality assurance standards and certifications for PCBs Continuous improvement strategies in PCB testing and quality management

Text/Reference Books :

	1	Printed Circuit Boards: Design and Technology, Walter C Bosshart ,Tata McGraw-hill publication
	2	Printed Circuit Boards: Design, Fabrication, Assembly & Testing, R S Khandpur,Tata McGraw-hill publication
	3	Printed Circuit Boards, Coombs Clyde F., Tata McGraw-hill publication
	4	The Design & Drafting of Analog Printed Circuit boards, Darryl Lindsey, BishopGraphics Inc
	5	Printed Circuit Boards: Design Techniques For EMC Compliance, Montrose Mark I,IEEE Press Series of Electronics Technology

List of Experiments

	1	Design the current mirror circuit in schematic editor using Autodesk Eagle softwareand Run the operating point analysis simulation.
	2	Design the basic diode circuit in schematic editor using Autodesk Eagle software andRun the Transient Analysis simulation.
	3	Design the basic MOSFET circuit in schematic editor using Autodesk Eagle software
		and Run the DC Sweep Analysis simulation.
	4	Design the BJT Oscillator circuit in schematic editor using Autodesk Eagle software and Run the Transient Analysis simulation.
	5	Create the library component resistor with the following dimensions and specifications using Autodesk Eagle software.
	6	Create the library component for 555 timer IC with the given dimensions and specifications using Autodesk EAGLE Software.
	7	Create the library component for G5LE OMRON RELAY with the given dimensions and specifications using Autodesk EAGLE Software.
	8	Create the library component for NCP716B LDO with the given dimensions and specifications Autodesk EAGLE Software.
	9	Design the USB TO TTL/CMOS Programmer circuit using FTDI232 IC into schematic editor and draw the PCB layout for the same in Autodesk EAGLE software, run the Electrical Rule Check(ERC) in schematic editor.
	10	Design the Astable Multivibrator circuit using 555 timer ic into schematic editor and draw the PCB layout for the same in Autodesk EAGLE software, generate BOM, netlist and run design rule check.
	11	Design the DC TO DC 5V Voltage regulator circuit using LM317 IC into schematic editor and draw the PCB layout for the same in Autodesk EAGLE software, generate gerber files for top electrical and bottom electrical.

	12	To learn the process of generating files(HPGL, ISEL, Excellon) for CNC drilling and milling machine.
	13	To learn the process of generating 3D files format and observe the DXF view.
	14	Study the various format settings done in photoplotter machine. Learn about artwork generation software, the concept of importing PCB Gerber file and converting files to photoplotter format.
	15	To learn the process of generating legends(silkscreen) for Top electrical/ bottom electrical (SSB) Or both (DSB).

Course Title:	**Digital Signal Processing**	**Sub code:**	**5LP27**			
		Structure:	**L**	**T**	**P**	**C**
			3	0	2	4

Course Objective:	• Learning about discrete time systems and to learn about FFT algorithms. • Learning the design techniques for FIR and IIR digital filters. • Learning about Realization of Digital systems.
Course Outcome:	Understand the principles and techniques of digital signal representation and processing. Analyze and design digital filters for various signal processing applications. Gain proficiency in time-domain and frequency-domain analysis of discrete-time signals and systems. Explore advanced topics such as spectral analysis, adaptive filtering, and multirate signal processing. Develop practical skills in implementing signal processing algorithms using software tools and programming languages.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Introduction to discrete time signals and systems	8	20
Discrete Fourier Transform, Linear filtering methods based on the DFT, Filtering of long sequences. Direct computation of the DFT, Divide and Conquer approach, Radix -2, radix-3 and radix-4 Fast Fourier Transform, Goertzel algorithm, Chirp-z transform, quantization effect in computation of the DFT.		
Module 2: Implementation of the Discrete time systems	8	20
Structure for the realization of discrete time FIR and IIR systems, Direct Form, cascade form, Frequency sampling structure, lattice structure. State space system analysis and structures. Round-off effects in digital filter.		
Module 3: Design of FIR Digital Filters	8	20
Magnitude and phase response of digital filter, frequency response of Linear phase FIR filters, Design Techniques for FIR (Low pass, high pass, band pass and band reject) filters. Design of Optimal Linear phase FIR Filters, Design of Minimum phase FIR Filters.		
Module 4: Design of IIR Digital Filters	8	20
IIR filter design by approximation of derivatives, impulse invariant approach and bilinear transformation. Butterworth filters, Chebyshev filters, Inverse Chebychev filter and elliptic filters, Design of Low pass, high pass, band pass and band reject IIR filters. Spectral transformation of IIR filters, Effects of Finite word length indigital filters.		
Module 5: Spectral Estimation methods	8	20
Spectral estimation, Energy Density Spectrum, Estimation of autocorrelation and power spectrum, DFT inspectral estimation, Parameteric and nonparametric method for power spectrum estimation.		

Text/Reference Books :		
	1	Discrete Time Signal Processing, Oppenheim & Schafer, PHI Ltd, Third Edition
	2	Digital Signal Processing: Principles Algorithms and Applications, Proakis Johnand Manolakis.
	3	Digital Signal Processing- A computer based approach, Sanjit K. Mitra, McGrawHill Education.

List of Experiments		
	1	Compute linear convolution, circular convolution and cross correlation of twosequences.
	2	Verify different properties of Discrete Fourier Transform.
	3	Implement different FFT algorithms.
	4	Design and implementation of low pass, high pass, band pass and band reject FIRfilters.
	5	Design and implementation of low pass, high pass, band pass and band reject IIR filters of different types.
	6	Computation of power spectral density, correlation function and correlationmatrix of stochastic systems.
	7	Implementation of basic digital signal processes algorithms for differentapplications like demising, edge detection etc. using computer programming.
	8	Implementation of basic digital signal processes algorithms for different applications like denoising, edge detection etc. using digital signal processorslike TMS DSP kits.

Course Title:	**Computer Architecture and Organization**	**Sub code:**		**5L28**		
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**
Course Objective:	• This course aims to familiarize students with fundamental concepts related to computer organization, covering hardware and software aspects such as CPU architecture, memory organization, input/output systems, and operating system functionality. • Students will gain an overview of the design principles underlying digital computing systems, including topics such as instruction set architecture, processor microarchitecture, pipelining, memory hierarchy, and input/output interfaces. • Through theoretical study and practical exercises, students will learn how data is represented at the machine level, including binary representation of numbers, character encoding schemes, floating-point representation, and memory organization, enabling them to understand how information is processed within a computer system. • Students will gain insight into the execution of computations at the machine level, including arithmetic and logic operations, control flow mechanisms, instruction execution cycle, and addressing modes, enabling them to comprehend the underlying mechanisms of program execution and data manipulation within a computer system					
Course Outcome:	• Understand the fundamental principles and components of computer architecture including CPU, memory, and I/O devices. • Analyze and design the organization of computer systems at both hardware and software levels. • Gain proficiency in understanding the instruction set architecture (ISA) and its implications on system design. • Explore advanced topics such as pipelining, memory hierarchy, and parallel processing					

	architectures. • Develop practical skills in designing and evaluating computer systems through simulation, prototyping, and performance analysis.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction of Processor	8	20
Introduction, Technologies for building Processors and Memory, Performance, The Power Wall, Operations of the Computer Hardware, Operands Signed and Unsigned numbers, Representing Instructions, Logical Operations, Instructions for Making Decisions		
Module 2: Instructions Set	8	20
MIPS Addressing for 32-Bit Immediate and Addresses, Parallelism and Instructions: Synchronization,Translating and Starting a Program, Addition and Subtraction, Multiplication, Division, Floating Point, Parallelism and Computer Arithmetic: Sub word Parallelism, Streaming SIMD Extensions and Advanced Vector Extensions in x86.		
Module 3: Architecture Building Block	8	20
Logic Design Conventions, building a Datapath, A Simple Implementation Scheme, overview of Pipelining, Pipelined Datapath, Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions, The ARM Cortex – A8 and Intel Core i7 Pipelines, Instruction –Level Parallelism and Matrix Multiply Hardware Design language.		
Module 4: Memory Mapping	8	20
Memory Technologies, Basics of Caches, Measuring and Improving Cache Performance, dependable memory hierarchy, Virtual Machines, Virtual Memory, Using FSM to Control a Simple Cache, Parallelism and Memory Hierarchy: Redundant Arrays of Inexpensive Disks, Advanced Material: Implementing Cache Controllers.		
Module 5: Memory Management	8	20
Disk Storage and Dependability, RAID levels, performance of storage systems, Introduction to multi-threading clusters, message passing multiprocessors.		

Text/Reference Books:	
	1. David A. Patterson and John L. Hennessey, "Computer organization and design, The Hardware/Software interface", Morgan Kauffman / Elsevier, Fifth edition, 2014 2. V. Carl Hamacher, Zvonko G. Varanesic, and Safat G. Zaky, "Computer Organization", 6 th edition, McGraw-Hill Inc, 2012. 3. William Stallings, "Computer Organization and Architecture", 8th Edition, PearsonEducation, 2010

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Course title:	**Artificial Intelligence and Machine Learning**	**Sub code:**	**5LP29**			
		Structure:	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objective:	• This course aims to introduce students to fundamental concepts, theories, and advanced techniques in artificial intelligence (AI), providing a comprehensive understanding of AI principles and methodologies. • Students will be introduced to the foundational concepts and practical applications of machine learning, including supervised, unsupervised, and reinforcement learning algorithms, enabling them to understand the principles behind machine learning and its diverse applications. • Through practical examples and case studies, students will learn how to apply machine learning and AI algorithms in diverse fields such as science, medicine, finance, and others.

Course Outcome:	• Understand the principles and techniques of artificial intelligence and machine learning algorithms. • Analyze and apply supervised, unsupervised, and reinforcement learning techniques to solve engineering problems. • Gain proficiency in designing and implementing machine learning models for pattern recognition, classification, and regression tasks. • Explore advanced topics such as deep learning, neural networks, and natural language processing. • Develop practical skills in programming, data analysis, and model evaluation using machine learning libraries and frameworks.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction to Artificial Intelligence	8	20
Overview of Artificial Intelligence (AI) and its applications, History and evolution of AI, Foundations of AI: Logic, reasoning, and problem-solving, AI techniques: Search algorithms, knowledge representation, and expert systems,Ethical considerations and societal impact of AI		
Module 2: Machine Learning Fundamentals	8	20
Introduction to Machine Learning (ML) and its types (supervised, unsupervised, reinforcement learning), Basic concepts: Feature representation, training, and evaluation, Supervised learning algorithms: Linear regression, logistic regression, decision trees, and support vector machines,Unsupervised learning algorithms: Clustering, dimensionality reduction, and association rule learning Model evaluation and validation techniques		
Module 3: Deep Learning and Neural Networks	8	20
Introduction to Deep Learning and neural networks, Basics of artificial neurons and activation functions, Fundamentals of feedforward neural networks, Training neural networks: Backpropagation algorithm, gradient descent optimization, Deep learning architectures: Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and their applications		
Module 4: Advanced Topics in Machine Learning	8	20
Ensemble learning techniques: Bagging, boosting, and stacking, Support Vector Machine (SVM) extensions: Kernel methods, multi-class classification, Introduction to reinforcement learning: Markov Decision Processes (MDPs), Q-learning, and policy gradients, Introduction to natural language processing (NLP): Text preprocessing, sentiment analysis, and language modeling, Time series analysis and forecasting using machine learning techniques		
Module 5: Applications of Artificial Intelligence and Machine Learning	8	20
AI applications in various domains: Healthcare, finance, robotics, autonomous vehicles, etc., Case studies and real-world examples of AI and ML implementations, Ethical considerations in AI and ML applications, Future trends and emerging technologies in AI and ML, Hands-on projects and practical applications of AI and ML concepts		

Reference Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", PearsonEducation
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", PearsonEducation
4. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India
5. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited,2013.
6. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation andMachine Learning), The MIT Press 2004.

Experiments

7. Search Algorithm Simulation: Simulate depth-first search and breadth-first search algorithms to solve a simple maze problem.
8. Expert System Development: Create a rule-based expert system using a decision tree to diagnose common medical conditions.
9. Linear Regression Model Implementation: Build a linear regression model to predict house prices based on features like size and number of bedrooms.
10. K-Means Clustering Exercise: Apply the k-means clustering algorithm to segment customer data into distinct groups for targeted marketing strategies.
11. Convolutional Neural Network (CNN) Training: Train a CNN model to classify images of handwritten digits (MNIST dataset) into their respective classes.
12. Ensemble Learning Experiment: Compare the performance of different ensemble methods (e.g., random forests, gradient boosting) on a classification task using a benchmark dataset.
13. Reinforcement Learning Simulation: Implement a simple grid-world environment and train an agent

	using Q-learning to navigate and find optimal paths. 14. Sentiment Analysis with NLP: Perform sentiment analysis on movie reviews dataset to classify reviews as positive or negative using natural language processing techniques. 15. Time Series Forecasting: Use historical stock price data to forecast future prices using time series analysis techniques like ARIMA or LSTM networks. 16. AI and ML Project: Choose a domain of interest (e.g., healthcare, finance) and develop a mini-project applying machine learning techniques to solve a relevant problem, such as disease prediction or stock price prediction.

Course title:	VLSI Design	Sub code:	5LP30			
		Structure:	L	T	P	C
			3	0	2	4

Course Objective:	• To provide students with a comprehensive understanding of VLSI design fundamentals, covering CMOS logic, fabrication processes, layout representations, design flow, and verification techniques, preparing them for practical VLSI design projects. • Students will learn to model MOS transistors, analyze their characteristics, and design CMOS logic circuits. They will understand the principles behind CMOS logic design, including transistor sizing, noise margin, and static and switching characteristics. • Through theoretical study and practical exercises, students will gain proficiency in analyzing delay and power characteristics in VLSI circuits. • Students will explore various circuit families and design techniques used in VLSI design, including static CMOS, ratioed circuits, dynamic circuits, and pass-transistor circuits. • This module aims to familiarize students with subsystem design principles and FPGA technology.
Course Outcome:	• Understand the concepts of Verilog Language. • Design the digital systems as an activity in a larger system design context. • Study the design and operation of semiconductor memories frequently usedin application specific digital system. • Inspect how effectively ICs are embedded in package and assembled in PCBsfor different application. • Design and diagnosis of processors and I/O controllers used in embeddedsystems.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction To VLSI	8	20
Basics of VLSI design CMOS Logic: Combinational and sequential circuits, CMOS fabrication and layouts, Layout representations, Stick diagrams, Design partitioning, Logic design, Circuit design, Physical design, Design verification, fabrication, packaging and testing, Design Flow		
Module 2: MOS and CMOS	8	20
Modelling of MOS transistor, Capacitance voltage characteristics, non-ideal effects DC transfer characteristics, MOS Inverter, MOS Transistor Switches, CMOS Logic design, Circuit and System Representations, Design Equations, Static Load MOS Inverters, Transistor Sizing, Static and Switching Characteristics; Body Effect, Noise Margin.		
Module 3: Delay Power	8	20
Transient Response, RC Delay Model, Effective Resistance, Gate and Diffusion Capacitance, Equivalent RC Circuits, Transient Response, Elmore Delay, Layout Dependence of Capacitance, Determining Effective Resistance, Linear Delay Model Logical Effort, Parasitic Delay, Delay in a Logic Gate, Drive, Extracting Logical Effort from Datasheets, Limitations to the Linear Delay Model, Logical Effort of Paths, Delay in Multistage Logic Networks, Choosing the Best Number of Stages, Sources of power dissipation, dynamic power , static power, Wire Geometry, Example of Metal Stacks, Interconnect Modelling, Resistance, Capacitance Inductance, Skin Effect, Temperature Dependence, Interconnect Impact, Delay, Energy, Crosstalk, Inductive Effects,		
Module 4: Circuit Design	8	20
Circuit Families, Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass-Transistor Circuits, Sequencing Static Circuits, Sequencing Methods, Max Delay Constraints, Min-Delay Constraints, Time Borrowing, Clock Skew, Circuit Design of Latches and Flip-Flops, Conventional CMOS Latches, Conventional CMOS Flip-Flops, Pulsed Latches, Resettable Latches and Flip-Flops, Enabled Latches and Flip-Flops, Incorporating Logic into Latches		
Module 5: Subsystem Design FPGA	8	20
Adders, zero one detectors, comparators, counters, Memory subsystems SRAM, Read and write operation, DRAM, sense amplifiers Field Programmable gate arrays- Logic blocks, routing architecture, design flow technology mapping for FPGAs, Case studies Sitar x XC4000 & ALTERA's FLEX 8000/10000 FPGAs: AT &T ORCA's (Optimized Reconfigurable Cell Array): ACTEL's ACT-1,2,3 and their speed performance		

Reference Books:	
	1. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley,1979. 2. S. M. Kang and Y. Leblebici, CMOS Digital Integrated Circuits : Analysis and Design, Third Edition, MH, 2002 3. J. M. Rabaey, A. P. Chandrakasan and B. Nikolic, Digital Integrated Circuits : A Design Perspective, Second Edition, PHI /Pearson, 2003. 4. J. P. Uyemura, CMOS Logic Circuit Design, Springer; 2001,. 5. J. P. Uyemura, Introduction to VLSI Circuits and System, Wiley, 2002. 6. R. J. Baker, H. W. Li and D. E. Boyce, CMOS Circuit Design, Layout and Simulation, PH, 1997
List of Experiments:	
	1. Based on VHDL (Xilinx) platform and implementation on FPGA boards: Logic expression s, modulo synchronous and asynchronous up down counters. Multiplexers/ decoders, arithmetic logic unit, priority encoder,62 models based on Moore's law, mealy model etc. 2. CADENCE CAD tool-based experiments: Design of MOS transistor circuits, DC characteristics, AC small signal analysis and extraction of parameters, design of sample and hold circuits, measurement of switching times, design of PLL and measurement of all characteristics parameters, design of 3-8 decoder using MOS technology.

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Course title:	**SoC Design and Verification**	**Sub code:**	**6LP31**			
		Structure:	**L**	**T**	**P**	**C**
			3	**0**	**2**	**4**

Course Objective:	• Understand the fundamentals of System-on-Chip (SoC) design and verification methodologies to develop complex integrated circuits. • Gain proficiency in hardware description languages (HDLs) for SoC modeling and simulation. • Learn advanced techniques for designing and verifying digital and analog components within SoCs, including IP integration and system-level validation. • Explore industry-standard tools and methodologies for SoC design, verification, and testing, enhancing employability in the semiconductor industry. • Develop practical skills through hands-on projects and case studies, culminating in the design and verification of a custom SoC, preparing students for real-world engineering challenges.
Course Outcome:	• Demonstrate proficiency in designing and verifying complex System-on-Chip (SoC) architectures, adhering to industry standards and best practices. • Acquire hands-on experience in hardware description languages (HDLs) and industry-standard tools for SoC modeling, simulation, and synthesis. • Possess the skills to integrate and verify digital and analog components within SoCs, ensuring functional correctness and performance optimization. • Students will be capable of analyzing and resolving design challenges in SoC projects, considering factors such as power consumption, area utilization, and timing constraints. • Prepare students for careers in semiconductor companies, research institutions, or further studies in advanced topics related to SoC design and verification.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction to SoC Design	8	20
Overview of System-on-Chip (SoC) architecture and design methodologies, Introduction to hardware description languages (HDLs) such as Verilog and VHDL, SoC design flow and the role of simulation and verification		
Module 2: Digital Design and Verification	8	20
Combinational and sequential logic design techniques, Finite State Machine (FSM) design and implementation, RTL (Register Transfer Level) coding using Verilog/VHDL for digital SoC components, Functional verification techniques including testbench development and simulation		

Module 3: System Verilog And Universal Verification Methodology	8	20
Overview of System Verilog as an extension of Verilog with enhanced features for design and verification, Utilizing System Verilog for RTL (Register Transfer Level) design of SOC components including modules, interfaces, and hierarchical structures, Introduction to UVM as a standardized methodology for verification in System Verilog, Designing modular and reusable verification components using the UVM methodology, Developing verification plans to ensure comprehensive verification coverage of SOC designs.		
Module 4: SoC Integration and Verification	8	20
IP (Intellectual Property) integration strategies and standards,SoC bus architectures (e.g., AMBA) and interconnect design, System-level verification methodologies including constrained random testing and assertion-based verification, SoC debug techniques and tools		
Module 5: Advanced Topics and Project Work	8	20
Advanced SoC design concepts such as low-power design techniques and security considerations, Case studies and industry applications of SoC design and verification, Group projects involving the design, verification, and testing of a custom SoC, Presentation and discussion of project outcomes		

Reference Books:	
	1. "Digital Design and Computer Architecture" by David Harris and Sarah Harris 2. "SystemVerilog for Verification: A Guide to Learning the Testbench Language Features" by Chris Spear 3. "Analog Design Essentials" by Willy M. C. Sansen4. J. P. Uyemura, CMOS Logic Circuit Design, Springer; 2001,. 4. "Principles of CMOS VLSI Design: A Systems Perspective" by Neil H. E. Weste and David Harris 5. "System-on-Chip Verification: Methodology and Techniques" by Prakash Rashinkar, et al.
List of Experiments:	
	1. Introduction to SoC Design: o Experiment 1: FPGA Programming for Basic Logic Circuits. 2. Digital Design and Verification: o Experiment 2: Design and Verification of Basic Logic Gates in Verilog. 3. System Verilog and Universal Verification Methodology (UVM): o Experiment 3: Introduction to System Verilog Constructs. o Experiment 4: Development of a UVM Testbench for SOC Verification. 4. SoC Integration and Verification: o Experiment 5: Integration and Verification of Peripherals in an SoC. 5. Advanced Topics: o Experiment 6: Design and Verification of Advanced SoC Components. 6. Project Work: o Experiment 7-10: SoC Design Project: Full SoC Development with Peripherals and Advanced Components.

Course title:	**Electronic Product Design Using EDA tools**	**Sub code:**	**6LP32**			
		Structure	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**
Course Objective:	• Develop proficiency in utilizing EDA tools for schematic capture, simulation, synthesis, and layout design. • Enhance design skills to optimize electronic products for performance, reliability, and manufacturability through practical EDA tool applications.					

Course Outcome:	• Ability to independently carry out research /investigation and developmentwork to solve practical problems • Ability to write and present a substantial technical report/document • Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program • Inculcate the ability to understand clearly the steps in designing electronic systems which are in tune with current technology and adaptable for future changes • Create an environment such that graduates develop a passion for hardware and software design and be part of the electronic design industry to become leaders in indigenous product development

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction to Electronic Design Automation (EDA) Tools	8	20
Overview of EDA tools for electronic product design, Introduction to popular EDA software suites (e.g., Cadence, Synopsys, Mentor Graphics), Basic concepts of schematic capture, simulation, synthesis, and layout design.		
Module 2: Schematic Design and Simulation	8	20
Schematic capture techniques using EDA tools, Component selection, placement, and connectivity considerations, Introduction to simulation methodologies (e.g., transient, DC, AC, and transient analysis), Verifying circuit functionality, performance, and signal integrity through simulation.		
Module 3: Synthesis and Optimization	8	20
Principles of logic synthesis and optimization, Utilizing EDA tools for RTL (Register Transfer Level) synthesis, Optimization techniques for area, power, and timing constraints, Timing analysis and constraints setup for synchronous digital designs.		
Module 4: Layout Design and Physical Verification	8	20
Introduction to layout design principles and methodologies, Floor planning, placement, and routing techniques using EDA tools, Understanding Design Rule Checks (DRC) and Layout vs. Schematic (LVS) verification, Physical verification techniques to ensure design manufacturability and reliability.		
Module 5: Advanced Topics and Project Work	8	20
Advanced concepts such as analog/mixed-signal design, power analysis, and formal verification, Integration of EDA tools into a complete electronic product design flow, Hands-on project work involving the design, simulation, synthesis, layout, and verification of a complex electronic product using EDA tools, Presentation and documentation of project outcomes.		

Reference Books:

1. **"EDA for IC Implementation, Circuit Design, and Process Technology"** by Luciano Lavagno, Igor L. Markov, and Louis K. Scheffer
2. **"Digital Integrated Circuits: A Design Perspective"** by Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolić
3. **"Introduction to VLSI Circuits and Systems"** by John P. Uyemura
4. **"SystemVerilog for Design"** by Stuart Sutherland, Simon Davidmann, and Peter Flake
5. **"ASIC Design in the Silicon Sandbox: A Complete Guide to Building Mixed-Signal Integrated Circuits"** by Keith Barr

List of Experiments:

1. **Schematic Design Exercise:**
   - Create a schematic diagram for a simple digital circuit using EDA software, ensuring proper component selection and connectivity.
2. **Simulation Analysis:**
   - Conduct transient analysis on the designed circuit to verify its functionality and transient response using EDA simulation tools.
3. **Logic Synthesis and Optimization Task:**
   - Perform RTL synthesis and optimization for a given digital design, optimizing for area, power, and timing constraints.
4. **Timing Constraints Setup:**
   - Set up timing constraints and perform timing analysis for synchronous digital designs to ensure proper operation within specified timing requirements.
5. **Layout Design Challenge:**
   - Design the layout for the synthesized digital circuit, considering floor planning, placement, and routing techniques to optimize layout area and signal integrity.

	6. **Design Rule Checks (DRC) Evaluation:** • Conduct DRC checks on the layout design to identify and rectify violations, ensuring compliance with manufacturing rules and constraints. 7. **Layout vs. Schematic (LVS) Verification Task:** • Perform LVS verification to ensure consistency and accuracy between the schematic and layout designs, resolving any mismatches or discrepancies. 8. **Physical Verification Assignment:** • Perform physical verification tasks including DRC, LVS, and other checks to ensure design manufacturability and reliability. 9. **Advanced Design Exploration Project:** • Explore advanced design concepts such as analog/mixed-signal design or power analysis, implementing a small-scale project using EDA tools. 10. **Comprehensive Project Presentation:** 11. Present and document a comprehensive project involving the entire electronic product design flow, demonstrating proficiency in using EDA tools for design, simulation, synthesis, layout, and verification.

Course Title:	**Embedded system and IOT**	**Sub code:**	**6LP33**			
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**2**	**4**

Course Objective:	• Leanring the Discipline of Embedded Systems and IoT and Its Application to Real-Time Embedded System Development • Learning Basic Embedded Microcontroller Principles and Practices and Their Appropriate Applications. • Understanding the Principles of Analysis and Design for IoT Development. • Applying IoT Applications to Construct Embedded Systems of High Quality.
Course Outcome:	• Understand the principles and design methodologies of embedded systems and IoT devices. • Analyze and implement real-time operating systems, communication protocols, and sensor interfacing for embedded systems. • Gain proficiency in designing and developing embedded software for controlling and monitoring IoT devices. • Explore the integration of IoT technologies for smart applications in various domains such as healthcare, agriculture, and smart cities. • Develop practical skills in hardware-software co-design, system integration, and deployment of embedded systems and IoT solutions.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Introduction to Processor Architecture	8	20
Architecture of Intel processors from 80286 to Pentium-Microarchitectural techniques of advanced processors –pipelining-superscalar concept –Out of order execution –Speculative execution – branch prediction –register renaming -Multicore processors-Processors beyond Pentium- Architecture of ARM Cortex-M – NVIC – WIC--Sleep modes – peripheral programming of a Cortex-M processor.		
Module 2: Robotics Design And Application Instruction Set And Thumb Instruction Set	8	20
Robotics – Designing robotics applications using ARM cortex-M in MSP 432 Robotics kit GPU Processing. Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions.		
Module 3: Communication and Networking in IoT	8	20

Review of Communication Networks, Challenges in Networking of IoT Nodes, range, bandwidth Machine-to-Machine (M2M) and IoT Technology Fundamentals, Medium Access Control (MAC) Protocols for M2M Communications Standards for the IoT Basics of 5G Cellular Networks and 5G IoT Communications, Low-Power Wide Area networks (LPWAN)Wireless communication for IoT: channel models, power budgets, data rates.Networking and communication aspects: IPv6, 6LoWPAN, COAP, MQTT, Operating Systems need and requirements for IoT..		
Module 4: IoT Protocols	8	20
Low power, low range protocols –Zigbee –BLE – 6LoWPAN. Applications for IoT-Smart home, city,agriculture etc, - IoT services Project work on Design and development of an IoT product.		
Module 5: Modern Networking	8	20
Cloud computing: Introduction to the Cloud Computing, History of cloud computing, Cloud service options, Cloud Deployment models, Business concerns in the cloud, Hypervisors, Comparison of Cloud providers, Cloud and Fog Ecosystem for IoT Review of architecture IoT Data analytics and Security: OLAP and OLTP, NoSQL databases, Row and column Oriented databases, Introduction to Columnar DBMS CStore , Run :Length and Bit vector Encoding, IoT Data Analytics. Cryptographic algorithms, Analysis of Light weight Cryptographic solutions IoT security, Key exchange using Elliptical Curve Cryptography, Comparative analysis of Cryptographic Library for IoT		

Text/Reference Books :		
	1	Lyla B. Das, The x86 Microprocessors: 8086 to Pentium,, Multicores, Atom , and the 8051 Microcontroller : Architecture ,Programming and Interfacing, Second Edition , Pearson Education ,India 2014
	2	Lyla B. Das, Architecture, Programming, and Interfacing of Low-power Processors – ARM7, Cortex-M, Cengage, 2017
	3	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1 st Edition, Academic Press, 2014.
	4	ArshdeepBagha, Vijay Madisetti , Internet of Things ,A hands on approach,2015
	5	Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly,2005
List of Experiments		
	1	Display Hello WORD message using UART
	2	Using mobile hotspot network communicate server and Client
	3	Display Temperature Sensor reading on Putty using UART
	4	Interface Receiver and transmitter to send data
	5	Interface LMT86 with ADC to get readings on the UART
	6	Blink LED using suitable pattern
	7	Display light intensity on the UART

Course title:	**Computer Network and security**	**Sub code:**	**6L34**			
		Structure:	**L**	**T**	**P**	**C**
			2	**1**	**0**	**3**

Course Objective:	• This course aims to teach the basic concept of networks like network classification, network topologies network devices. • This course deal with the important concepts and techniques related to data communication and enable students to have an insight in to technology involved to make the network communication possible.
Course Outcome:	• Understand the fundamentals of computer networks, including protocols, architectures, and networking technologies. • Analyze and design network architectures for efficient data transmission, routing, and switching. • Gain proficiency in network security concepts, including cryptography, authentication, and access control. • Explore advanced topics such as wireless networks, network management, and cloud computing. • Develop practical skills in configuring and securing network devices, conducting vulnerability assessments, and implementing security measures to protect against cyber threats.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction	6	14
Data Communications, Networks, The Internet, Protocols and Standards, Network Models, Layered Tasks, The OSI Model, Layers in the OSI Model, TCP/IP Protocol Suite, Addressing, Physical Layer and Media, Data and Signals, Analog and Digital, Periodic Analog Signals, Digital Signals, Transmission impairment, Data Rate Limits, Performance, Network topologies.		
Module 2: Physical and Data Link Layer	8	20
Bandwidth utilization: Multiplexing and Spreading, Multiplexing, Spread Spectrum, Transmission Media, Guided Media, Unguided Media: Wireless, Switching, Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Structure of a Switch, Introduction, Block Coding, Liner Block Codes, Cyclic Codes, Checksum, Data Link Control, Framing, Flow and Error Control, Protocols, Noiseless Channels, HDLC, Point-to-Point Protocol, Multiple Access, Random Access, Aloha, Controlled Access, Channelization, IEEE Standards, Standard Ethernet, Changes in the Standard, Fast Ethernet, Gigabit Ethernet, IEEE 802.11, Bluetooth, Connecting LANs, Backbone Networks, and Virtual LANs, Connecting Devices, Backbone Networks, Virtual LANs, Sonet Networks, Virtual Tributaries, Virtual- Circuit Networks: Frame Relay and ATM, Frame Relay, ATM, ATM LANs.		
Module 3: Network Layer and Transport layer	8	20
Logical Addressing, IPv4 Addresses, IPv6 Addresses, Network Layer: Internet Protocol, Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Network Layer: Address Mapping, Error Reporting and Multicasting, Address Mapping, ICMP, IGMP, ICMPv6, Network Layer: Delivery, Forwarding and Routing, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols. Process-Process Delivery: UDP, TCP and SCTP, Process-to-Process Delivery, User Datagram Protocol (UDP), TCP, SCTP, Congestion Control and Quality of Service, Data Traffic, Congestion, Congestion Control, Two Examples, Quality Service, Techniques to improve QoS, Integrated Services, Differentiated Services, QoS in Switched Networks.		
Module 4: Application Layer	6	16
Domain Name System, Name Space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Resolution, DNS Messages, Types of Records, Registrars, Dynamic Domain Name System (DDNS), Encapsulation, Remote Logging, Electronic Mail and File Transfer, Remote Logging, Telnet, Electronic Mail, File Transfer, WWW and HTTP: Architecture, Web Documents, HTTP, Network Management: SNMP, Network Management System, Simple Network Management Protocol (SNMP), Multimedia, Digitizing Audio and Video, Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice over IP.		
Module 5: Network Security	6	14
Security concepts and terminology TCP/IP and OSI network security access control issues (packet filters, firewalls) communication security (OSI layer security protocols) security tools cryptography- Public Key Cryptography And Its Application, Cyber Security and its application		
Module 6: Wireless Sensor Network	6	16
Introduction to Wireless Sensor Networks, Sensor Node Architecture and Characteristics, Communication Protocols for Wireless Sensor Networks, Energy-Efficient Protocols and Algorithms, Applications and Challenges of Wireless Sensor Networks		
Reference Books:		

	1. Data Communications and Networking, Fourth Edition by Behrouza A. Forouzan,TMH. 2. Computer Networks, A.S. Tanenbaum,4th edition, Pearson education. 3. Introduction to Data communications and Networking, W. Tomasi, Pearsoneducation. 4. Data and Computer Communications, G.S. Hura and M. Singhal, CRC Press,Taylor and Francis Group. 5. An Engineering Approach to Computer Networks-S. Keshav,2nd Edition, Pearson Education 6. Understanding communications and Networks,3rd Edition, W. A. Shay, Cengage Learning. 7. "Modern Cryptography, Theory & Practice", Pearson Education. Wenbo Mao 8. "Computer Security", Pearson Education. Matt Bishop

Course title:	**ADVANCE COMMUNICATION**	**Sub code:**		**6L36**		
		Structure:	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Course Objective:	• To provide students with an understanding of satellite communication systems, including various orbit types, transmission theory, system noise parameters, link design, subsystems, and VSAT network architectures, enabling them to design and analyze satellite communication systems effectively. • Students will learn about optical fiber types, signal degradation factors, fabrication techniques, optical sources, detectors, link design principles, optical switches, nonlinear effects, and amplifier technologies, empowering them to design and analyze optical communication systems and networks. • Through theoretical study and practical examples, students will gain proficiency in radar system fundamentals, signal processing techniques, and applications such as pulse-Doppler radar, synthetic aperture radar (SAR), moving target indication (MTI), and adaptive radar, enabling them to analyze and design radar systems for various applications. • Students will understand the evolution of mobile communication from 1G to 5G, including analog and digital voice systems, GSM, CDMA, 3G, 4G, and LTE technologies. They will learn about the architecture, protocols, data rates, and enhancements in each generation, along with an introduction to 5G networks and technologies such as SDN, NFV, MEC, and network slicing. • This module aims to familiarize students with microwave communication systems and electromagnetic wave propagation phenomena. They will learn about different propagation modes, fading effects, microwave system architectures, and digital microwave systems, enabling them to design and analyze microwave communication links effectively.					
Course Outcome:	• Understand the orbital and functional principles of satellite communicationsystems. • Architect, interpret, and select appropriate technologies for implementation ofspecified satellite communication systems. • Analyse and evaluate a satellite link and suggest enhancements to improve thelink performance. • Select an appropriate modulation, multiplexing, coding and multiple accessschemes for a given satellite communication link. • Specify, design, prototype and test analogue and digital satellite communication systems as per given specifications.					
Content		**No. of hours**		**ESE Marks (%)**		
Module 1: Basics of Satellite theory and it's application		8		20		

Introduction: Overview of Satellite Communications, GEO, MEO and LEO satellite systems, frequency bands, Kepler's Law. Basic transmission theory, types of satellite and its uses System noise temperature and G/T ratio, CNR, CIR, ACI, IMI, Down link design, Up link design, System design examples. Attitude and Orbit Control System (AOCS), Telemetry, Tracking and Command System (TT&C), Power System, Satellite antennas, Communications subsystem, transponders. Overview of VSAT systems, Network architectures, Access control, Multiple access selection. Orbits, Coverage and frequency bands, off axis scanning, delay and throughput, NGSO constellationdesign		
Module 2: Optical communication and its application	8	20
Different types of optical fibre ,Modal analysis of a step index fibre . Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR. Optical sources - LEDs and Lasers, Photo-detectors - pin-detectors, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties. Optical switches - coupled mode analysis of directional couplers, electro-optic switches. Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solition based communication. Optical amplifiers - EDFA, Raman amplifier, Coherent communication and WDM systems.		
Module 3: Radar theory and its applications	8	20
The Radar System, the radar range equation, scattering and RCS, RCS models, propagation, antennas, receivers, noise figure. Radar Signal Processing Fundamentals, detection and likelihood ratio. Applications of Radar Signal Processing: Pulse-Doppler radar, CFAR detection, synthetic aperture radar (SAR), inverse synthetic aperture radar (ISAR), moving target indication (MTI), displaced-phase-center-antenna technique (DPCA), adaptive radar, super resolution (MUSIC), space-time adaptive processing (STAP)		
Module 4: Mobile communication	8	20
Evolution from 1G to 5G, Analog voice systems in 1G, digital radio systems in 2G, voice and messaging services, TDMA based GSM, CDMA, 2.5G (GPRS), 2.75G (EDGE); IMT2000, 3G UMTS, W-CDMA, HSPA, HSPA+, 3G services and data rates, IMT Advanced, 4G, LTE, VoLTE, OFDM, MIMO, LTE Advanced Pro (3GPP Release 13+), IMT2020, enhancements in comparison to IMT Advanced **5G network:** Data Adaptation Protocol (SDAP), centralized RAN, open RAN, multi-access edge computing (MEC); Introduction to software defined networking (SDN), network function virtualization (NFV), network slicing; restful API for service-based interface, private networks.		
Module 5: Microwave theory and EM Wave propagation	8	20
Block diagram of terrestrial communication, EM wave frequency and its application ,advantage of microwave system,properties. EM wave propagation- ground wave or surface wave sky wave/ionospheric wave, space wave, duct wave propagation, Fading, microwave communication system, LOS microwave system, digital microwave system, block diagram of digital microwave system		

Reference Books:	
	1. Satellite communication, "Timothy Pratt, Charles Bostian, Jeremy Allnut", JohnWilley and Sons Inc, 2nd edition. 2. Satellite Communication Technology, Dr. K. Miya, 2nd edition. 3. G. D. Gordon and W. L. Morgan, "Communications Satellite Handbook," WileyIndia, 2010 4. "Fibre Optic Communications" by Harold B Killen 5. "Fiber Optics" by Robert J Hoss 6. "Fibre Optic Communication" by Agarwal D C 7. F.E. Terman, Radio Engineering, McGraw Hill Book Co. (for Chapter 7 only),Fourth Edition 1955 8. Simon Kingsley & Shaun Quegan, Understanding RADAR Systems, McGraw HillBook Co., 1993 9. Telecommunication Transmission Systems Microwave, Fiber Optic, Mobile Cellular Radio, Data, And Digital Multiplexing By Robert Winch

Course title:	Dissertation Phase-II	Sub code:	8P43			
		Structure:	L	T	P	C
			0	0	40	20

Course Objective:	Final Year Projects represent the culmination of study towards the Bachelor of Engineering degree. Projects offer the opportunity to apply and extend material learned throughout the program. Assessment is by means of a seminarpresentation, submission of a thesis, and a public demonstration of work undertaken. The projects undertaken span a diverse range of topics, including theoretical, simulation and experimental studies. The emphasis is necessarily on facilitating student learning in technical, project management and presentation spheres.
Course outcome:	• Apply knowledge and skills acquired throughout the program to solve real-world engineering problems. • Gain hands-on experience in designing, implementing, and testing innovative engineering solutions. • Develop project management skills including planning, scheduling, and resource allocation. • Enhance communication and presentation skills through the documentation and presentation of project outcomes. • Prepare for transition into the workforce or further academic pursuits by demonstrating competency in a specialized area of electronics engineering.

Content	No. of hours	ESE Marks (%)
Module 1: Term Work		
Dissertation Phase-II, is in continuation of Project Part-I undertaken by the candidates in first term. The term workshall consist of a typed report of about 70 pages or more, on the work carried out by the batch of students inrespect of the project assigned, during first term and second term. It should be in the proper format.		
Module 2: Practical Examination:		
It shall consist of demonstration of designed, fabricated project and oral based on it. The said examination will be conducted by a panel of two examiners; one of them will be a guide and another will be an externalexaminer. The external examiner will be either from the allied industry or a senior faculty member from another institute.		