National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronics Engineering (Electronic System Engineering)

Program Name: Electronics Engineering (Electronic System Engineering)

Program Code:B.TechWith Effect from Academic Year: 2021-2022

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	3	-	2	5	3	**60**	24	**40**	00	100	40	25	10	25	10	50	20	150
2	Engineering Drawing-I	1LP02	2	-	3	5	3	25	10	25	00	50	20	50	20	50	20	100	40	150
3	Engineering Mathematics-I	1L03	3	2	-	5	3	60	24	40	00	100	40	-	-	-	-	-	-	100
4	Electrical Engineering	1LP04	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
5	Basic computer programming, data structure and algorithm	1LP05	3	1	2	6	3	60	24	40	00	100	40	25	10	25	10	50	20	150
6	Energy and Environment Engineering	1L06	3	1	-	4	3	60	24	40	00	100	40	-	-	-	-	-	-	100
	Total		**17**	**4**	**9**	**30**	**-**	**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 to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

For the courses having ONLY Practical Examination, the PA has two parts, marks for : (1) Practical Part - 60% of total marks (ii) Micro-Project Part - 40% of total marks.

- **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 will not be processed or carried forward.**

National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronics Engineering (Electronic System Engineering)

Program Name: Electronics Engineering (Electronic System Engineering)

Program Code: B.TechWith Effect from Academic Year: 2021-2022

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	2	-	5	3	60	24	40	00	100	40	-	-	-	-	-	-	100
2	Engineering chemistry	2L08	3	2	-	5	3	60	24	40	00	100	40	-	-	-	-	-	-	100
3	Engineering mechanics	2LP09	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
4	Electronic devices	2LP10	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
5	Workshop technology	2LP11	3	1	2	6	3	60	24	40	00	100	40	25	10	25	10	50	20	150
6	Communication skills	2L12	3	1	-	4	3	60	24	40	00	100	40	-	-	-	-	-	-	100
Total			**18**	**6**	**6**	**30**	**-**	**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 to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

For the courses having ONLY Practical Examination, the PA has two parts, marks for : (1) Practical Part - 60% of total marks (ii) Micro-Project Part - 40% of total marks.

- **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 will not be processed or carried forward.**

National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronics Engineering (Electronic System Engineering)

Program Name: Electronics Engineering (Electronic System Engineering)

Program Code:B.TechWith Effect from Academic Year: 2021-2022

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	2	-	5	3	60	24	40	00	100	40	-	-	-	-	-	-	100
2	Electronic measurement and instrumentation	3LP14	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
3	Management Economics	3L15	3	2	-	5	3	60	24	40	00	100	40	-	-	-	-	-	-	100
4	Python Programming	3LP16	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
5	Digital Logic and Circuits	3LP17	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
6	Linear Electrical Networks	3LP18	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
		Total	**18**	**4**	**8**	**30**	**-**	**360**	**-**	**240**	**-**	**600**	**-**	**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 to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

For the courses having ONLY Practical Examination, the PA has two parts, marks for : (1) Practical Part - 60% of total marks (ii) Micro-Project Part - 40% of total marks.

- **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 will not be processed or carried forward.**

National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronics Engineering (Electronic System Engineering)

Program Name: Electronics Engineering (Electronic System Engineering)

Program Code:B.TechWith Effect from Academic Year: 2021-2022

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						
							Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
			L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	Power Electronics	4LP19	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
2	Electromagnetic and Field Theory	4L20	3	2	-	5	3	60	24	40	00	100	40	-	-	-	-	-	-	100
3	Microprocessor and Microcontroller	4LP21	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
4	Analog Communication	4LP22	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
5	Analog System Design	4LP23	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
6	Signals and System	4L24	3	2	-	5	3	60	24	40	00	100	40	-	-	-	-	-	-	100
	Total		**18**	**4**	**8**	**30**	**-**	**360**	**-**	**240**	**-**	**600**	**-**	**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 to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

For the courses having ONLY Practical Examination, the PA has two parts, marks for : (1) Practical Part - 60% of total marks (ii) Micro-Project Part - 40% of total marks.

- **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 will not be processed or carried forward.**

National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronics Engineering (Electronic System Engineering)

Program Name: Electronics Engineering (Electronic System Engineering)

Program Code:B.TechWith Effect from Academic Year: 2021-2022

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	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
2	Control System Engineering	5L26	3	2	-	5	3	60	24	40	00	100	40	-	-	-	-	-	-	100
3	Digital signal processing	5LP27	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
4	Embedded system and IOT	5LP24	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
5	Printed Circuit Board Technology-I	5LP29	3	1	2	6	3	60	24	40	00	100	40	25	10	25	10	50	20	150
6	Information Theory and coding	5L40	3	1	-	4	3	60	24	40	00	100	40	-	-	-	-	-	-	100
	Total		**18**	**4**	**8**	**30**	**-**	**360**	**-**	**240**	**-**	**600**	**-**	**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 to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

For the courses having ONLY Practical Examination, the PA has two parts, marks for : (1) Practical Part - 60% of total marks (ii) Micro-Project Part - 40% of total marks.

- **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 will not be processed or carried forward.**

National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronics Engineering (Electronic System Engineering)

Program Name: Electronics Engineering (Electronic System Engineering)

Program Code:B.TechWith Effect from Academic Year: 2021-2022

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	Antenna and wave Propagation	6L31	3	-	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
2	Printed Circuit Board Technology-II	6LP32	3	1	2	6	3	60	24	40	00	100	40	25	10	25	10	50	20	150
3	Computer Architecture and organization	6L33	3	1	-	4	3	60	24	40	00	100	40	-	-	-	-	-	-	100
4	Sensors & Transducers	6LP34	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
5	Software project management	6L35	3	1	-	4	3	60	24	40	00	100	40	-	-	-	-	-	-	100
6	Optical fiber communication	6LP36	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
7	Industrial Visit, Employability skill and Mini project lab	6P37	-	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	50
	Total		**18**	**3**	**9**	**30**	**-**	**360**	**-**	**240**	**-**	**600**	**-**	**75**	**-**	**75**	**-**	**150**	**-**	**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 to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

For the courses having ONLY Practical Examination, the PA has two parts, marks for : (1) Practical Part - 60% of total marks (ii) Micro-Project Part - 40% of total marks.

- **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 will not be processed or carried forward.**

National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronics Engineering (Electronic System Engineering)

Program Name: Electronics Engineering (Electronic System Engineering)

Program Code:B.TechWith Effect from Academic Year: 2021-2022

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	Digital system design using Verilog	7LP38	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
2	Computer network and data communication	7LP39	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
3	3.1 Satellite communication	7LP40.1	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
	3.2 Mechatronics	7LP40.2																		
	3.3 Mobile and wireless communication	7LP40.3																		
	3.4 Artificial intelligence and machine learning	7LP40.4																		
4	Microwave Engineering	7L41	3	-	-	3	3	60	24	40	00	100	40	-	-	-	-	-	-	100
5	Project Part I	7P42	1	-	6	7	-	-	-	-	-	-	-	-	-	-	-	-	-	100
6	6.1 Electronic product design Using EDA tools	7LP43.1	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
	6.2 Solar installation and maintenance	7LP43.2																		
	Total		**16**	**-**	**14**	**30**	**-**	**300**	**-**	**200**	**-**	**500**	**-**	**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 to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

For the courses having ONLY Practical Examination, the PA has two parts, marks for : (1) Practical Part - 60% of total marks (ii) Micro-Project Part - 40% of total marks.

- **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 will not be processed or carried forward.**

National Institute of Electronics & Information Technology, Aurangabad

Teaching and Examination Scheme for B.Tech in Electronics Engineering (Electronic System Engineering)

Program Name: Electronics Engineering (Electronic System Engineering)

Program Code:B.TechWith Effect from Academic Year: 2021-2022

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	Industrial automation using PLC and SCADA	8LP44	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
2	2.1 Digital image Processing	8LP45.1	3	-	2	5	3	60	24	40	00	100	40	25	10	25	10	50	20	150
	2.2 Consumer Electronics	8LP45.2																		
3	RADAR Communication	8L46	3	2	-	5	3	60	24	40	00	100	40	-	-	-	-	-	-	100
4	Project	8P47	1	2	12	15	-	-	-	-	-	-	-	-	-	-	-	-	-	200
	Total		**10**	**4**	**16**	**30**	**-**	**180**	**-**	**120**	**-**	**400**	**-**	**50**	**-**	**50**	**-**	**100**	**-**	**600**

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

Theory and practical periods of 60 minutes each. Total Marks: **600**

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 to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

For the courses having ONLY Practical Examination, the PA has two parts, marks for : (1) Practical Part - 60% of total marks (ii) Micro-Project Part - 40% of total marks.

- **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 will not be processed or carried forward.**

Course title:	ENGINEERING METHAMATICS-I	Sub code	1L03			
		Structure	L	T	P	C
			3	0	0	3

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 successful completion 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.

Contents	No. of hours	ESE Marks (%)
Module 1: Differential Calculus:	10	25
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: Integral Calculus:	10	25
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 3: Infinite series:	8	25
Sequences, Infinite series of real and complex numbers, Cauchy criterion, tests of convergence, absolute and conditional convergence, improper integrals, improper integrals depending on a parameter, uniform convergence, power series, radius of convergence.		
Module 4: Matrices:	12	25
Rank of matrix, consistency of a system of equations, linear dependence and independence, linear and orthogonal transformations, Eigen values and eigen vectors, Cayley – Hamilton theorem, reduction to diagonal form, Hermitian and skew Hermitian matrices, Quadratic forms.		

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:	ENGINEERING DRAWING	Sub code	1LP02			
		Structure	L	T	P	C
			2	0	2	4

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:	• Gain the importance of lines, planes, solids in engineering. • Gain the visualization of projections of lines, planes, solids in different angles from reference plane. • Will be able to draw and visualise orthographic and isometric projections. • Will be able to give proper dimensions to the projections.

Content	No. of hours.	ESE Marks(%)
Module 1: Projections of Straight Lines:	10	25
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 2: Projections of planes:	8	25
Plane with surface parallel to one plane and perpendicular to other, plane inclined to one plane and perpendicular to other, projections of planes inclined to both the plane.		
Module 3: Projections of Solids:	10	25
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: Orthographic Projections& Isometric views:	12	25
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 exemplary figure.

Course title:	ELECTRICAL ENGINEERING	Sub code	1LP04			
		Structure	L	T	P	C
			3	0	1	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 power systems, transformers, generators, motors etc.
Course Outcome:	• Predict the behaviour of any electrical and magnetic circuits. • Formulate and solve complex AC, DC circuits. • Identify the type of electrical machine used for that particular application. • Realize the requirement of transformers in transmission and distribution of electric power and other applications.

Content	No. of hours	ESE Marks (%)
Module 1: Electrical Circuit:	8	20
Circuit Elements Resistance, Inductance & Capacitance, Kirchhoff's Laws, 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	25
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: Electrical Measurements:	8	20
Definition, Indicating, Integrating & Recording Instruments, Deflecting Controlling & Damping Mechanisms, Ammeter & Voltmeters, P.M.M.C. Type & Moving Iron Type, Electrodynamometer Type Wattmeter's, Induction Type Single Phase Energy Meter		
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	15
Elementary Idea about Power Generation, Transmission and Distribution. DC Shunt and Series Motor – Construction, Principle of Working, Characteristics, Speed Control and Applications. Induction Motors – Construction, Principle of Working of Single Phase and 3- Phase Motors. Torque Slip Characteristics.		
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, Prentice Hall 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 Electrical Engineering", 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 direct loading.
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:	BASIC CONCEPTS OF PROGRAMMING, DATA STRUCTURE AND ALGORITHM	Sub code	1LP05			
		Structure	L	T	P	C
			3	0	1	4

Course Objective:	• To introduce basics of programming and develop logical thinking of students. • 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:	• Acquire knowledge to give function and parameter passing. • Students will be able to create their own algorithm. • Acquire knowledge to use Arrays and strings. • Will be able to declare and initialize pointers. • Will be able to write sequential and text files.

Content	No. of hours	ESE Marks(%)
Module 1: Introduction:	8	10
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	18
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:	8	18
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:	8	18
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: File Management in C:	8	18
Open, close, read and write operations, Sequential and text files.		

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

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 subjects each 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.

Course title:	PHYSICS	Sub code	1LP01			
		Structure	L	T	P	C
			3	0	0	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 as well 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 and technologies based on lasers and optical fibres. • Student can also appreciate various material properties which are used in engineering applications and devices.

Content	No. of hours	ESE Marks(%)
Module 1: Interference and Diffraction:	9	25
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: Semiconductors:	9	25
Position of fermi level in intrinsic and extrinsic semiconductor, conductivity in semiconductor, Hall effect, Hall coefficient, band structure of PN junction under forward bias and reverse bias, LED, Zener diode, Solar cell, Photocell.		
Module 3: Magnetic Materials& Dielectrics:	9	25
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 4: Fibre Optics and LASER:	9	25
Concept, fibre materials, structure and classification of optical fibre, Numerical aperture, advantages of optical fibre communication. Spontaneous and Stimulated emission, population inversion, Ruby laser, Helium Neon gas laser, Engineering applications of laser.		

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) Semiconductor diode characteristics of Zener and LED diode.
5) To plot Transistor characteristics using CE configuration.
6) Study of solar cell characteristics.
7) Study of photocell characteristics.
8) To study transistor as an amplifier (CE, CB and CC configuration).
9) To determine the band-gap in a semiconductor
10) To study Hall effect and Hall coefficient.
11) To study different types of Optical fibres.

Course title:	ENERGY AND ENVIRONMENTAL ENGINEERING	Sub code	1L06			
		Structure	L	T	P	C
			3	0	0	3

Course Objective:	• To teach the principal renewable energy systems. • To explore the environmental impact of various energy sources and also the effects of different types of pollutants.
Course Outcome:	• Principal renewable energy systems • Explore the environmental impact of various energy sources and also the effects of different types of pollutants.

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- Off shore Wind energy- Environmental benefits and impacts. Biomass resources-Biomass conversion Technologies- Feedstock pre-processing and treatment methods- Bioenergy program in India-Environmental benefits and impacts. Geothermal Energy resources –Ocean Thermal Energy Conversion – Tidal.		
Module 4: Air Pollution:	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.		
Module 5: Greenhouse gases:	8	20
Greenhouse gas effect, acid rain. Noise pollution. Pollution aspects of various power plants. Fossil fuels and impacts, Industrial and transport emissions- impacts.		

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:	ENGINEERING MATHEMATICS-II	Sub code:	2L07			
		Structure:	L	T	P	C
			3	2	0	5

Course Objective:	To make students understand the basic importance of multi variable calculus (Differential calculus & Integral calculus), Vector calculus and ordinary differential equations in engineering.
Course Outcome:	After the completion of the course, students are able to solve industrially applicable problems.

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:	8	20
Analytic functions, Cauchy. Riemann equations (Cartesian and polar), Properties of analytic functions, Construction of analytic functions given real or imaginary part, Conformal mapping of standard elementary functions, and bilinear transformation.		

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:	ENGINEERING CHEMISTRY	Sub code:	2L08			
		Structure:	L	T	P	C
			3	2	0	5

Course Objective:	• To present sound knowledge of chemistry fundamentals, enriching students to understand 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:	Students would become familiar with the important practical applications of electrochemistry, solids, their properties and applications, and the polymer materials.

Content	No. of hours	ESE Marks (%)
Module 1: Electrochemistry	8	20
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 2: Corrosion	8	20
Dry corrosion and wet corrosion, mechanisms, types of corrosion, DMC, DAC, stress, inter granular, atmospheric and soil corrosion, Passivity, Polarization, over potential and its significance, Factors affecting corrosion, protection from corrosion by metallic coatings, electroplating, electroless plating and cathodic protection, Chemical conversion coatings and organic coatings- Paints, enamels.		
Module 3: Batteries	8	20
Different types of batteries-Primary, Secondary & Flow battery and Fuel cell. Working principle and uses-Laclanche cell, Alkaline battery, NiCad battery, lithium battery & Mercury battery. Fuel cell- Theory, working and application. Different types of fuel cells-H2/O2, propane-oxygen, PEFC and SOFC. Lead Acid storage cell-charging & discharging principle, operation and uses. Solar battery- its working principle.		
Module 4: Solid State	8	20
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 5: Polymer	8	20
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 MECHANICS	Sub code:	2LP09			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To explain the importance of mechanics in the context of engineering and conservation equations. • To explain the significance of centroid, centre of gravity and moment of inertia. • To introduce the techniques for analysing the forces in the bodies. • To apply the different principles to study the motion of a body, and concept of relative velocity and acceleration. • To describe the trajectory of a particle under projectile motion. • To identify the basic elements of a mechanical system and write their constitutive equations.
Course Outcome:	The terminal objectives of the course is that, on successful completion of teaching-learning and evaluation activities, a student would be able to identify and analyse the problems by applying the fundamental principles of engineering mechanics and to proceed to research, design and development of the mechanical systems.

Content	No. of hours	ESE Marks (%)
Module 1: Force systems & Equilibrium	8	20
Vector representation of force system, Moment of a force about a point and about an axis; couple moment; reduction of a force system to a force – a couple Wrench, Free Body Diagram, Reactions at supports, Equilibrium of Planar (including friction) and Spatial force system, Analysis of statically determinate systems (Beam, Trusses etc.)		
Module 2: Centroid and Moment of inertia	8	20
First moment of area, Centroid of area, Moment of inertia, Polar moment of inertia, Parallel axis theorem, Radius of gyration, Section modulus.		
Module 3: Internal forces in member	8	20
Determination of variation of Axial force (Axial Force Diagram), Shear force (Shear Force Diagram), Bending moment (Bending Moment Diagram) and twisting moment (Torque diagram)		
Module 4: Concept of stress and strain	8	20
Normal and shear stress and strain, State of stress at a point, Stress strain curve, Hook's law, Modulus of elasticity, Poisson's ratio, Modulus of rigidity, Bulk modulus, Transformation of stress.		
Module 5: Determination of stress	8	20
Stress across a rectangular, T & I section, and circular section due to bending moment Stress across a rectangular, T & I section, and circular section due to shear force. Stress across a circular section due to torsion.		

Reference Books	
	1. Hibbler, Engineering Mechanics, Pearson Education, Asia Pvt Ltd. 2. Beer F.P. and Johnston E.R., Vector Mechanics for Engineers: Statics and Dynamics, Tata McGraw-Hill 3. Irving H. Shames, Engineering Mechanics: Static and Dynamics, Pearson Education, Asia Pvt Ltd. 4. Meriam J.L. and Kraige L.G., Engineering Mechanics, John Wiley and Sons. 5. Stephen Timoshenko, Strength of Materaials, Part -1, CBS Publishers and Distributors, New Delhi. 6. Singer F.L. and Andrew Pytel, Strength of Material, Harper and Row Publishers, New York. 7. Popov E.P., Mechanics of deformable bodies, Prentice-Hall 8. Beer F.P. and Johnston E.R., Mechanics of materials, McGraw-Hill International
list of Experiments	
	1. Verification of equilibrium equation for coplanar forces. 2. Verification of Lami‟s theorem. 3. Verification of Law of parallelogram of forces. 4. Verification of Law of polygon of forces. 5. Verification of equilibrium equation for spatial forces. 6. Determination of coefficient of friction. 7. Analysis of truss (Analytical / Graphical method).Determination of modulus of elasticity for copper wire. 8. Determination of modus of rigidity of material. 9. Flexural test on beam. 10. Tension Test on Mild Steel Specimen

Course title:	ELECTRONICS DEVICES	Sub code:	2LP10			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To introduce basic semiconductor devices, their characteristics and application. • To understand analysis and design of simple diode circuit. • To learn to analyse the PN junction behaviour at the circuit level and its role in the operation of diodes and active device.
Course Outcome:	• Understand the impact of wave nature of particles on the performance of the semiconductor devices. • Understand the carrier transport mechanisms in semiconductors. • Develop a fundamental understanding of the static and dynamic behaviour of P-N junction diodes. • Understand the physics, characteristics and models of Bipolar Junction transistors, Junction Field Effect Transistors and Metal Oxide Semiconductor Field Effect Transistors. • Understand the Solid State Device capabilities and limitations on Electronic Circuit Performance.

Content	No. of hours	ESE Marks (%)
Module 1: Basic Devices	8	20
Semiconductor diodes: V-I characteristics, Modelling for various circuit applications, rectifier, Clipping and clamping circuits RC filters. Bipolar junction transistor (BJT), V-I characteristics, Biasing. LED photodiode, opto-coupler, V-I characteristics, optoelectronic circuits.		
Module 2: Power devices & Switching Devices	8	20
Power diode, MOSFET (Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics. MOSFET as switch, diode/active resistor, CMOS Inverter as amplifier: Active load.) IGBT, SCR TRIAC, DIAC, UJT characteristics and applications.		
Module 3: JFET	8	20
Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self). FET as an amplifier and its analysis (CS) and its frequency response. Small signal model, FET as High Impedance circuits.		
Module 4: Electronics Amplifiers & Oscillators	8	20
Classification of amplifiers, Fundamentals of Low noise and Power amplifiers. Feedback amplifiers: Feedback concept and topologies, Effect of feedback on terminal characteristics of amplifiers. Barkhausen criterion, stability with feedback. Classification of oscillators, RC Oscillators: FET RC Phase Shift oscillator, LC Oscillators: Hartley and Colpitts oscillators, Crystal oscillators.		
Module 5: Multi-vibrators & Voltage Regulator	8	20
IC555 Block diagram, Types of Multi-vibrators: Astable, Mono-stable and Bi-stable, Operation of Multi-vibrators using IC555. Applications of IC555 in Engineering, Block diagram of an adjustable three terminal positive and negative regulators (317,337) typical connection diagram, Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. Comparison of Linear Power supply and SMPS.		

Reference Books	
	1. Electronic devices and Circuit Theory", "R. Boylestad", "Pearson Education", 9th Edition 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	
	1. Study and use of Oscilloscope, signal generator to view waveforms and measure amplitude and frequency. 2. V-I characteristics of PN Junction and Zener diodes, and determining its DC and AC resistance. 3. Studies on half-wave and full-wave rectifier circuits without and with capacitor filter. 4. Studies on clipper and clamper circuits. 5. I-V characteristic of an n-p-n and p-n-p transistors, DC biasing the transistor in common-emitter configuration and determination of its operating point (i.e., various voltages and currents). 6. Study on BJT fixed bias, self-bias, and voltage divider bias configurations. 7. Transfer and Drain Characteristics of JFET (Find gm, rd and μ from characteristics). 8. Study on FET fixed bias, self-bias configurations. 9. Darlington Emitter Follower Amplifier. 10. Differential Amplifier using Bipolar Junction Transistors. 11. Single staged RC coupled current series emitter coupled feedback amplifier, Two stage RC coupled transistor Amplifier. 12. Study of MOSFET in common source configuration. 13. Study of OP-AMP in inverting, non-inverting configuration, summing amplifier, integrator, and differentiator.

Course title:	WORKSHOP TECHNOLOGY	Sub code:	2LP11			
		Structure:	L	T	P	C
			3	1	2	6

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:	• Know the importance of general safety precautions on different shop floors. • Identify the basics of tools and equipment's used in fitting, carpentry, sheet metal, machine, welding and smithy. • Fabrication of wooden joints and understand and joining of metals. • Make metal joints and sheet metal work. • Understand the basics of removal of material from work piece surface to attain specific shape. • Familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.

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 a joint and report on demonstration of a job involving wood tuning.		
Module 3: Smithy	8	20
Use and setting of smithy tools At least one job is to be demonstrated		
Module 4: Welding	8	20
Use and setting of tools and equipment's for edge preparation for welding jobs and Arc welding for different 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 be demonstrated. At least one demonstration of mould making.		

Reference Books

1. S K Hajra, CHoudhury, A K Hajra, CHoudhury, & Nirjhar Roy, Elements of Workshop 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:	2L12			
		Structure:	L	T	P	C
			3	1	0	4

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:	The students will be able to express themselves in a meaningful manner to different levels of people in their academic and social domains.

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, Technology Pessimism, 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, Oxford University 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 and Engineers, Oxford University Press 9. Caroline Whitback Ethics in Engineering Practice and Research, Cambridgs University Press.

Course title:	ENGINEERING MATHEMATICS - III	Sub code:	3L13			
		Structure:	L	T	P	C
			3	2	0	5

Course Objective:	• To explain the importance of numerical methods in solving differential equation, integration and algebraic equations • To explain the significance of Laplace and z transform and its use in solving differential and difference equation. • To apply the different statistical and curve fitting techniques to gain insight of data. • To describe the theory of complex variable
Course Outcome:	On successful completion of teaching-learning and evaluation activities, a student would be able to apply fundamental concepts of Ordinary Differential Equations and Partial Differential Equations and the basic numerical methods for their solution. Solve the problems choosing the most suitable method.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Numerical Method	8	20
Lagrange's interpolation formula, Numerical differentiation, solution of ordinary differential equation by Picard's method, Taylor 's series method, Euler's modified method and Runge-Kutta fourth order 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	8	20
Function of Complex Variables, Introduction, Analytic function, Cauchy-Riemann Equations, Harmonic function, Taylor's & Laurent's series, Singularities, Residues, Cauchy Residue theorem, Integration along unit circle & along the upper half semi-circle, conformal and bilinear transformation.		
Module 5: Z Transform&Vector Calculus	8	20
Z- Transform, Z-transform of elementary function & properties. Inverse Ztransforms. Solution of difference equation by Z- transforms. Vector calculus, differention, gradient, divergence, curl of vector function. Vector integration. Green's Theorem, 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:	Electronic Measurement &Instrumentation	Sub code:	3LP14			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	The primary aim of this subject is to acquaint the students with the basic principles of measuring instruments and show how each of them can be exploited for the measurement of large number of variables.
Course Outcome:	• Explain basic concepts and definitions in measurement. • Explain the operation and design of electronic instruments for parameter measurement and operation of different Transducers • Explain the operation of oscilloscopes and the basic circuit blocks in the design of an oscilloscope. • Explain the circuitry and design of various function generators.

Content	No. of hours	ESE Marks(%)
Module 1: Fundamentals of Electronic Measurement and Instrumentation	6	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 of errors, Statistical analysis , probability of errors, Limiting errors,Standards of measurement.		
Module 2: Electromechanical Instruments	8	20
Construction of Galvanometer, Suspension Galvanometer, Torque and deflection Galvanometer, PMMC mechanism, DC voltmeter; AC voltmeters; Peak, average and true RMSvoltmeters; Digital Millimetres; Ammeters, Ohm-meters and their design' AC indicatinginstruments, Watt-hour meter; Power factor meter.		
Module 3: AC, DC Bridges&Transducers	8	20
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. Static and dynamic characteristics, Classification of transducers, Capacitive transducer, Inductive transducer, Resistive transducer, RVDT, Strain Gauge, RTD, Optical Transducers, Hall effect transducer, Piezoelectric transducers, Transducers for measurement of Pressure, Temperature,Level, Displacement, Flow.		
Module 4: Oscilloscope and Signal Generators	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.		
Module 5: Signal Analyzer and Data Acquisition System	8	20
Construction and operation of Signal analyzer, Wave analyzer, Harmonic Distortion analyzer, Spectrum analyzer and Logic analyzer; Signal conditioning and its necessity, process adopted in Signal conditioning, Functions of Signal conditioning, AC/DC Conditioning systems, Data conversion: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 Measurement Techniques”, PHI Publications.
2. A.K. Sawhney : “Electrical and Electronic Measurement and Instrumentation”, Dhanpat Rai & 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 Graw Hill 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 LabVIEW software
5.	Study of LabVIEW 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 LabVIEWs Visual display
9.	Exploring String and File I/O
10	Data Acquisition in LabVIEW

Course title:	Managerial Economics	Sub code:	3L15			
		Structure:	L	T	P	C
			3	2	0	5

Course Objective:	The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.
Course Outcome:	After completion of this course, the student will able to understand various aspects of Managerial Economics and analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Introduction To Managerial Economics	8	20
Definition, nature and scope of managerial economics- relation with other disciplines- Demand Analysis: Demand Determinants, Law of Demand and its exceptions.		
Module 2: Elasticity Of Demand	8	20
Definition, Types, Measurement and Significance of Elasticity of Demand. Demand forecasting, factors governing demand forecasting, methods of demand forecasting (Survey methods, Statisticalmethods, Expert opinion method, Test marketing, Controlledexperiments, Judgmental approach to Demand Forecasting).		
Module 3: Theory Of Production And Cost Analysis	8	20
Module 4: Introduction To Markets And PricingPolicies	8	20
Market structures: Types of competition, features of perfect competition, monopoly- monopolistic competition. Price-Output determination under perfect competition and monopoly – Methods of Pricing-cost plus pricing, marginal cost, limit pricing, skimming pricing, bundling pricing, sealed bid pricing and peak load pricing.		
Module 5: Business Organisations And New EconomicEnvironment	8	20
Characteristic features of business, features and evaluation of sole Proprietorship, partnership, Joint Stock Company, public enterprisesand their types, changing business environment in post-liberalizationscenario.		

Reference Books

	1	Aryasri: Managerial Economics and Financial Analysis, 4/e, TMH
	2	Varshney & Maheswari: Managerial Economics, Sultan Chand
	3	Premchand Babu, Madan Mohan:Financial Accounting and Analysis,Himalaya
	4	S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International
	5	Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi
	6	Domnick Salvatore: Managerial Economics in a Global Economy, Cengage

Course Title:	PYTHON FOR IOT	Sub code:				
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study Python Programming fundamental • To study and develop python programming application for IoT. • To study raspberry pi and design IoT applications.
Course Outcome:	• Able to understand various python web scrapping • Implement Various IoT system using Python Programming and raspberry pi.

Content	No. of hours	ESE Marks (%)
Module 1: Python Concepts, Data Structures, Classes	8	20
Interpreter – Program Execution – Statements – Expressions – Flow Controls – Functions - Numeric Types – Sequences - Strings, Tuples, Lists and - Class Definition – Constructors – Inheritance – Overloading – Text & Binary Files - Reading and Writing.		
Module 2: Data Wrangling:	8	20
Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String Manipulation, Regular Expressions.		
Module 3: Data Aggregation, Group Operations, Time series & Web Scrapping :	8	20
GoupBy Mechanics – Data Aggregation – GroupWise Operations and Transformations – Pivot Tables and Cross Tabulations – Date and Time Date Type tools – Time Series Basics – Data Ranges, Frequencies and Shifting. Data Acquisition by Scraping web applications –Submitting a form - Fetching web pages – Downloading web pagesthrough form submission – CSS Selectors.		
Module 4: – Visualization in Python :	8	20
Matplot lib package – Plotting Graphs – Controlling Graph – Adding Text – More Graph Types – Getting and setting values – Patches.		
Module 5: Implementation using Raspberry Pi :	8	20
Working with Raspberry Pi 3 Model - Installing OS and Designing Systems using Raspberry pi - Configuring Raspberry Pi for VNC Connection - Getting introduced to Linux OS Basic Linux commands and uses - Getting Started with Python - Interface sensor and Actuator with Raspberry Pi		

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. Design IoT gateway using Raspberry Pi board and necessary devices. 2. Understand and Implement five basic and advance python program using raspberry pi python IDE 3. Interface RGB LED with raspberry pi using python programming 4. Interface relay board and Implement home automation IoT Programmed using python programming 5. Control DC Motor using raspberry pi and python programming 6. Design web control IoT applications using raspberry pi and python programming 7. Interface DHT 11 with raspberry pi using python programming 8. Implement IoT DHT11 MQTT protocol using Python programming

Course title:	Digital Logic And Circuits	Sub code:	3LP17			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• Understanding the basics of Digital Electronics and different number systems and conversion between them. • Design and construction of the basic and universal logic gates. • Studying the Boolean algebra and simplification of Boolean expression using different methods. • Study and construction of sequential logic circuits, understanding various design of flip flops. • Studying the programmable logic devices, shift registers counters and various memory devices.
Course Outcome:	After studying this course students would have a thorough understanding of the fundamental concepts and techniques used in digital electronics.Gain knowledge between different types of number systems, and their conversions. Design various logic gates and simplify Boolean equations. Design various flip flops, shift registers and determining outputs. Design different types of counters.

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, Hamming code, 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 Logic Families.		
Module 3: Combinational Logic Design	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, The tabulation method, Determination of Prime implicants, Selection of Essential Prime implicants, The cube notation, Sharp operation, Iterative Consensus, Generalized Consensus, Minimization of Multiple output switching functions, Determining Prime implicants using Generalized Consensus, Finding a Minimum cover, Breaking cyclic and similar structures, Standard IC's and their applications.		
Module 4: MSI and PLD Components	8	20
Binary adder and sub tractor, Multiplexers, Decoders/De-multiplexers, Read Only Memory, Programmable Logic Arrays, Programmable Array Logic, Implementation of Combinatorial Logic using these devices.		
Module 5: Sequential Logic Design	8	20
Introduction, S-R Flip-flops, JK flip-flop, D flip-flop, T flip-flop, master slave flip-flop. Flip-flop excitation table, Interconversion of flip-flop, Classification of sequential circuits, Register and Counter circuits. A to D and D to A converter circuits.		

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 using logic gates.
	7	Implementation of 1:4 de-multiplexer using logic gates.
	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:	3LP18			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study the basics of circuit analysis. • To solve D.C. circuits by using KVL and KCL. • To solve A.C. circuits by using KVL and KCL. • To apply theorems for finding the solutions of network problems. • Analyse the frequency response of circuits and to obtain the correlation between time domain and frequency domain response specifications. • Design low pass, high pass, band pass and band elimination filter networks.
Course Outcome:	Understand basics electrical circuits with nodal and mesh analysis. Appreciate electrical network theorems. Apply Laplace transform for steady state and transient analysis. Determine different network functions. Appreciate the frequency domain techniques. Analyse RLC circuits. Determine the stability of an electrical circuit. Design network filters.

Content	No. of hours	ESE Marks(%)
Module 1: Introduction&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.		
Module 3: Network Analysis	8	20
State variable method, Analytic and numerical solutions, 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 4: Network Synthesis	8	20
Network reliability, Hurwitz Polynomials, Positive real functions, Properties of RC, RL & LC networks, Foster and Causer forms of realization, Transmission zeroes, Synthesis of transfer functions.		
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.
list of Experiments		
	1	Verification of Kirchhoff's laws.
	2	Verification of Superposition theorem.
	3	Verification of Thevenin's Theorem and Maximum power transfer theorem.
	4	Verification of Tallegen's theorem.
	5	Measurement of power and power factor in a single phase AC series inductive circuit and study improvement of power factor using capacitor.
	6	Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
	7	Determination of parameters of AC single phase series RLC circuit.
	8	To find poles and zeros of admittance function.
	9	Design and find cut-off frequency of low pass and high pass filters.
	10	Design and find the pass band frequencies of band pass filters.
	11	Design and find the stop band frequencies of band reject filters.

Course title:	Power Electronics	Sub code:	4LP19			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study the characteristics and operation of the various semiconductor devices. • To analysis different power electronic converters. • To learn the practical application of the different type of converters • To learn the practical application of the different type of converters
Course Outcome:	The student will be able to understand the principle of operation of commonly employed power electronic converters, capable of analyzing non -linear circuits with several power electronic switches.

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, Thyristor chopper 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 induction motor 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.
list of Experiments		
	1	Thyristor V/I characteristics & Measurement of holding current of SCR.
	2	Firing circuit of SCR.
	3	Commutation of SCR.
	4	TRIAC and DIAC characteristics.
	5	Single phase/Three phase , Thyristor –Bridge converter with R/RL load
	6	Series inverter
	7	Parallel inverter
	8	SCR application (Any one) .
	9	DC chopper
	10	AC/DC drives

Course title:	Electromagnetics and Field Theory	Sub code:	4L20			
		Structure:	L	T	P	C
			3	2	0	5

Course Objective:	• To provide basic skill required to understand and develop applications related to 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:	To understand the concept of electromagnetic waves , details of static and dynamic electromagnetic waves, concept of simple dipole antennas and to build a strong concept waveguide, transmission lines and smith chart

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. Faraday's Law and Transformer e.m.f, 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 of transmission 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-wave dipole, Loop antenna, Yagi-Uda array, Array Antennas.

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. Van Duzer, 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, 7^{th} Edition-W.H.Hayt& J. A. Buck, Tata-McGraw-Hill

Course title:	Microprocessor and Microcontroller	Sub code:	4LP21			
		Structure:	L	T	P	C
			3	0	2	5

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:	The student will be able to apply a basic concept of digital fundamentals to Microprocessor based personal computer system, identify a detailed s/w & h/w structure of the Microprocessor, distinguish and analyze the properties of Microprocessors & Microcontrollers and analyze the data transfer information through serial & parallel ports.

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 scalar architecture, 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 3rd Indian 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,sevensegment,LCDModule,Matrix keyboard etc.

Course title:	Analog Communication	Sub code:	4LP22			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study the fundamental concept of the Analog communication systems. • To analyse various Analog modulation and demodulation techniques. • To know the working of various transmitters and receivers. • To understand the influence of noise on the performance of Analog communication systems • To acquire the knowledge about information and capacity.
Course Outcome:	Acquire knowledge on the basic concepts of Analog Communication Systems. Analyse the Analog modulated and demodulated systems. Verify the effect of noise on the performance of communication systems. Know the fundamental concepts of information and capacity.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Introduction	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, 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, Illustrative Problems.		
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 Problems. Radio Receiver measurements: Sensitivity, Selectivity, and fidelity		
Module 5: Information & Channel Capacity	8	20
Introduction, Information content of message, Entropy, Entropy of symbols in long independent and		

dependent sequences, Entropy and information rate of Mark off sources, Shannon's encoding algorithm, Discrete communication channels, Rate of information over a discrete channel, Capacity of discrete memory less channels, Discrete channels with memory, Shannon – Hartley theorem and its implications, 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 to Signals & 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 System Design	Sub code:	4LP23			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• Design of OPAMPS, Classification of OPAMPs. • To study and design various linear applications of OPAMPs. • To study and design various nonlinear applications of OPAMPs
Course Outcome:	Understand the basic building blocks of linear integrated circuits and its characteristics. Analyze the linear, non-linear and specialized applications of operational amplifiers. Understand the theory of ADC and DAC. Realize the importance of Operational Amplifier.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Op-Amp Fundamentals and Applications	8	20
Basic building blocks of op-amp, DC level shifter, Output stage. An overview of different types of op-amp, their peculiarities and application areas. 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, Comparator IC such as LM339, Bandwidth and slew rate limitations, Precision rectifiers, Peak detector.		
Module 2: OP-Amp signal generators and Active Filter Design	8	20
Sine wave generators, Multi vibrators, Triangular wave generators, Saw tooth generators, V to F and F to V converters, function generator IC 8038.All types of filter responses, First order active filters LP and HP, BPF, band reject and bi quad filters, sensitivity analysis.		
Module 3: Non-linear Applications and Phase Locked Loops	8	20
Introduction to Log/Antilog amplifiers and Analog multipliers, Block diagram of PLL Phase Detector, LPF, VCO Block diagram of PLL IC 565 free running frequency, lock range, capture range, Transfer characteristics of PLL, Applications of PLL - Frequency synthesizer, FM demodulator, AM demodulator, FSK demodulator.		
Module 4: Design of Analog Systems	8	20
Review of selection parameters of Analog passive and active components; Design of Power Supplies: Regulated and Switched mode. Design of Preamplifier circuits using IC, Design of transistorized class A/B/C power amplifier and IC based P.A., Design of Tone Control Circuits: Active tone control, GraphicEqualizers, Design of AM/FM detectors.		
Module 5: Design and Synthesis of Digital Systems	8	20
Introduction to Finite State Machines, State diagrams; Design of Mealy FSM; Design of Moore FSM, Design of IC based counter circuits using 7490.7492,74192,74190 etc, Multiplexers, De- multiplexer trees. Selection criteria of transducers, display devices; Design of Data Acquisition System for parameters like: Temperature, Pressure, Humidity, and Light.		

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	Inverting amplifier and Non-inverting amplifier
	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	PLL 565
	9	Analog to Digital converter
	10	Digital to Analog converter

Course title:	Signals and Systems	Sub code:	4L24			
		Structure:	L	T	P	C
			3	2	0	5

Course Objective:	• To study about signals and systems. • To do analysis of signals & systems (continuous and discrete) using time domain & frequency domain methods. • To understand the stability of systems through the concept of ROC. • To know various transform techniques in the analysis of signals and systems.
Course Outcome:	• For integral-differential equations, the students will have the knowledge to make use of Laplace transforms. • For continuous time signals the students will make use of Fourier transform and Fourier series. • For discrete time signals the students will make use of Z transforms. • The concept of convolution is useful for analysis in the areas of linear systems and communication theory.

Content	No. of hours	ESE Marks(%)
Module 1: Signals and systems	8	20
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	20
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	20
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	8	20
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):	8	20
SAMPLING: Sampling theorem, Impulse sampling, sampling with zero order Hold, Reconstruction of signal from 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	8	20

Z-transform, Region of convergence and its properties, Inverse Z transform, properties of ZT, Analysis and characterization 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 Prentice Hall 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, John Wiley, 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
			3	0	2	5

Course Objective:	• To understand the key modules of digital communication systems with emphasis on digital modulation techniques.. • The design of the systems which involves randomness using mathematical analysis and computer simulations. • Learn about theoretical bounds on the rates of digital communication system and represent a digital signal using several modulation methods • Draw signal space diagrams compute spectra of modulated signals and apply redundancy for reliable communication.
Course Outcome:	• To formulate basic statistics involved in communication theory. • To demonstrate the concepts involved in digital communication. • To explain the concepts of digital modulation schemes. • To analyze the performance of digital communication systems.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Random Variables and Random Process	12	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 Coding schemes, Pulse shaping, Scrambling, Eye diagram, Gram-Schmidt orthogonalization scheme.		
Module 3: Digital Modulation	8	20
Modulation and Demodulation of Digital modulation schemes-ASK, FSK, PSK, DPSK, QPSK and Constellation diagram. Introduction to M-ary communication.		
Module 4: Digital Communication Through Band Limited Channels	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.		
Module 5: Digital Receiver and Spread spectrum Signal for Digital Communication	8	20
Optimum threshold detection, Concept of Matched Filters, BER analysis of BASK, BFSK, BPSK, Model of Spread Spectrum Digital Communication. Direct Sequence Spread Spectrum Signal (DS-SS), Frequency Hopped Spread Spectrum Signal (FH-SS).		

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:	Control System Engineering	Sub code:	5L26			
		Structure:	L	T	P	C
			3	2	0	5

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 to ascertain 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:	• Develop the mathematical model of mechanical and electrical systems. • Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method. • Determine the time domain specifications for first and second order systems. • Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique. • Determine the stability of a system in the frequency domain using Nyquist and bode plots. • Develop a control system model in continuous and discrete time using state variable techniques.

Content	No. of hours	ESE Marks(%)
Module 1: Introduction to Control Systems	7	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	9	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, Diaganolisation.		

Reference Books

	1	Automatic Control Systems (With Matlab Programs), HASAN SAEED, S. K. Kataria& Sons
	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:	Digital Signal Processing	Sub code:	5LP27			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study about discrete time systems and to learn about FFT algorithms. • To study the design techniques for FIR and IIR digital filters. • To study about Realization of Digital systems.
Course Outcome:	• Able to do analysis and characterization of the discrete time systems. • Use Fourier analysis concept for frequency domain representation and analysis. • Realize the implementation of discrete time systems. • Design the different aspects of IIR and FIR filters. • Calculate the spectral density parameters for measuring the performance.

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 in digital filters.		
Module 5 Spectral Estimation methods	8	20
Spectral estimation, Energy Density Spectrum, Estimation of autocorrelation and power spectrum, DFT in spectral 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 John and Manolakis.
	3	Digital Signal Processing- A computer based approach, Sanjit K. Mitra, McGraw Hill Education.

List of Experiments		
	1	Compute linear convolution, circular convolution and cross correlation of two sequences.
	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 FIR filters.
	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 correlation matrix of stochastic systems.
	7	Implementation of basic digital signal processes algorithms for different applications 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 processors like TMS DSP kits.

Course Title:	Embedded system and IOT	Sub code:	5LP28			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• Students will understand the discipline of Embedded system and IoT and its application to the development of real time embedded system • Students will learn basic Embedded Microcontroller & practices and their appropriate applications. • Students will understand the principles of analysis and design for IoT development. • Students will think about IoT applications to construct embedded system of high quality which is reliable and easy to understand, modify and maintain.
Course Outcome:	• Define basic concepts of embedded system • Describe ARM cortex-m microcontroller. • Illustrate the design of M2M IoT application. • Test developed IoT protocols for requirements validation. • Test embedded application using Linux Operating system

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 : Robotics Design and Application	8	20
Robotics – Designing robotics applications using ARM cortex-M in MSP 432 Robotics kit GPU Processing.		
Module 3: Machine To Machine Communication	8	20
M2M to IoT – A Market Perspective – Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT. M2M to IoT- An Architectural Overview – Building architecture, Main design principles and needed. An IoT architecture outline, standards considerations. Review of internet protocols –Processing platforms for IoT-sensors – actuators-Cloud computing models.		
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: Linux OS	8	20
Linux and linux device drivers –Linux Internals-Project work on porting a real time OS onto an embedded board.		

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 for		
	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:	Printed Circuit Board Technology-1	Sub code:	5LP29			
		Structure:	L	T	P	C
			3	1	2	6

Course Objective:	• To study about PCB Fundamentals, types and its classifications. • To study the design rules for Analog, digital and mixed signal electronic circuits. • To study about Transient, AC Sweep, DC Sweep and operation point simulation for various electronic circuits. • To study 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 PCB fabrication.

Content	No. of hours	ESE Marks(%)
Module 1: Introduction and overview of printed circuit board design	6	15
History & Definition of printed circuit board design, Classification of PCBS- SSB, DSB (PTH & Non PTH), Multilayer PCB, Application of various PCBs, Introduction to Semiconductor Packing Technology, Role of scale & Grid in PCB design, PCB mounting methods and PCB standards, Layout Considerations-Land Requirement, Layout Methodology, Design Elements & Performance Parameters, Manufacturing Documentation like role of Block Diagram, Schematic drawing, Net-list generation Assembly Drawing, Mechanical Drawing.		
Module 2: Layout Planning, Artwork generation using Film master	12	30
Electrical Design Considerations-Resistance in general, Capacitance in general, Inductance of Conductor and Conductor Pattern, Component placement approach with respect to conductor width, conductor shapes, Thermal Consideration, Mounting consideration, requirement of heat sink, Layout check with respect to mechanical and electrical consideration, Layout Methodology, Layout Design Checklist and inspection, Useful standards, Artwork approach and design guidelines for SSB & DSB design, Artwork Preparation Methods-Taping UP: Laying down the tapes and drafting material using appropriate methods, Design Guidelines for Artwork Preparation - Conductor Orientation, Conductor, Routing, Spacing, Importance of hole diameter and solder Pad diameter, Advance methods of Artwork generation, Artwork Inspection and checks, Introduction parameters of Photographic film like film emulsions, dimensional stability of film master, types of films, Types of Reprographic Cameras, Dark Room setup and procedure of film processing, Film Registration, Faults related to film processing and remedies.		
Module 3: Design rules For PCBs & Automation in PCB Design	12	30
Design rule for High frequency amplifiers & oscillators, Design rule for Multistage amplifiers with high power o/p stage, Design rule for feed-back amplifier, Design rule for differential amplifier, Supply and ground line conductors' considerations, Design rules for TTL,CMOS & ECL circuits, Reflection and Crosstalk, Ground to supply noise, E.M. Interference, Problems in design & recommendations, Dividing		

Circuit into High and Low Power Parts, Copper Clad Laminates, PCB Terminal Connections & their Assembly, Conductor Width & Thermal Consideration, Limitation of Manual Designing, Introduction to various EDA tools, CAD operation, Schematic Capture & Layout, Automation in component Placements, Routing Assignments and routing Procedures, Post process and Gerber data generation, Design rules check, Generation of film master using photoplotter, data transfer mechanisms.

Module 4: Design with Multi- layer Boards and Flexible PCBs.	6	15

Techniques - **PTH,** Buried and **blind** via, Materials **for Multi** - Layer boards, Mechanical & Electrical Design consideration for **Multi**-Layer Boards, Fabrication Process for Multi-Layer Boards, Useful Standards for Multi-layer PCBs, Construction of Flexible PCBs - Types of films, Foils & Adhesives, Design considerations for Flexible Circuits, Manufacturing of Flexible Circuits, Rigid Flex Printed Circuits Boards, Advantages of Flexible Circuits, Special Applications of Flexible Circuits, Stencil Printing of SMD, Industrial SMT Assembly Process, SMD Soldering - Manual and Reflow Soldering Techniques, Repair and Rework of SMDs, Advantages and Limitations **of** SMT.

Module 5: PCB Technology Trends, Quality, Environmental Concerns in PCB Industry	4	10

Fine Line Conductor with Ultra - Thin Copper Foil, Multi Wire Board, Metal Core PCBs, Additive and Semi additive Process, Mechanical Milling of PCBs, Quality Assurance in PCB, Testing for Quality Control Methods, Testing for Printed Circuits Boards, Reliability Testing, Acceptability of PCBs, Pollution Control in PCB Industry, Polluting Agents, Recycling of water, Recovery Techniques, Air pollution, Recycling of Printed Circuit Board, Environmental Standards: Safety Precaution for the Personnel, Toxic Chemicals in PCB Fabrication, Lead - free Soldering.

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, Bishop Graphics 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 software and Run the operating point analysis simulation.
	2	Design the basic diode circuit in schematic editor using Autodesk Eagle software and Run 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:	Information Theory and Coding	Sub code:	5L30			
		Structure:	L	T	P	C
			3	1	0	4

Course Objective:	• To familiarize the students with the Information Theory. • To study and understanding of the concept of coding technique and its applications. • To understand the aspects of channel capacity. • To study the various techniques of coding and decoding in information theory. • To understand the various multiple access techniques.
Course Outcome:	• Learn the concept of information and entropy • Describe the Shannon's theorem for coding • Describe the channel capacity • Apply various kinds of coding methodology. • Describe the real time application of coding techniques.

Content	**No. of hours**	**ESE Marks(%)**
Module 1: Introduction to Information Theory	8	20
Entropy, discrete memory less source, Shanon's noiseless coding theorem, shenon's fano code, run length encoding, ARQ system		
Module 2: Noisy Coding System	8	20
Encoding of discrete sources. Markov sources, Shannon's noisy coding theorem and converse for discrete channels.		
Module 3: Channel Capacity	8	20
Channel model, channel coding theorem, information capacity theorem &its implication Calculation of channel capacity and bounds for discrete channels, Techniques of coding & decoding, random selection code, channel capacity for MIMO system.		
Module 4: Cyclic codes & Information Theory Application	8	20
Cyclic codes, data compression, cryptography, overview of encryption technique. Application of information theory.		
Module 5: Convolutional codes & Communication link	8	20
Convolutional arithmetic codes. Introduction to multiuser communication, Multiple access technique. Introduction to satellite communication system. Binary signalling , TDMA & CDMA wireless communication system.		

Text/Reference Books :

1	R.B. Ash, Information Theory, Prentice Hall, 1970.
2	Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
3	Ranjan Bose - Information Theory Coding and Cryptography, TMH
4	N. Abramson, Information and Coding, McGraw Hill, 1963
5	M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
6	Taub and Schilling - Principle of Communication Systems, (TMH) 2nd edition

Course title:	Antennas And Wave Propagation	Sub code:	6L31			
		Structure:	L	T	P	C
			3	0	0	3

Course Objective:	• To understand the basic terminology and concepts of Antennas. • To attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that. • Analyse the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis. • To have knowledge on antenna operation and types as well their usage in real time field. • Aware of the wave spectrum and respective band-based antenna usage and also to know the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.
Course Outcome:	•Analyse radiation patterns of antennas • Evaluate antennas for given specifications • Illustrate techniques for antenna parameter measurements • Design antennas for specific applications

Content	No. of hours	ESE Marks (%)
Module1: Antenna Basics And thin linear wireantenna	10	20
Introduction, Basic Antenna Parameters - Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height, Related Problems.Radiation from Small Electric Dipole, Quarter wave Monopole and Halfwave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beamwidths, Directivity, Effective Area and Effective Height. Natural current distributions, fields and patterns of Thin Linear Centre-fed Antennas of Different Lengths, Illustrative Problems. Loop Antennas - Introduction, Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small and Large Loops (Qualitative Treatment).		
Module 2: VHF, UHF AND Microwave Antennas – I:	8	20
Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded Dipoles & their characteristics, Helical Antennas - Helical geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes. Horn Antennas - Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.		
Module 3: VHF, UHF AND Microwave Antennas – II:	8	20
Microstrip Antennas - Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas - Geometry and Parameters, Characteristics of Microstrip Antennas. Impact of Different Parameters on Characteristics, Reflector Antennas - Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors - Geometry, Pattern Characteristics, Feed Methods, Reflector Types - Related Features, Illustrative Problems.		
Module 4: Antenna Arrays and Antenna Measurements:	10	20
Point Sources - Definition, Pattern, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays - Broadside Arrays, End fire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non- UNIT form Amplitude Distributions - General Considerations and Binomial Arrays, Illustrative Problems.Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods).		
Module 5: Wave Propagation:	10	20

Introduction, Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts, Ground Wave Propagation (Quantitative Treatment) - Introduction, Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections, Space Wave Propagation - Introduction, Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super retraction, M-Curves and Duct Propagation, Scattering Phenomena, Tropospheric Propagation

Sky Wave Propagation - Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and skip Distance, Multi-hop Propagation

Text/Reference Books:

1. Antennas for All Applications – John D. Kraus and R. J. Marhefka, and Ahmad S. Khan TMH, New Delhi, 4th ed., (Special Indian Edition) 2010.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed 2000
3. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd ed., 2005
4. Antennas and Wave Propagation – K.D. Prasad, SatyaPrakashan, Tech India Publications, New Delhi, 2001.
5. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi.

Antennas – John D. Kraus, McGraw-Hill (International Edition), 2nd Ed.

List of Experiments:

1. To study various antennas, its application and tentative radiation pattern. (study experiment)
2. To study and observe the radiation patter of strait dipole antenna.
3. To study and compare the radiation patter of folded dipole with straight dipole antenna and comment on the radiation resistance and it's matching with free space.
4. To study and compare the radiation pattern of 3-element and 5-element Yagi and give your comment on effect of addition of parasitic elements to the given antenna.
5. To study the variation of radiated field with distance from transmitting antenna
6. To study and plot the radiation pattern of the Log-Periodic antenna and observe its frequency independency
7. To study and observe the radiation pattern of the horn antenna
8. Introduction to HFSS (High Frequency Simulation Software)
9. Micro Strip antenna design and simulation using HFSS.
10. Study of Antenna Measurement setup in Anechoic chamber.

Course Title:	Printed Circuit Board Technology-2	Sub code:	6LP32			
		Structure:	L	T	P	C
			3	1	2	6

Course Objective:	• To study about PCB materials, copper clads and other fundamentals of PCB manufacturing process. • To study the PCB fabrication process flow for SSB (Single sided boards) &DSB (Double sided boards). • To study about through hole and SMT PCB soldering and de-soldering process.
Course Outcome:	• Able to do fabrication for SSB & DSB plated through hole PCBs. • Perform CNC Drilling and Milling operation along with UV exposure, Developing, Etching and Stripping operation for SSBs & DSBs. • Perform Through hole plating operation of PCBs for DSBs. • Perform PCB assembly process for Through hole and SMT PCBs.

Content	No. of hours	ESE Marks (%)
Module 1: Properties of Copper Clad Laminates and Surface Preparation:	8	20
Properties of Copper Clad Laminates: Anatomy of Laminates, Types of Laminates with application, Manufacturing Process of copper Clad, Physical and Electrical properties of Laminates, Evaluation of Laminates and test methods like peel strength, flexural strength, Surface Preparation: Need ofSurface Preparation, Manual Cleaning Process, Mechanical Cleaning Process, Trends in cleaning processes.		
Module 2: Mechanical Operation:	8	20
Need for Mechanical Operations, Cutting Methods - Shearing, Sawing, Blanking, Milling & Routing, Hole Punching, Drilling - Classification of drill bits, Drill details. Drilling machines, Drilling problems, Micro vias, Use of UV laser for Drilling PCB, Hybrid Laser drilling Process, Useful Standards.		
Module 3: Plating and Etching Process:	8	20
Need for Plating, Types of plating. Platting Techniques-Immersion plating for Tin and Gold, Electroless Copper plating & Electroplating in detail, Special Platting Techniques, Alternative Finishes, Plating Defects & Plating Quality Control, Consideration for shop floor, Useful standards, Etching Solution and Chemistry, Equipment for etching, Facilities for Etching Area, Problems in Etching, Electrochemical Etching, Mechanical Etching.		
Module 4: Screen Printing and Photo printing in PCB Fabrication:	8	20
Introduction, Material required for screen printing -screen Frames, Screen fabrics Squeegees, Printing Inks and curing methods, Direct and Indirect Methods of Pattern transfer, Manual Screen printing, Automatic Screen-Printing process, Photo resist in general, Characteristic of photo resist, Types of Photoresist and coating/lamination methods, Manufacturing process of SSB and DSB using wet film process, Dry film Resist - Features & categories. Processing of Dry - Film Resist, Trouble shooting.		
Module 5: Component Assembly and Soldering Techniques:	8	20
Classification of component assembly Techniques, Formation and mounting Techniques, PCB Repair and rework, Introduction & Theory of Soldering, Types of solder alloys and fluxes, Solder Paste for SMDS, Tools. Soldering Techniques - Manual soldering, Mass soldering, Role of solder mask, Solder mask application methods, Quality Control of solder Joints, Solder Joint Defect & cause.		

Text/Reference Books:

1. Printed Circuit Boards: Design and Technology, Walter C Boss hart, 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, Bishop Graphics Inc.
5. Printed Circuit Boards: Design Techniques for EMC Compliance, Montrose Mark I, IEEE Press series of Electronics Technology.

List of Experiments:

1. Draw the basic electronic component footprints on given Grid sheet in 2x dimensions and study the datasheets for all given components.
2. Study the datasheets of Through hole Resistor and LED. Draw the Basic LED circuit on the Given Grid sheet along with component footprints and route manually.
3. Study the datasheet of LM317M Voltage regulator IC. Draw 5V Voltage regulator circuit on the given grid sheet along with component footprints and route manually.
4. Study the datasheet of 555 TIMER IC. Draw the AstableMultivibrator circuit using 555 Timer IC on the given grid sheet along with component footprints and route Manually.
5. Learn about PCB cleaning Process, study the operation and working of PCB brushing machine and perform brushing operation on FR-4 copper clad.
6. Learn about CNC milling and drilling process, study the operation and working of CNC milling and drilling and perform drilling operation on FR-4 copper clad for SSB and DSB.
7. To learn the process of galvanic plated through hole machine, and study the operation and working of through hole plating machine and perform operations on double sided PCBs.
8. To develop the artwork on photo films using photo plotter machine, installation of films on machine and developing of the photo films using developer bath and fixer bath.
9. To learn about PCB lamination Process, study the operation and working of PCB laminator machine, laminate Single sided board using PCB laminator machine on FR-4 copper clad.
10. To laminate Double Sided Board (DSB) using PCB laminator machine on FR-4 copper clad.
11. Learn about PCB Ultraviolet exposing process, study the operation and working of Ultraviolet exposing machine and perform Artwork film Exposure operation on FR-4 Single Sided Board.
12. To learn Artwork film exposure on Double Sided Board (DSB) using PCB UV exposing machine.
13. To learn about PCB developing Process, study the operation and working of PCB developing machine, develop the UV exposed artwork on Single sided board.
14. To learn about developing UV exposed artwork on Double Sided Board (DSB) using PCB developing machine.
15. To learn about PCB etching process, study the operation and working of PCB etching machine for SSB and DSB.
16. To learn about PCB stripping process, study the operation and working of PCB stripping machine for SSB and DSB.
17. To learn about PCB soldering techniques and perform soldering and de-soldering process for through hole PCBs.
18. To learn about PCB soldering techniques and perform soldering and de-soldering

Course Title:	Computer Architecture And Organization	Sub code:		6L33		
		Structure:	L	T	P	C
			3	1	0	4

Course Objective:	• To understand the basic hardware and software issues of computer organization. • To provide an overview on the design principles of digital computingsystems. • To understand the representation of data at machine level. • To understand how computations are performed at machine level
Course Outcome:	• Ability to analyse the abstraction of various components of a computer. • Ability to analyse the hardware and software issues and the interfacing. • Ability to work out the trade-offs involved in designing a moderncomputer system.

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, Pearson Education, 2010

Course Title:	SENSORS AND TRANSDUCERS	Sub code:	6LP34			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study about operation and principle of working for sensors and transducers. • To study about thermocouples operation, principle of working and its application. • To study about displacement position and proximity sensors operation, principle of working and its application.
Course Outcome:	• Concept behind working of measurement systems and different types of sensors and transducers. • Sensor to measure various physical parameters used in Industry and normal measurement applications. • Working principle of resistive, inductive and capacitive transducers and their applications. • Understanding of thermocouples, piezoelectric and pyro-electric transducers and their applications. • Understanding of acoustic, optical sensors and other sensors and their applications.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction to Sensor and Transducer based Measurement system:	8	20
Introduction, General concepts and terminology of measurement systems, General input-output configuration, static and dynamic characteristics of a measurement system, statistical analysis of measurement data, standards and calibration, transducers and sensors, classification, emerging fields of sensor technologies.		
Module 2: Resistive, Reactancevariation &Electromagnetic Sensors:	8	20
Potentiometers, Strain Gauges, Resistive Temperature Detectors (RTDs), Thermistors, Magneto resistors, Light-Dependent Resistors (LDRs), Resistive Hygrometers, Resistive Gas Sensors, Liquid Conductivity Sensors, Signal Conditioning for Resistive Sensors: Resistance Measurement, Voltage Dividers, Dynamic Measurements, Capacitive Sensors, Inductive Sensors, Electromagnetic Sensors.		
Module 3: Flow, Pressure & Level Transducers:	8	20
Flow Transducers Like Differential Pressure, Variable Area, Positive Displacement, Electromagnetic, Anemometer, Ultrasonic Flow meter, Turbine Flow meter, Vortex Flow meter, Electromagnetic Flow meter, Coriolis Effect Flow meter, Pressure Transducers Like Mercury Pressure Sensor, Bellows, Membranes And Thin Plates, Piezoresistive Sensors, Capacitive Sensors, VRP Sensors, Optoelectronic Sensors, Vacuum Sensors, Level Transducers Like Displacer, Float, Pressure Gages, Balance Method, Time-Of-Flight Measurements, Level Measurements By Detecting Physical Properties.		
Module 4: Thermocouples & Temperature Sensors:	8	20
Thermoelectric Sensors: Thermocouples, Piezoelectric Sensors, Pyroelectric Sensors, Electrochemical		

Sensors, Acoustic Temperature Sensors, Nuclear Thermometer, Magnetic Thermometer, Semiconductor Types, Thermal Radiation, Quartz Crystal, NQR, Spectroscopic Noise Thermometry, Heat Flux Sensors.

Module 5: Digital & Semiconductor Sensors & Sensors for Robotics:	8	20

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 For Proximity Sensing, Electro-Optical Sensors, Capacitive Sensors, Magnetic Sensors.

Text/Reference Books :

1. Patranabis D., "Sensors And Transducers", Prentice-Hall India.
2. Ramon Pallas & John G. Webster, "Sensors and Signal Conditioning", John Wiley & Sons
3. Webster John G., "Instrumentation and Sensors Handbook", CRC Press
4. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs and Applications", Springer
5. Shawhney A. K., "Electrical And Electronics Measurements And Instrumentation", DhanpatRai& Sons

List of Experiments:

1. To study the strain gauge characteristics.
2. To study the characteristics and weight measurement by load cell.
3. To study the construction of LVDT and its use in displacement and thickness measurement.
4. To study the flow measurement by differential pressure type transducer.
5. To study the characteristics of LDR, thermostat and thermocouples.
6. To study the testing and calibration of T, J, K, R and S thermocouples.
7. To study the voltage – intensity characteristics of a phototransistor.
8. To study the ramp response characteristics of filled in system thermometer.
9. To study step response of RTD and thermocouple.
10. To study Hall Effect Transducer.
11. To study the characteristics of piezoelectric sensors.
12. Measurement of temperature, depth etc by optical fibre sensor.
13. To study the characteristics of Charge-Coupled and CMOS Image Sensors.

Course Title:	ADVANCE IOT	Sub code:				
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study IoT architecture • To study Network Layer Protocols • To study IoT Services and security protocol.
Course Outcome:	• Able to understand IoT communication model. • Able to understand IoT Security Protocols. • Able to understand IoT Services layer protocol

Content	No. of hours	ESE Marks (%)
Module 1: INTRODUCTION	8	20
IoT architecture outline, standards - IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics		
Module 2: IOT REFERENCE ARCHITECTURE	8	20
Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints		
Module 3: IoT DATA LINK LAYER & NETWORK LAYER PROTOCOLS	8	20
PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4,IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP		
Module 4: - IoT TRANSPORT & SESSION LAYER PROTOCOLS	8	20
Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT		
Module 5: IoT SERVICE LAYER PROTOCOLS & SECURITY PROTOCOLS	8	20
Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC802.15.4 , 6LoWPAN, RPL, Application Layer		

Text/Reference Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The EvolvingWorld of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications ,2016
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand,StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet ofThings: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2015
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things",ISBN 978-3-642- 19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016
4. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

List of Experiments:	
	1. Scanning the available SSID's in the range of Wi-Fi. 2. Demonstration of a peer-to-peer network topology. 3. Check the connectivity to any device in the same network. 4. Send hello world to TCP server existing in the same network 5. Reading Temperature and Relative Humidity value from the sensor 6. Reading sensor data from sensorand sending into UART. 7. Transmitting the measured physical value from the sensor over the air. 8. BLE beacon: Experiment involves initializing BLE stack, advertising packet/beacon (Eddystone frame format may be used) and starting the advertisement. 9. Experiment is to understand BLE GATT protocol and develop profiles based on GATT services. 10. Point to point communication of two C-Motes over the radiofrequency. 11. Reading Temperature,Relative Humidity, Light intensity value from light sensor, Proximity detection with IR LEDvalue from the sensor. 12. Demonstrate CoAP Protocol using Terminal 13. Demonstrate MQTT protocol using Terminal 14. Demonstrate DHT11 Sensor using free cloud services.

Course title:	OPTICAL COMMUNICATION	Sub code:	6LP36			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study about the various optical fiber modes, configuration and transmission characteristics • To learn about the various optical sources, detectors and transmission techniques • To explore various idea about optical fiber measurements and various coupling techniques • To enrich the knowledge about optical communication systems and networks
Course Outcome:	• Demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber. • estimate the losses and analyse the propagation characteristics of an optical signal in different types of fibers • Describe the principles of optical sources and power launching-coupling methods • Compare the characteristics of fiber optic receivers

Content	No. of hours	ESE Marks (%)
Module 1: Introduction to Optical Fibers	8	20
Introduction-general optical fibre communication system- basic optical laws and definitionsoptical modes and configurations -mode analysis for optical propagation through fibersmodes in planar wave guide-modes in cylindrical optical fibre-transverse electric and transverse magnetic modes- fiber materials-fiber fabrication techniques-fiber optic cablesclassification of optical fiber-single mode fiber-graded index fiber.		
Module 2: Transmission Characteristic of Optical Fiber	8	20
Attenuation-absorption –scattering losses-bending losses-core and cladding losses-signal dispersion –inter symbol interference and bandwidth-intra model dispersion-material dispersion- waveguide dispersion-polarization mode dispersion-intermodal dispersion optimization of single mode fiber-characteristics of single mode fiber-R-I Profilecut-off wave length-dispersion calculation-mode field diameter.		
Module 3: Optical Sources and Detectors	8	20
Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structuressurface emitting LED-Edge emitting LED-quantum efficiency and LED power-light source materials-modulation of LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation-temperature effort.Detectors: PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effectscomparisons of photo detectors.		
Module 4: Optical Receiver, Measurements and Coupling	8	20
Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front end amplifiers-digital receiver performance-probability of error-receiver sensitivity-quantum limit.Optical power measurement-attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wave length Measurements- Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fiber-Fiber Splicing,Optical Fiber connectors.		
Module 5: Optical Communication Systems and Networks	8	20

System design consideration Point – to –Point link design –Link power budget –rise time budget, WDM – Passive DWDM Components-Elements of optical networks-SONET/SDHOptical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-Optical ETHERNET-Soliton.

Reference Books:

1. "Fibre Optics: Communication and Application" by Henry Zanger and Cynthia Zanger
2. "Fibre Optic Communications" by Harold B Killen
3. "Fiber Optics" by Robert J Hoss
4. "Fibre Optic Communication" by Agarwal D C
5. "Integrated Optics" by T Tamir

list of Experiments:

1. Demonstration and study of different types of Optical Fibers.
2. To Establishanalog link using optical fiber cable.
3. To Establish Digital link using optical fiber cable.
4. To measure propagation or attenuation loss in optical fibre.
5. To Study Bending Loss in fiber optic communication.
6. To Measure the Numerical Aperture (N.A.) of the Fiber Optic Cable.
7. Demonstration and study of different types of Optical fiber connectors.
8. To implement Frequency Modulation technique with fiber optic.
9. To implement Pulse Width Modulation technique with fiber optic.
10. Setting up of Fiber Optics voice link using Intensity Modulation.
11. To Study the Fiber Optic Splicing and Joining.

Course title:	Digital System Design using Verilog	Sub code:	7LP36			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study and design digital circuits using Verilog HDL. • To learn the design of VLSI circuits using SPICE. • To perform schematic, layout, DRC and LVS of the mentioned circuits.
Course Outcome:	• Understand the concepts of Verilog Language. • Design the digital systems as an activity in a larger systems design context. • Study the design and operation of semiconductor memories frequently used in application specific digital system. • Inspect how effectively ICs are embedded in package and assembled in PCBs for different application. • Design and diagnosis of processors and I/O controllers used in embedded systems.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction and Methodology	8	20
Digital Systems and Embedded Systems, Real-World Circuits, Models, Design Methodology. Combinational Basics: Combinational Components and Circuits, Verification of Combinational Circuits. Number Basics: Unsigned integers, Signed Integers, Fixed point Numbers, and Floating-point Numbers. Sequential Basics: Sequential Data paths and Control Clocked Synchronous Timing Methodology.		
Module 2: Introduction to Verilog HDL	8	20
Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module, Simulation and Synthesis Tools. Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.		
Module 3: Sequential and Combinational Circuit Design	8	20
Synchronous and asynchronous FSM design, Basic design steps, State encoding techniques, Analysis of sequential circuits, Algorithmic state machines (ASM) charts. Design with basic logic gates, comparators, data selectors, priority encoders, decoders, full adder, ripple-carry adder, carry-look ahead adder, HDL models.		
Module 4: Programmable Logic Devices	8	20
PAL, PLA, PLD, CPLD, FPGA. Case Studies: Xilinx 9500 CPLD series, SPARTAN FPGA, VIRTEX Series, Review of Multi FPGA boards for real time application development. Case Studies: Design, Simulation, Synthesis and Implementation of Sequential Designs like- ALU design, CPU design: Code converters.		
Module 5: FPGAs	8	20
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. Peter J. Ashen den, ―Digital Design: An Embedded Systems Approach Using VERILOG, Elsevier, 2010. 2. J Bhasker, A Verilog HDL Primer, BS Publication 3. Fundamentals of Logic Design with Verilog Design–Stephen. Brown and Zvonko Vranesic, TMH, 2ndEdition 2010. 4. Advanced Digital Logic Design using Verilog, State Machine & Synthesis for FPGA –Sunggu Lee, Cengage Learning, 2012. 5. Advanced Digital Design with Verilog HDL –Michael D. Ciletti, PHI, 2009.
List of Experiments:	
	1. To write the Verilog code for Basic and universal logic gate. 2. To write the Verilog code for 8:1 Multiplexer. 3. To write the Verilog code for 1:8 De-multiplexers. 4. To write the Verilog code for 3:8 Decoder. 5. To write the Verilog code for Shift Register. 6. To write the Verilog code for Adder. 7. Half Adder b) Full Adder 8. To write the Verilog code for ALU. 9. To write the Verilog code for Comparator Circuits. 10. To write the Verilog code for Flip Flops. 11. D – FF b) JK-FF c) T-FF 12. To write the Verilog code for sequential counter. 13. To write the Verilog code for BCD to 7 Segment Decoder.

Course title:	Data Communication & Computer Network	Sub code:	7LP39			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• A data communication and computer networks has been growing with rapid technological progress. Computer communication through networking becomes essential part of our life. By considering importance of networking in day today lire, it is essential for students to know 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:	The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency: a. Analyze the functioning of data communication and computer network. b. Select relevant transmission media and switching techniques as per need. c. Analyse the transmission errors with respect to IEEE standards. d. Configure various networking devices. e. Configure different TCP/IP services.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction	8	20
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, Digital Transmission, Digital-to-Digital Conversion, Analog-to-Digital Conversion, Analog Transmission, Digital-to-analogue Conversion, Analog-to-analogue Conversion		
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, Using Telephone and Cable Networks for Data Transmission, Telephone Networks, Dial-up Modems, Digital Subscriber Line, Cable TV Networks, Cable TV for Data Transfer Error Detection and Correction, 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, Cellular Telephony, Satellite Networks, Sonet/SDH, Architecture, Sonet Layers, Sonet Frames, STS Multiplexing, Sonet Networks, Virtual Tributaries, Virtual-Circuit Networks: Frame Relay and ATM, Frame Relay, ATM, ATM LANs.		
Module 3: Network 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.		

Module 4: Transport Layer	8	20
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 5: Application Layer	8	20
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.		

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, Pearson education.
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.

List of Experiments:

1. Configure Peer-to-Peer Network with at least three hosts.
2. Create desired standard network cable including cross cable and test by using cable tester.
3. Connect Computers using given topology with wired media.
4. Connect Computers using wireless media.
5. Write a C program for CRC Error Detection.
6. Create a Network Using Bluetooth-(Piconet/Scatternet).
7. Share Printer and Folder in a network and transfer a file from one computer to another.
8. Install operating, system (Windows/Linux-RedHat/Ubuntu).
9. Configure File Server.
10. Configure Client to File Server and use file services.
11. Configure Static and Dynamic IP addresses.
12. Configure DI-TCP server.
13. Run Basic TCP/1P Utilities and Network commands: ipconfig. ping, tracert, netstat, path ping, route.
14. Install Wireshark and configure as packet sniffer.
15. Set access rights and security permissions for user.
16. Create 1PV6 based small computer network using a simulator (preferably open source-based simulator).
17. Setting up a wireless network.

Course title:	Satellite Communication	Sub code:	7LP40.1			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To enable the student to become familiar with satellites and satellite services. • Study of satellite orbits and launching. • Study of earth segment and space segment components. • Study of satellite access by various users.
Course Outcome:	• Understand the orbital and functional principles of satellite communication systems. • Architect, interpret, and select appropriate technologies for implementation of specified satellite communication systems. • Analyse and evaluate a satellite link and suggest enhancements to improve the link performance. • Select an appropriate modulation, multiplexing, coding and multiple access schemes 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: Orbital Mechanics	8	20
Introduction: Overview of Satellite Communications, GEO, MEO and LEO satellite systems, frequency bands. Orbital Mechanics: Orbit Equations, Locating the satellite w. r. t. the earth, Orbital elements, Look Angles, Orbital perturbation, Effects of earth's oblate ness, moon and sun, Satellite eclipse, sun transit outage, Coverage angle, slant range, satellite launching.		
Module 2: Satellite subsystems	8	20
Attitude and Orbit Control System (AOCS), Telemetry, Tracking and Command System (TT&C), Power System, Satellite antennas, Communications subsystem, transponders.		
Module 3: Satellite Link Design	8	20
Basic transmission theory, System noise temperature and G/T ratio, CNR, CIR, ACI, IMI, Down link design, Up link design, System design examples. Modulation and Multiplexing: FM with multiplexed telephone signals, Analog FM SCPC, PSK, QPSK.		
Module 4: Multiple Access Schemes	8	20
FDM/FM/FDMA, TDMA, Frame structure, frame acquisition, synchronization, TDMA in VSAT network, On-board processing, CDMA, Spread spectrum transmission and reception, DS-SS CDMA capacity. Error Control for Digital Satellite Links: Error control coding, Block codes, Convolution codes, Implementation of error detection on satellite links.		
Module 5: VSAT Systems & LEO Satellite systems	8	20
Overview of VSAT systems, Network architectures, Access control, Multiple access selection. Orbits, Coverage and frequency bands, off axis scanning, delay and throughput, NGSO constellation design.		

Reference Books:	
	1. Satellite communication, "Timothy Pratt, Charles Bostian, Jeremy Allnut", John Willey and Sons Inc, 2nd edition. 2. Satellite Communication Systems Engineering, "W. L. Pritchard, H.G. Suyderhoud, R.A. Nelson," Pearson Education, 2nd edition. 3. M. RICHHARAIA, Satellite Communication Systems, BS Publishers, 2nd Edition, 2008. 4. Satellite Communications Systems: systems, techniques and technology, 5th edition, by G. Maral, M. Bousquet, Z. Sun, Publisher: John Willy and sons. 5. Satellite Communication Technology, Dr. K. Miya, 2nd edition. 6. G. D. Gordon and W. L. Morgan, "Communications Satellite Handbook," Wiley India, 2010 7. D. Roddy, "Satellite Communications," 4thEd., Tata McGraw-Hill Education, 2006. 8. TRI.T. HA, Digital Satellite Communications, McGraw-Hill, 2000.
List of Experiments:	
List of Lab Assignments / Experiments OR List of Tools on which the lab assignment should be based (If Any)	

Course title:	Mechatronics	Sub code:	7LP40.2			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To prepare learners to identify, analyse and solve engineering problems related to mechatronics engineering. • To enable the learners in building and programming technology systems such as CNC machines, rapid prototyping systems, industrial robotics etc. through interdisciplinary approach. • To prepare the learners to use modern tools involving different disciplines of engineering in order to simulate and solve real life problems. • To develop the ability of learners to synthesize data and technical concepts for innovative product design and process automation using concurrent design approach.
Course Outcome:	The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency: • Install and maintain the sensors and transducers of mechatronics systems. • Install and Maintain CNC Machine. • Install and Maintain pneumatic components in mechatronic systems. • Install and Maintain hydraulic components in mechatronic systems. • Install and Maintain different components of robotic systems.

Content	No. of hours	ESE Marks (%)
Module 1: Sensors for Mechatronics system	8	20

Mechatronics system architecture: Sensors, signal conditioners, PLC/ Embedded controllers, pneumatic, hydraulic and electrical actuators.

Introduction to Real Time Mechatronics System: Block diagram & Functions: Real time mechatronics system (Flexible Manufacturing System: FMS), Computer Integrated Machines: CIM))

Sensors: Construction, principle of operation and application) Proximity and position Sensors: Photo electric sensors, Hall Effect sensors, optical encoder, eddy current proximity sensor, inductive sensor, capacitive sensor.

i. Velocity Sensors: Electromagnetic transducers, Techno generators
ii. Motion Sensors: Stroboscope, pyro electric sensors.
iii. Acceleration sensors: strain gauge accelerometer. Piezoelectric
iv. Pressure sensors: Load cells
v. Torque sensors: Torque Measurement using strain gauge, torque measurement using torsion bar (optical method, capacitive method, proximity sensor method, stroboscope method).
vi. Signal conditioners: Need of isolators, filters, amplifiers, fluid amplifiers and optical amplifiers and data converters in mechatronics.

Module 2: Basic Mechatronics systems	8	20

Basic System Models: Introduction, mechanical system building blocks Translational and Rotational system building up a mechanical system model, Electrical system building blocks -building up a model for an electrical system. System Models: Introduction, rotational-translational systems, electromechanical systems - System components & function. (No mathematical modelling), CNC Machines: General configuration of CNC system, advantages of CNC, part programming of CNC machines, G codes and M codes, small application programs, CNC based drilling machine.

Module 3: Pneumatic System	8	20
Basic Pneumatic Systems: Basic, Pneumatic system circuit, Air compressors, filters and regulators, air treatment, valves. Actuators: Principle of operation of linear actuators (single acting cylinder, double acting cylinder) rotary actuators (rotating vane, gear type) and direction control valves (poppet valve, spool valve), Pneumatic System: Applications, Advantages and Limitations**.**		
Module 4: Hydraulic System	8	20
Actuators: Principle of operation of linear actuators (single acting cylinder, double acting cylinder) rotary actuators (rotating vane, rack and pinion type). Mechanical Motion Element: cams, gear, belt, rack and pinion and bearings (principle of operation and application), Hydraulic System: Applications, Advantages and Limitation.		
Module 5: Robotics and Mechatronics Applications	8	20
Robotics: Block diagram and function of each component (sensors, drive system, control system, end effectors), construction and degrees of freedom of cylindrical, spherical and Cartesian robots, applications of robot. Microcontroller based antilock brake system. Microcontroller based pick and place robot. Microcontroller based car park barrier system. AGV (Automated Guided Vehicle): Basic concept, block diagram, role of mechatronic in guided vehicle.		

Reference Books:

1. Ramachandran, K. P.; Vijaya Raghavan, G. K.; Bala Sundaram, M.S., "Mechatronics -Integrated Mechanical electronic systems" Wiley-India, New Delhi First edition, 2008 ISBN: 978-81-265-1837-1.
2. Bolton, W., "Mechatronics" Pearson Education, New Delhi, 2003,3rd Edition, ISBN: 0131216333.
3. Rajput, R. K. "Mechatronics" S. Chand & Co. ltd. New Delhi, 1st Edition, ISBN: 81-219-2859-1.
4. Singh, M. D.; Joshi, J. G., "Mechatronics" PHI Learning Private Limited, New Delhi,2006, ISBN: 8120329864.

List of Experiments:

1. Identify different types of proximity and position sensors.
2. Choose the appropriate sensors for the given applications.
3. Use relevant transducer for velocity, motion, acceleration and torque sensors for the specified applications.
4. Measure the speed of the given motor using stroboscope sensor.
5. Identify various components of translational mechanical system.
6. Identify various components of rotational mechanical system.
7. Identify various components of electrical system.
8. Develop simple programs for CNC using G code and M code. (open-source software).
9. Troubleshoot pneumatic system of mechatronic systems.
10. Test the pneumatic system available in your Lab.
11. Troubleshoot hydraulic system of mechatronic systems.
12. Test the hydraulic system available in your Lab.
13. Trouble shoot different mechanical actuators of mechatronic systems
14. Simulate the working of cylindrical, spherical and Cartesian robot showing different degree of freedoms.
15. Simulate the working of pick and place robot. (MATLAB / Simulink software).
16. Demonstrate the working of Automated Guide Vehicle (Virtual Lab / Demonstration in Industry/Videos).
17. Demonstrate the working of Anti-lock Braking System (ABS) (Virtual Lab / Demonstration in Industry/Videos).

Course title:	Mobile and Wireless Communication	Sub code:	7LP40.3			
		Structure;	L	T	P	C
			4	0	2	5

Course Objective:	In this world of connectivity and collaborative work environment, it is necessary to connect to the network from anywhere, with anybody, at any time. Wireless communication provides connectivity with mobility, flexibility and convenience. Wireless devices are used across the various industries like Healthcare, Education, Automation, Renewable energy sector, Automobile etc. Effective use of Social networking has become possible due to high end wireless devices. This course will help the students to develop skills to handle wireless and mobile communication systems.
Course Outcome:	The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency: • Troubleshoot mobile handsets. • Assess cellular systems capacity. • Assess performance of standards of different cellular mobile systems. • Select relevant wireless technology suitable for various applications. • Test the performance of various wireless protocols.

Content	No. of hours	ESE Marks (%)
Module 1: Wireless Communication System:	8	20
Wireless network generations, Mobile Radio standards- AMPS, N- AMPS, IS -95, GSM, UMTS, CDMA 2000, Mobile wireless systems: Cordless Telephone system and Cellular telephone system Fixed wireless networks: Wireless Local Loop (WLL) & Local Multipoint Distribution System (LMDS), Mobile Phone Unit: Block diagram, working, features, of transmitter, and receiver section, Frequency Synthesizer, Control unit and Logic Unit of Mobile phone, sensors: speakers, camera, touch screen, motion sensors and other common sensors.		
Module 2: Fundamentals of Cellular System	8	20
Cellular concept fundamentals: Cell, cell structure, Cluster, Reuse factor, minimum reuse distance, basic cellular system: mobile station, base station, Traffic channel (Forward and Reverse), Control channel (Forward and Reverse), Frequency reuse, channel assignment strategies, F land off strategies: Concept of handoff, Types of Handoffs: Hard, Soft, Queued, delayed, MAHO (Mobile Assisted Handoff), Proper. and Improper Handoff, Umbrella cell approach, Interference and system capacity: Co-Channel interference, Adjacent Channel Interference, Channel Planning for wireless systems Improving Coverage and capacity in cellular systems: Cell splitting, Sectoring, Microcell Zone concept. Repeaters for range extension.		
Module 3: Digital Cellular Mobile Standards	8	20
Global System for Mobile Communication (GSM): Features and Services, GSM radio aspects, GSM architecture, GSM channel types, Security aspects. GSM Call routing: Mobile terminated call and mobile originated call sequence, stages of call processing in GSM, IS-95/CDMA One: features, Radio aspects, comparison with GSM standards. Signaling System No.7 (SS7): Network services part (NSP), Message transfer Part (MTP), Signaling Correction Control part (SCCP), Services and performance of SS7.		
Module 4: Advance Wireless Standards	8	20
Need for 3G and 4G technology, IMT-2000 global standards: Vision, Compatibility, service and spectrum requirements, UMTS /W-CDMA standard: Features, architecture, UMTS Air- interface specification,		

security procedure, CDMA 2000, features and advanced versions, advantages of CDMA 2000 over 3G-GSM standards. Next generation mobile standards: Features of 4G & 4G LTE, VoLTE, 4.5G, 5G.		
Module 5: Wireless Network Technologies	8	20
Bluetooth technology: Features, architecture, frequency band, IEEE 802.15.1 and other wireless protocol, applications, personal area network (PAN) RFID: Concept, frequency band, classification of RFID tags, applications WEAN technology: IEEE 802.11, WLAN system architecture, radio spectrum WMAN /Wi-max/IEEE 802.16 WMAN and IEEE 802.16a WiMAX Mobile Ad-hoc networks (MANET's): MANET topologies, applications.		

Reference Books:

1. Mobile Cellular Telecommunications System by Lee, C. Y. William.
2. Wireless Communication- Principles and practice by Rappaport, S. Theodore.
3. Wireless Communication by Signal, T. L.
4. Wireless and mobile network Architectures by Lin Yi-Bang Clamtac Imrich.

list of Experiments

1. Identify different sections and components of mobile phone such as ringer section, dial section, receiver section and transmitter section, camera, microphone, speaker, flash light.
2. Identify the inbuilt sensors of mobile handset and test their performance.
3. Perform cold test of different sections of mobile phone unit.
4. Test the supply of the Transmitter /Receiver section of mobile phone unit.
5. Test the Battery charger section and power management unit of mobile phone unit.
6. Determine the coverage area of a split cell which has radius half the radius of original cell.
7. Determine the channel capacity of a cellular system service area comprised of 4/7/12 microcells with 8/12/16 channels per microcell.
8. Determine the channel capacity if each microcell in the above lab exercise split into 4 minicells and each minicell is further split into 4 microcells.
9. For the 7- cell cluster and 168-voice channels cellular system, determine the assignment of voice channel to each cell if Omnidirectional antenna is used at the cell site.
10. For the 7- cell cluster, 168-voice channels cellular system, determine the assignment of voice channel to each sector if 3- sector 120° and 6 -sector 60° directional antenna are used at the cell site.
11. Perform installation, registration, activation and authentication of mobile applications on mobile handset.
12. Read/Retrieve the contents of SIM card using relevant software.
13. Execute call control commands using relevant software.
14. Execute Network service commands using relevant software.
15. Execute Security commands using relevant software.

Course title:	Artificial Intelligence and Machine Learning	Sub code:	7LP40.4			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To introduce the basic concepts, theories and state-of-the-art techniques of artificial intelligence. • To introduce basic concepts and applications of machine learning. • Help students to learn the application of machine learning /A. I algorithms in the different fields of science, medicine, finance etc.
Course Outcome:	• Understand concept of knowledge representation and predicate logic and transform the real-life information in different representation. • Understand state space and its searching strategies. • Understand machine learning concepts and range of problems that can be handled by machine learning. • Apply the machine learning concepts in real life problems.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction	8	20
Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.		
Module 2: Introduction to Search	8	20
Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.		
Module 3: Knowledge Representation & Reasoning	8	20
Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.		
Module 4: Machine Learning	8	20
Supervised and unsupervised learning, Decision trees, Statistical learning models, learning with complete data - Naive Bayes models, Learning with hidden data - EM algorithm, Reinforcement learning.		
Module 5: Pattern Recognition	8	20
Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods-Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbour (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – mean clustering.		

Reference Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education
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 and Machine Learning), The MIT Press 2004.
List of Experiments:	
	1. Implement A* Search algorithm. 2. Implement AO* Search algorithm. 3. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples. 4. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. 5. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. 6. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. 7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means' algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program. 8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem. 9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Course title:	Microwave Engineering	Sub code:	7L41			
		Structure:	L	T	P	C
			3	0	0	3

Course Objective:	• An understanding of microwave waveguides, passive & active devices, tubes and network analysis. • An ability to design microwave matching networks. • An understanding of RADARs and its applications.
Course Outcome:	• Familiarity with basic concepts and theory of RF & Microwave Engineering. • Ability to demonstrate waveguide components, assemble them. • Ability to solve problems on microwave communication system. • Ability to design, implement, analyze and maintain a high frequency communication system • Ability to get idea about different microwave network circuit.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction	8	20
RF & Microwave spectrum, Historical Background, Typical application of RF & Microwaves.		
Module 2: Microwave Tubes	8	20
Limitation of conventional tubes in microwaves, two cavity and multicavity Klystron, Reflex Klystron, Magnetron, travelling wave tube, Backward wave oscillator–working principles, characteristics.		
Module 3: Semiconductor Microwave Device	8	20
Tunnel diode, Gunn diode, IMPATT diode, TRAPATT diode, Microwave bipolar transistor, hetero-junction bipolar transistor, parametric amplifier Passive Components: S-matrix, Directional coupler, Bethe-hole coupler, Magic tee, Hybrid ring, Circulator, Isolator.		
Module 4: Microwave Measurement	8	20
Measurement of VSWR-Low, Medium and High, Measurement of power, Bolometer, Frequency measurement, Impedance measurement.		
Module 5: Microwaves	8	20
Introduction to satellite communication, Radar, Industrial application of microwaves.		

Reference Books:

1. Microwave Devices & Circuits S.Y. Liao Pearson Education/PHI
2. Microwave Engineering, Monojit Mitra, Dhanpat Rai New Delhi
3. Microwaves, K. C. Gupta, New Age Publisher
4. Microwave Engineering, Kulkarni, Dhanpat Rai New Delhi

Course title:	Project Part -I	Sub code:	7P42			
		Structure:	L	T	P	C
			1	0	6	7

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 seminar presentation, 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:	On successful completion of the course students will be able to: • Demonstrate a sound technical knowledge of their selected project topic. • Undertake problem identification, formulation and solution. • Design engineering solutions to complex problems utilising a systems approach. • Conduct an engineering project. • Communicate with engineers and the community at large in written an oral form. • Demonstrate the knowledge, skills and attitudes of a professional engineer.

Content	**No. of hours**	**ESE marks (%)**
• The project work will be carried out by a batch of at the most 3 students (Preferably 2 students) working on topic related to the electronics, telecommunications, computer science and allied fields. The batch will select the topic, by consulting the guide from above mentioned topic. They have to design and fabricate the system, which will be submitted at the end of second term of current academic year. • The batch has to prepare a typed report of not less than 25 pages. This should include the literature survey, technical details, design, related data etc. It should be in the proper format. Every candidate has to give a talk on the selected topic in presence of staff members and students. The Principal, of the institute will appoint two internal examiners to assess the term work; guide shall be one of the examiners.		

Course title:	Electronic Product Design Using EDA tools	Sub code:	7LP43.1			
		Structure	L	T	P	C
			3	0	2	5

Course Objective:	• To produce graduates with a solid foundation in Electronics Engineering fundamentals including hardware, software and mathematics and make them competent to apply this knowledge in their chosen career in the electronics design industry. • To ensure that graduates will be proficient in analysing real life problems with high sensitivity to the needs of society, and provide solutions which are economically and socially feasible. • To produce graduates who have the necessary competence and innovative skills to be an effective part of the research field of electronics design and development. • To produce graduates who are adequately motivated to continue in their chosen field and build greater technical knowledge and develop higher skills as technology advances and changes.
Course Outcome:	• 1.An ability to independently carry out research /investigation and development work to solve practical problems • An ability to write and present a substantial technical report/document • 3.Students should be able to 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 • 5. 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: System Reliability Concepts	8	20
Introduction to concepts of reliability, nature of reliability problems in electronic equipment, series configuration, Parallel Configuration, Mixed Configuration, Methods of Solving Complex Systems, Mean Time to Failure (MTTF) and Mean Time between Failure (MTBF) of Systems. Maintainability, Availability Concepts, System Downtime, Mean time to Repair (MTTR), Fault Tree Analysis- Concepts and Procedures, Rules for Fault Tree Construction.		
Module 2: Ergonomics and Aesthetics in Electronic Product Design	8	20
Overview of Electronic Product Design, Top-Down and Bottom-Up Approach, Considering Power Supply Design as an example, Ergonomic and Aesthetics Definition with Example, issues in Designing Electronic Products, Design of Controls and Display w. r. t. Ergonomic and Aesthetics Consideration.		
Module 3: Control Panel Design and thermal consideration	8	20
Types of Controls, Design and Organization of Control Panel, Engineering Considerations, Layout of Components, Selection of Materials, Sheet metals and plastic, Structural Design and Control Cabinets Fabrication. Thermal management of electronic equipment, Thermal design considerations, Component level, board level, system level, Fans and system operating characteristics, Heat Sink design.		

Module 4: Computer Aided design	8	20
Introduction to Computer Aided Design, Applications and Examples, Finite Element Methods (FEM) and Analysis, Techniques for Surface Modelling, Rendering and Shading, Sources of New Ideas, Creativity Techniques, Form factor, Shape, Colour, Graphics etc.		
Module 5: Mini Project	8	20
Mini Project based on EDA Tools.		

Reference Books

1. Ralph Remsburg, "Advanced Thermal Design of Electronic Equipment", Springer
2. V.S. Bagad, "Electronic Product Design", Technical Publications.
3. Dave S. Steinberg, "Cooling techniques for electronic equipment", Wiley, 1991.
4. Ernest Paul DeGarmo, J. T. Black, Ronald A. Kohser "Materials and Processes in Manufacturing", John Wiley & Son.
5. Military Handbook, Electronic Reliability Design Handbook, Department of Defense, USA
6. Patrick O'Connor & Andre Kleyne, "Practical Reliability Engineering", 5th ed., Wiley Publication.
7. Milton Ohring, "Reliability and Failure of Electronic Materials and Devices", Academic Press.
8. Dale H. Bester field, "Total Quality Management", 3rd ed., Pearson Education.

List of Experiments:

1. Finding out Reliability Parameters from Datasheet for Following Component:
   - •Any type and Rating of Resistance.
   - •Any type and Rating Capacitance.
   - •Any type and Rating Diode.
   - •Any type and Rating Transistor.
2. Prototype Electronic Product Design and Development for Power Supply.
3. Prototype Electronic Product Design and Development for Traffic Light.
4. Using Hand Made Model, Software Packages etc.
5. Control panel layout design for various home appliances.
6. CAD base design and simulation of product cabinet.
7. Design and analysis of ergonomic consideration of cabinets used for electronic products.
8. Design a prototype of led based street light.
9. Design a prototype of led based table lamp.
10. Thermal design consideration for component level, board level, system level design.

Course title:	Solar Installation and Maintenance	Sub code:	7LP43.2			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• Solar power plants have got many objectives in a broad context. Some of these objectives are Energy Savings, Eco-Friendly, Easy Installation, Battery Backup, Green energy. • Install and maintain solar photovoltaic (PV) power generation systems and equipment.
Course Outcome:	At the end of the course, the student will be able to: - • Identify renewable energy sources and their utilization. • Understand basic concepts of solar radiation and analyze solar thermal systems for its utilization. • Understand working of solar cells and its modern manufacturing technologies. • Identify methods of energy storage. • Compare energy utilization from wind energy, geothermal energy, biomass, biogas and hydrogen.

Content	No. of hours	ESE Marks (%)
Module 1: Introduction to Solar Energy	8	20
Overview of the course; Examination and Evaluation patterns; Global warming; Introduction to Renewable Energy Technologies. Necessity of Energy Storage; Energy Storage Methods. Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data.		
Module 2: Solar Thermal systems	8	20
Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems.		
Module 3: Solar Photovoltaic Energy and battery storage	8	20
Definition of Power and Energy, Renewable Energy and non-renewable energy sources Estimating energy requirements: Daily energy consumption, monthly energy consumption and electricity bill. Solar PV Modules, Ratings of SPV Modules, Standard SPV Module Parameters. Factors affecting electricity generated by SPV Modules, Measuring module parameters, Solar PV Module arrays: Series connections, parallel connections, mixed connections, calculation of total array power. Junction boxes, fuses, connectors, mounting structures. Some basics about batteries, working of a battery (charging, discharging), components of a battery cell. Types of batteries, parameters of batteries. Batteries for PV systems Liquid vented batteries, VRLA batteries. Series/Parallel connection of batteries, Estimating total energy storage capacity in series/parallel connected batteries.		
Module 4: Solar Power Electronics and wiring	8	20
Inverters (DC to AC inverters): Types of inverters, Inverter specifications, Inverter components: circuit and working, Charge controller: function, working, types, specifications MPPT Charge controller, Wires: Resistance, voltage drop, types of wires, their current carrying capacity and voltage drop calculation, wire sizing, DC cabling, DC distribution box, AC cabling, AC distribution box.		

Module 5: Solar PV system design, operation and maintenance	8	20
Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems. Load estimation and energy requirement, sizing and configuration of SPV Modules, Sizing of inverter, charge controller and batteries, Selection of cables, fuses, junction box, mounting structures, Maintenance and troubleshooting of SPV Modules, batteries, maintenance and troubleshooting of inverters.		

Reference Books:	
	1. Sukhatme S.P. and J.K.Nayak, Solar Energy - Principles of Thermal Collection and Storage, Tata McGraw Hill, New Delhi, 2008. 2. J.A. Duffie and W.A. Beckman, Solar Energy - Thermal Pro 3. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2006.

List of Experiments:	
	1. Study and Install Solar Panel Mounts. 2. Study and Install the Solar Panels. 3. Study and Wire the Solar Panels. 4. Study and Install Solar Inverter. 5. Study and install Bond Solar Inverter and Solar Battery. 6. Study and connect the Inverter to the Consumer Unit. 7. Start and Test Solar Panels. 8. Solar Panel Maintenance.

Course title:	Industrial automation using PLC and Scada	Sub code:		8LP44		
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	This course provides theoretical and practical aspects of implementing automation in industry. This course offers learning of pneumatics/ hydraulics systems, electrical controls and Programmable logic controllers.
Course Outcome:	• Students should be able to design and implement automated systems using pneumatics. • Students should be able to provide hydraulic solutions for designing automated systems. • Students should be able to devise Assembly automated systems using feeders, orienteers and escapement devices • Students should be able to design and implement electro-pneumatic/hydraulic solutions for automated systems. • Students should be able to apply PLC programming and implement it on PLC kits.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Introduction to Automation	8	20
Introduction-Automation in production system, Principles and strategies of automation, Basic elements of an automated system, Advanced automation functions, Levels of automations, Automated flow lines and transfer mechanisms, Analysis of transfer lines without storage, Automated flow lines with storage buffers.		
Module 2: Programmable Logic Controller (PLC)	8	20
Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Design of alarm and interlocks, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of PLCs, Integrating Process safety PLC and DCS, Application of international standards in process safety control.		
Module 3: Introduction to computer based industrial automation	8	20
Direct Digital Control (DDC), Distributed Control System (DCS) andsupervisory control and data acquisition(SCADA) based architectures.SCADA for process industries includes understanding of RTUs,Pumping stations,Evacuation processes, Mass Flow Metersand other flow meters, Leak-flow studies of pipelines, Transport Automation.		
Module 4: Hydraulic System Elements, Actuators, Circuits and their applications	8	20
Hydraulic System Elements: Pumps, types, working, characteristics, applications: Types of conductors, and connectors, their selection: Seals and packing, types, materials, applications. Hydraulic Actuators: Linear and Rotary, types, working, cushioning effect, mounting, calculation of force and velocity of piston System components: Accumulators, Intensifiers, their types, working, applications. Speed control circuits, regenerative, sequencing, counterbalancing, synchronizing, interlocking, circuits with accumulator and intensifier. Introduction to Fluidics and study of simple logic gates: Hydraulic clamping and braking systems.		
Module 5: Pneumatics & Pneumatic System Control Elements	8	20
Pneumatics: Air compressors, types, working, selection criteria; FRL unit, construction and working; Pneumatic cylinders and air motors, construction and working, types, calculation of force and air		

consumption, Comparison of air, hydraulic and electric motor.
Pneumatic System Control Elements: Direction control valves, types, control methods for spool working; Flow control valves, working of variable flow control, quick exhaust, time delay and shuttle valve; Pressure control valves, types and working.

Reference Books

1. Johnson, C. D., "Process control instrumentation Technology" Prentice Hall, 8th edition, United States of America,2014 ISBN: 978-0131194571
2. Dunning, Gary "Intro. To Programmable logic control" Cenage Learning, United States of America,2005 ISBN: 9781401884260
3. Mitra, Madhuchhanda; Gupta, SamarjitSen, "Programmable logic controllers and industrial automation an introduction" Penram. 1st Edition, Mumbai. 2007 ISBN: 9788187972174
4. "Programmable logic controllers",Petruzella, F.D. Tata- McGraw Hill, 3'"Edition, 2010 ISBN: 9780071067386
5. Espositio A., "Fluid Power with Applications", Pearson, 2002.
6. Majumdar S. R. ,"Oil Hydraulic Systems" , Tata McGraw Hill 2000
7. Majumdar S. R., "Pneumatic systems-principles and Maintenance", TataMcGraw Hill, 2000.
8. Janakiraman P.A., "Robotics and image processing", Tata McGraw Hill, 1995.
9. YoramKoren, "Robotics", McGraw Hill, 1992.

list of Experiments

1. Use potentiometer as error detector.
2. Determine error of angular position of DC servo system.
3. Test the Step response of R-C (first order) circuit.
4. Test the Step response of R-L-C (second order) circuit.
5. Test the functionality of temperature control with on-off controller.
6. Use PI controller to control temperature of the given process.
7. Use PD controller to control temperature of the given process.
8. Use PID controller to control temperature of the given process.
9. Identify and test different parts of PLC.
10. Develop ladder diagram to test the functionality of the logic gates.
11. Develop ladder diagram to test Demorgan's theorem
12. Develop the ladder diagram for Adder and Subtractor by using PLC.
13. Develop ladder diagram for ON and OFF control of lamp using timer and counter.
14. Develop ladder diagram for traffic light Control system.
15. Develop ladder diagram for stepper motor control.
16. Develop ladder diagram for temperature controller.

Course title:	Digital image Processing	Sub code:	8LP45.1			
		Structure:	L	T	P	C
			3	0	2	5

Course Objective:	• To study the image fundamentals and mathematical transforms necessary for image processing. • To study the image enhancement techniques • To study image restoration procedures. • To study the image compression procedures.
Course outcome:	After the completion of the course student will be able to: • Understand the need for image transforms and their properties. • Choose appropriate technique for image enhancement both in spatial and frequency • domains. • Identify causes for image degradation and apply restoration techniques. • Compare the image compression techniques in spatial and frequency domains. • Select feature extraction techniques for image analysis and recognition.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Digital Image Fundamentals	8	20
Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital Image Processing Systems. Elements of Visual Perception, A Simple image model, Sampling and Quantization, Neighbourhood of Pixels, Pixel Connectivity, Labelling of Connected Components, Distance Measures, Arithmetic and Logic Operations, Image Transformations, Perspective Transformations, Stereo Imaging.		
Module 2: Image Enhancement, Wavelets And Multi-resolution Processing	8	20
Spatial Domain Methods, Frequency Domain Methods, Point processing, Intensity Transformations, Histogram Processing, Spatial filtering, Smoothing Filters, Sharpening Filters, Enhancement in the Frequency Domain, Low Pass Filtering, High Pass Filtering, Homomorphic filtering. Sub band Coding, Haar Transform, Multiresolution Series Expansions, Wavelet Transforms in One Dimension, Discrete Wavelet Transform, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets.		
Module 3: Image Compression & Image Segmentation	8	20
Fundamentals of Compression, Image Compression Model, Error free Compression, Lossy Predictive Coding, and Transform Coding. Detection of Discontinuities, Line Detection, Edge Detection, Edge Linking and Boundary Detection, Thresholding, Threshold Selection on Boundary Characteristics, Region Growing, Region Splitting and Merging, Use of motion in Segmentation.		
Module 4: Image Representation and Description	8	20
Chain Codes, Polygonal Approximations, Signatures, Skeleton, Boundary Descriptions, Shape Numbers, Fourier descriptors, Moments, Topological Descriptors.		
Module 5: Image Recognition and Interpretation	8	20
Elements of Image Analysis, Pattern and Pattern Classes, Minimum Distance Classifier, Matching by Correlation, Baye's Classifier, Neural Network Training Algorithm, Structural methods.		

Reference Books:	
	1. Rafael C Gonzalez and Richard E Woods, Digital Image Processing, Pearson Education Asia, New Delhi, 2000. 2. B. Chanda, D. DuttaMajumder, Digital Image Processing and Analysis, PHI, New Delhi, 2000. 3. A.K. Jain, Fundamentals of Digital Image Processing, PHI, New Delhi, 2001.
list of Experiments:	
	1. Program to enhance image using image arithmetic and logical operations. 2. Program for an image enhancement using pixel operation. 3. Program for Gray level slicing with and without background. 4. Program for image enhancement using histogram equalization. 5. Program to filter an image using averaging low pass filter in spatial domain. And median filter. 6. Program to sharpen an image using 2-D Laplacian high pass filter in spatial domain. 7. Program for detecting edges in an image using Roberts cross gradient operator and sobel operator. 8. Program for smooth an image using low pass filter in frequency domain. (Butterworth lpf) 9. Program for smooth an image using high pass filter in frequency domain. (Butterworth hpf) 10. Program for morphological image operations-erosion, dilation, opening & closing. 11. Program for illustrating colour image processing. 12. Program for image Watermarking.

Course title:	Consumer Electronics	Sub code				
		Structure	L	T	P	C
			3	0	2	5

Course Objective:	A consumer electronic appliance is increasing demand day by day in developing nations. This requires large number of technically trained men power in relevant industries. Looking towards the need of the country, in-depth knowledge for maintaining various electronics audio-video systems and home appliances is necessary for engineering students. The main objective this subject is to offer students a brief knowledge of varied electronic audio-video, microwave, washer, air-conditioner, consumer appliance. To develop skills to troubleshoot in systematic way knowledge so gained would also help in production units of those consumer gadgets or help the scholars to start out their own enterprises.
Course outcome:	After the completion of the course students will be able to: • To identify the various digital and analog signal. • Describe various safety standards use in consumer electronics appliances. • Troubleshoot different types of microphones and speakers. • Understand the principal and application of home appliances. • Maintain audio systems. • Analyse the composite video signal used in TV signal transmission. • Troubleshoot colour TV receivers. • Maintain various consumer electronic appliances.

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Audio Fundamentals and Devices	8	20
Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity and linearity, Reverberation, Audio level metering, decibel level in acoustic measurement, Microphone: working principle, sensitivity, nature of response, directional characteristics, Types: carbon, condenser, crystal, electrets, tie- clip, wireless, Loud speaker: working principle, characteristic impedance, watt capacity, Types: electrostatic, dynamic, permanent magnet etc. , woofers and tweeters, Sound recording: Optical recording, stereophony and multichannel sound, MP3 standard.		
Module 2: Audio Systems	8	20
Audio system: CD player, home theatre sound system, surround sound. Digital console: block diagram, working principle, applications.FM tuner: concepts of digital tuning, ICs used in FM tuner. Public address system: planning, speaker impedance matching, Characteristics, power amplifier, Specification. Troubleshooting procedure of audio systems.		
Module 3: Television Systems	8	20
Monochrome TV standards, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution. Composite video signal: horizontal and vertical sync details, scanning sequence. Colour TV standards, colour theory, hue, brightness, saturation, luminance &chrominance. Different types of TV camera. Transmission standards: PAL system, channel bandwidth. Block diagram of Colour TV Transmitter. Troubleshooting procedure of Colour TV Transmitter.		
Module 4: Television Receivers and Video Systems	8	20
PAL-D color TV receiver, block diagram, Precision IN Line color picture tube. Digital TVs: - LCD, LED, PLASMA, HDTV, 3-D TV, projection TV, OLED, DTH receiver: Concept, receiver block diagram, Indoor and outdoor unit.Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI Multimedia Interface), Digital Video Interface. CD and DVD player: working principles, interfaces.b troubleshooting procedure of Color TV Receiver systems.		

Module 5: Home /Office Consumer Appliances	8	20
Photocopier and FAX block diagram, working. Microwave Oven: types, single chip controllers, wiring and safety instructions, technical specifications. Washing Machine: wiring diagram, electronic controller for washing machine, technical specifications, types of washing machine, fuzzy logic. Air conditioner and Refrigerators: Components features, applications, and technical specification, Digital camera and cam coder: pick up devices, picture processing and picture storage.		

Reference Books

1. Bali S.P, "Consumer Electronics", Pearson Education India,2010 , latest edition
2. Bali R and Bali S.P., "Audio video systems: principle practices & troubleshooting", Khanna Book Publishing Co. (P) Ltd., 2010Delhi, India, latest edition.
3. Gulati R.R., "Modern Television practices", New Age International Publication (P) Ltd. New Delhi Year 2011, latest edition.
4. Gupta R.G., "Audio video systems", Tata McGraw Hill, New Delhi, India 2010, , latest edition.
5. Whitaker Jerry & Benson Blair, "Mastering Digital Television", McGraw-Hill Professional, 2010, latest edition.
6. Whitaker Jerry & Benson Blair, "Standard handbook of Audio engineering", McGraw-Hill Professional, 2010, latest edition.

list of Experiments

17. Test the performance of the Speaker and Microphone.
18. Measure audio intensity level with the help of suitable audio level meter.
19. Build and Test FM tuner.
20. Build Test 2 channel audio power amplifiers.
21. Build Test sound mixer circuit.
22. To obtain composite video signal by using TV pattern generator and measure its dimensions.
23. To visualize / compare the various patterns of colour TV pattern generator for fault finding.
24. Operate digital TV trailer kit and observe wave form.
25. Verify the performance of LED TVs. Compare performance parameters of at least three brands.
26. Install and test DTH receiver.
27. Explore the various functions of automatic washing machine and locate various sensors used in that washing machines.
28. Check the wiring of ACs and explore all the functions.
29. Test various functions of microwave oven.
30. Verify functions of Camcorder.
31. Explore digital cameras settings.
32. To build and test temperature control system.

Course title:	RADAR Communication	Sub code:	8L46			
		Structure:	L	T	P	C
			3	2	0	5

Course Objective:	This course is an introduction to radar. Its objective is to provide an understanding of the basic concepts, operation, and applications of modern radar systems. It is designed to develop the knowledge and techniques necessary to analyse the performance of radar systems so that ultimately, the student is able to specify the subsystem performance requirements in a radar system design.
Course Outcome:	• Understand the basic operation of pulse and CW radar systems. • Evaluate the radar performance based on pulse width, peak power and beam width. • Choose suitable tracking radar for a given problem. • Select appropriate criterion for detecting a target. • Understand the working of phased array radars and navigational aids

Content	**No. of hours**	**ESE Marks (%)**
Module 1: Radar and Radar Equation	8	20
Introduction, Radar block diagram and operation, frequencies, applications, types of displays, derivation of radar equation, minimum detectable signal, probability of false alarm and threshold detection, radar cross-section, system losses.		
Module 2: CW Radar	8	20
Doppler Effect, CW Radar, applications, FM – CW radar, altimeter, Multiple Frequency Radar. Pulse Radar – MTI, Delay Line Canceller, Multiple Frequencies, Range-gated Doppler Filters, Non-coherent MTI, Pulse Doppler Radar.		
Module 3: Tracking Radar	8	20
Sequential lobing, conical scanning, mono pulse, phase comparison mono pulse, tracking in range, comparison of trackers.		
Module 4: Detection	8	20
Introduction, Matched Filter, Detection Criteria, Detector characteristics		
Module 5: Phased Arrays	8	20
Basic concepts, feeds, phase shifters, frequency scan arrays, multiple beams, applications, advantages and limitations. Navigational Aids: Direction Finder, VOR, ILS and Loran		

Reference Books:

1. M.I. Skolnik, Introduction Radar Systems, Second Edition, McGraw Hill Book Co., 1981
2. F.E. Terman, Radio Engineering, McGraw Hill Book Co. (for Chapter 7 only), Fourth Edition 1955
3. Simon Kingsley & Shaun Quegan, Understanding RADAR Systems, McGraw Hill Book Co., 1993.

Course title:	Project-II	Sub code:	8P47			
		Structure:	L	T	P	C
			1	2	12	15

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 seminar presentation, 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:	• Demonstrate a sound technical knowledge of their selected project topic. • Undertake problem identification, formulation and solution. • Design engineering solutions to complex problems utilising a systems approach. • Conduct an engineering project. • Communicate with engineers and the community at large in written an oral form. • 6. Demonstrate the knowledge, skills and attitudes of a professional engineer.

Content	No. of hours	ESE Marks (%)
Module 1: Term Work		
Project Part-II, is in continuation of Project Part-I undertaken by the candidates in first term. The term work shall consist of a typed report of about 70 pages or more, on the work carried out by the batch of students in respect 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 external examiner. The external examiner will be either from the allied industry or a senior faculty member from another institute.		