MANONMANIAM SUNDARANAR UNIVERSITY(MSU),TIRUNELVELI-627012

MASTERS DEGREE OF SCIENCE
(CBCS WITH LOCF)

SYLLABUS FOR
M.Sc.,ELECTRONICS
(SEMESTER PATTERN)

(As a student who joined recently a college affiliated with MSU from 2026 to 2027 onwards)

MANONMANIAM SUNDARANAR UNIVERSITY,TIRUNELVELI

M.Sc., Electronics

Under CBCS with effect from the academic year 2026-27 and onwards

Learning Outcome based Curriculum

Vision of the University

To provide quality education to reach the un-reached

Mission of the University

- To conduct research, teaching and outreach programmes to improve conditions of human living.
- To create an academic environment that honours women and men of all races, caste, creed, cultures, and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity.
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development.
- To provide quality / inclusive education, especially for the rural and unreached segments of economically downtrodden students including women,socially oppressed and differently abled.

PREAMBLE

The M.Sc. Electronics and Communication programme is designed to provide advanced knowledge, technical proficiency and professional competence in the broad domains of electronics, communication engineering and allied technologies. The programme aims to build a strong foundation in electronic devices and circuits, analog and digital communication systems, wireless and optical communication, signal processing, embedded systems, microprocessors and microcontrollers, VLSI design, Internet of Things (IoT), communication networks and emerging technologies, enabling learners to meet the requirements of academia, research organizations, industries and entrepreneurial ventures.

The curriculum offers a balanced blend of theoretical learning, laboratory experimentation, simulation-based training, project-oriented activities and research methodology. It emphasizes the development of analytical thinking, problem-solving skills, design capabilities and innovation through hands-on learning experiences and exposure to modern communication and electronic system design tools.

The programme integrates industrial training, internships, mini-projects, major projects and professional competency enhancement activities to strengthen technical expertise and employability. It encourages students to undertake interdisciplinary research, develop innovative solutions and gain practical exposure to contemporary technologies in electronics and communication. The programme also fosters teamwork, leadership qualities, effective communication skills, ethical values and social responsibility.

The curriculum equips learners with the ability to design, analyze, implement and optimize electronic and communication systems using modern engineering tools and techniques. It promotes scientific inquiry, environmental consciousness, sustainable technological development and adherence to professional ethics in addressing real-world challenges.

In alignment with the Vision and Mission of ManonmaniamSundaranar University, the programme nurtures lifelong learning, research orientation, innovation and entrepreneurship. It prepares graduates for higher studies, research careers and leadership positions in the fields of electronics, communication and related industries, empowering them to contribute effectively to technological advancement and sustainable national and global development.

PROGRAMMEEDUCATIONALOUTCOMES(PEO)

In alignment with the Vision and Mission of the University, the following have been defined as the PEO for the graduates.

PEO1: Developing strong positive attitude to learn independently the concepts in the field of study.

PEO2: Ensuring confidence among the learners to apply the knowledge and skills gained to solve real life issues.

PEO3: Habituating ethical values among the learners to succeed in personal and professional life.

PROGRAMMEOUTCOMES(PO)

After the successful completion of Postgraduate Programme from the University, the learner should be able to

PO1: Comprehend the knowledge acquired and share the knowledge with others to convince them in a discussion.

PO2: Analyze and compare the factual data/situation and formulate the problem into a conceptual model to critically evaluate for finding solution.

PO3:Apply the theories and philosophies learned in formulating theoretical research problem with underlying assumptions and solve the problem scientifically.

PO4: Think reflectively on the earlier attempts for applications of the concepts with a sense of inquiring practices and attempt for self directed lifelong learning process.

PO5: Understand the existence of multicultural practices and global viewpoint and utilization of knowledgewith the ability to prolong moral/ethicalvalues in personal and professional life.

PO6: Explore through multiple sources and get exposed to the digital literacy and information explosion with latest technology.

PO7: Act as a responsible member in the varied teams with facilitating capability and formulate teams as a leader for defined purposes.

PROGRAMME SPECIFIC OUTCOMES(PSOs)

After the successful completion of M.Sc (Electronics and Communication) Programme from the University, the learner should be able to

PSO1 – Electronic System Design and Development: Design, analyze and implement analog, digital and mixed-signal electronic systems using modern design methodologies, simulation tools and laboratory techniques.

PSO2 – Communication and Networking Technologies: Apply the principles of analog and digital communication, optical communication, wireless communication and computer networks to develop and optimize reliable communication systems.

PSO3 – Embedded Systems and IoT Applications: Develop embedded solutions using microprocessors, microcontrollers, sensors and Internet of Things (IoT) technologies for automation, monitoring and intelligent system applications.

PSO4 – Advanced Computing and Emerging Technologies: Utilize contemporary technologies such as Artificial Intelligence, Machine Learning, Python programming, Android application development, VLSI design, Nano electronics and Smart Manufacturing to address interdisciplinary technological challenges.

PSO5 – Instrumentation, Automation and Industrial Applications: Design and implement instrumentation, control, robotics, industrial automation and virtual instrumentation systems for industrial, biomedical, automotive and renewable energy applications.

PSO6 – Research, Innovation and Entrepreneurship: Apply research methodologies, analytical skills and innovative approaches to investigate engineering problems, develop sustainable technological solutions and pursue entrepreneurial opportunities in electronics and communication domains.

PSO7 – Professional Competency, Ethics and Lifelong Learning: Demonstrate professional ethics, effective communication, leadership, teamwork and lifelong learning abilities to adapt to emerging technologies and contribute responsibly to society, industry and research organizations.

Duration of the Programme:

The duration of the programme is Two academic years comprising of Four semesters with two semesters in each academic year. Each semester will be of 90 working days. Examinations will be conducted at the end of each semester for the respective courses.

Medium of instruction: Medium of instruction and examination shall be in ENGLISH.

SCHEME OF EXAMINATIONS: As per the CBCS pattern with SE (Secured External) examinations score and IA (Internal Assessment) Score

i. **Internal Assessment (25 Marks)**

Tests – 15 Marks
Seminar / Attention (Participation) in Class – 5 Marks; and
Tutorials / Quizzes / Assignments – 5 Marks

ii. **Semester End Examinations (75 Marks)**

Written exams, Practical, Project report, and Comprehensive Viva Voce
Note: In both Internal and Semester End Examinations

Lower Order Thinking (K1, K2, & K3) – 40 % in each part
Higher Order Thinking (K4, K5, & K6) – 60 % in each part

Marks For External: (Max.Marks:75, Passing minimum: 38, Time: 3Hours)
Part A (15x1=15 Marks), Answer All questions, Two questions from each unit
Part B (5x4=20 Marks), Answer All questions, One question from each unit with internal Choice
Part C (5x8=40 Marks), Answer All questions, One question from each unit with internal Choice

Practical's: TIME: 3Hours, Maximum Marks: 50 (External) and 50(Internal)

Marks will be calculated by laboratory performance, attendance, record note book maintenance, model practicalexaminationperformanceand Viva-voce exam.

- **Internship/Fieldwork:**(Maximum Marks): IA: 50 Marks and SE: 50Marks
- **Project Work:** (Maximum Marks): IA: 100 Marks and SE:100Marks

Model Question Paper

(2 Pages) Reg.No: _____

Code No: 10815 E Sub. Code: FSEL 11/
FSES 11

B.Sc(CBCS) DEGREE EXAMINATION,
November - 2026
Electronics /Electronics and Communication
(For those admitted in June 2026 onwards)
Core: XXXXXXXXXXXXXXX

Time: 3 hours Maximum: 75 marks

Course Outcome	Bloom's K-level	Qn. No.	PART – A 15 X 1= 15 Marks Answer ALL Questions Choose the BEST Answers
CO1	K1	1.	
CO1	K1	2.	
CO1	K2	3.	
CO2	K2	4.	
CO2	K3	5.	
CO2	K3	6.	
CO3	K4	7.	
CO3	K4	8.	
CO3	K5	9.	
C04	K5	10.	
CO4	K4	11.	
CO4	K4	12.	
CO5	K5	13.	
C05	K5	14.	
CO5	K4	15.	

Course Outcome	Bloom's K-level	Qn. No.	PART – B 5 X 4 = 25 Marks Answer ALL Questions choosing either (a) or (b) Each answer should not exceed 250 words
CO1	K1	16a.	
CO1	K1	16b.	
CO2	K2	17a.	
CO2	K2	17b.	
CO3	K3	18a.	
CO3	K3	18b.	
CO4	K4	19a.	
CO4	K4	19b.	
CO5	K5	20a.	
C05	K5	20b.	

Course Outcome	Bloom's K-level	Qn. No	PART – C 5 X 8 = 35 Marks Answer ALL Questions choosing either (a) or (b) Each answer should not exceed 600 words
CO1	K1	21a.	
CO1	K1	21b.	
CO2	K2	22a.	
CO2	K2	22b.	
CO3	K3	23a.	
CO3	K3	23b.	
CO4	K4	24a.	
CO4	K4	24b.	
CO5	K5	25a.	
C05	K5	25b.	

M.Sc., Electronics

PSOs: SEVEN Programme Specific Outcomes (PSO) in line with the POs proposed for the Postgraduate and Undergraduate programme.

Title of the Course	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	Total Score
Analog and Digital System Design	3	1.5	1.75	2	2.25	1.25	0.5	12.25
Advanced Microprocessors	2.25	2.25	3	2.5	1.25	1.25	0.5	13
Mathematical Methods and Network Analysis	2.75	2.5	1.25	2	1.75	2	0.75	13
Computer Networks	1.25	3	2.75	2	1.5	1	0.5	12
Electronic Properties of Materials	3	1.25	0.75	2.5	2	1	0.5	11
Bio medical Instrumentation	2.5	1.25	1.75	1.75	3	1	1	12.25
Automotive Electronics	2.75	1.25	2	1.75	3	1	1	12.75
Analog Electronic Design Lab	3	1.75	1	1.5	2.75	1	0.5	11.5
Digital Electronic Design Lab	3	1.25	2.5	1.75	2	1	0.5	12
Digital Communication System	2.25	3	1.75	1.75	1.25	1	0.5	11.5
Microcontrollers, Embedded System and IOT applications	2.5	1.5	3	2	1.75	1	0.5	12.25
Optoelectronics and Optical Fiber Communication	1.75	3	1.5	1.75	1.75	1	0.5	11.25
Solar Energy Systems	3	2	2.5	1.75	3	1	0.5	13.75
Electromagnetic, Microwave and Antenna	3	2	2.5	1.75	1.25	1	0.5	12
Artificial Intelligence Using Machine Learning	2.25	2.75	3	2.25	1.25	2	0.75	14.25
Microcontroller's Lab	3	2.75	2.25	2	1.25	1	0.5	12.75
Embedded System Design and IOT Lab	3	2.75	2.25	2	1.25	1.25	0.5	13
PCB Designing Tools	3	2.5	2.75	2	1.25	1	0.5	13
Total score of all courses contributing to PSO	47.25	38.25	38.25	35	33.5	20.75	10.5	

Each Course has to address a minimum of 4 PSOs

Level of contribution of the Course towards attaining PSOs

0 – No Contribution 1– Low Level 2 – Medium Level 3 – High Level

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System for M.Sc., (Electronics)

Sl. No.	Subject code	Subject Status	Subject Title	Hrs /Wk	Credit	Exam Hrs	Internal	External	Total
	1	2	3	4	5	6	7	8	9
SEMESTER-1									
1.		CoreTheory –1	Analog and Digital System Design	6	4	3	25	75	100
2.		CoreTheory –2	Advanced Microprocessors	6	4	3	25	75	100
3.		Core Theory-3(Anyone)	A. Mathematical Methods and Network Analysis/ B. Computer Networks	6	4	3	25	75	100
4.		Elective-1(Anyone)	A. Electronic Properties of Materials/ Bio medical Instrumentation B. AutomotiveElectronics	4	4	3	25	75	100
5.		Core Practical -1	Analog Electronic Design Lab	4	2	3	50	50	100
6.		Core Practical -2	Digital Electronic Design Lab	4	2	3	50	50	100
Sub total				**30**	**20**				**600**
SEMESTER–II									
7.		Core Theory-4	Digital Communication System	6	5	3	25	75	100
8.		Core Theory-5	Microcontrollers, Embedded System and IOT applications	6	5	3	25	75	100
9.		Core-6 (Anyone)	Optoelectronics and Optical Fiber Communication/ Solar Energy Systems	6	5	3	25	75	100
10.		Elective -2 (Anyone)	Electromagnetic, Microwave and Antenna/ Artificial Intelligence Using Machine Learning	4	3	3	25	75	100
11.		Core Practical–3	Microcontroller'sLab	3	2	3	50	50	100
12.		Core Practical–4	Embedded System Design and IOT Lab	3	2	3	50	50	100
13.		Skill Enhancement Course (SEC)-1	PCB Designing Tools	2	2	3	25	75	100
Sub total				**30**	**24**				**700**

SEMESTER–III									
14.		Core Theory-7	Advanced Power Electronics and Virtual Instrumentation	6	5	3	25	75	100
15.		Core Theory-8	Mobile, Optical and Data Communication Systems	6	5	3	25	75	100
16.		Core-9 (Anyone)	A. Research Methodology B. Smart manufacturing	6	5	3	25	75	100
17.		Elective-3 (Anyone)- Industry Module	Digital Signal and Image Processing/ Industrial Automation	6	5	3	25	75	100
18.		Core-10 Practical – 5	Advanced Communication Lab	2	1	3	50	50	100
19.		Core-10 Practical-6	DSPMAT Lab and LAB View Instrumentation Lab	2	1	3	50	50	100
20.		Skill Enhancement Course (SEC)-2	Robotics and Automation	2	2	3	25	75	100
21.		Internship (Anyone)	Internship/ Industrial Activity	0	2	-	25	75	100
Subtotal				**30**	**26**				**800**
SEMESTER–IV									
22.		Core Theory-11	Introduction to Python and Android Application Tools Development	6	5	3	25	75	100
23.		Core Theory-12	VLSI Design and VHDL Programming	6	5	3	25	75	100
24.		Elective-4 (Anyone)	A.RF Circuit and Satellite Communication/ B.E-Vehicles Technologies	4	3	3	25	75	100
25.		Core Practical-7	VLSI and Android Application Development Lab	2	1	3	50	50	100
26.		Core Practical-8	Object Oriented Programming using Python Lab.	2	1	3	50	50	100
27.		Core Project-1	Project Work with Viva-voce	6	5	3	100	100	200
28.		Skill Enhancement course (SEC)-3 / Professional Competency Skill	Nano Electronics	4	2	3	25	75	100
29.		Extension Activity-1	Extension Activity– Human Rights	-	1	-	-	-	-
Sub total				**30**	**23**	**-**	**-**		**800**
			TOTAL	**120**	**93**				**2900**

M.Sc (Electronics) / Semester - I/Core-1

ANALOG AND DIGITAL SYSTEM DESIGN

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	ANALOG AND DIGITAL SYSTEM DESIGN	Core Theory–1	**6**	**0**	**-**	**-**	**4**	**6**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Describe the concepts of analog and digital system design, PSPICE simulation techniques, amplifier circuits, operational amplifier applications, signal conditioning circuits, finite state machines, and programmable logic devices.	K1, K2
CO2	apply design principles and simulation tools to develop analog electronic circuits, operational amplifier-based systems, signal conditioning circuits, and digital logic systems for specified applications.	K3
CO3	analyze the performance and characteristics of amplifier circuits, oscillators, converters, PLL circuits, sequential logic circuits, finite state machines, and PLD-based systems using appropriate analytical techniques.	K4
CO4	evaluate and design analog and digital electronic systems by integrating suitable circuit architectures, simulation methodologies, and programmable devices to meet real-world engineering requirements.	K5,K6

UNITI **L- 15Hrs**

ANALOG SYSTEM DESIGN: Circuit Design and Analysis using PSPICE– Schematics, attributes and types of analysis in PSPICE, use of PROBE.

UNITII **L- 15Hrs**

DESIGN AND ANALYSIS-1: Design and analysis of BJT/FET differential and multistage amplifiers, current sources, current mirrors and active loads, small signal circuit analysis

UNITIII **L- 15Hrs**

DESIGNANDANALYSIS-2: Operational Amplifiers (OPAMP) - characteristics and Applications - Integrator, Differentiator, Wave-shaping circuits, Active filters, Oscillators, Schmitt trigger circuit, non-sinusoidal oscillators and timing circuits

UNITIV **L- 15Hrs**

DESIGN AND ANALYSIS-3: Design and analysis of signal conditioning circuits, Current to Voltage, Voltage to Current, Voltage to Frequency, Frequency to Voltage converters, Phase Locked Loop(PLL) and its application circuits.

UNITV **L- 15Hrs**

DIGITAL SYSTEM DESIGN: Digital system design concepts, approaches, basic combinatorialand Sequential circuits, Implementation of systems like ALU, Stop watch. Finite state machines,Control unit design, Applications of FSM like sequence detector, sequence generator, Steppercontrol programmable logic devices-ROM, PAL, FPGA, CPLD etc., PLD based system designapplications.

TEXT AND REFERENCE BOOKS:

1. Analysis and Design of Analog Integrated Circuits: Grey and Mayer.
2. Electronic Circuit analysis and design: D.A.Neaman,McGrawHill.
3. Microelectronic Circuits Analysis and Design: Rashid P W S pub.
4. Electronic Devices and circuit theory: R.L Boylestad and L.Nashelsk, Pearson
5. M.Mano, Digital Logic and Computer Design, Prentice-HallIndia.
6. M.MorrisMano, Michael D.Ciletti, "Digital Design",Pearson,2013.
7. Tocci,Wedmer and Moss,"Digital systems principles and applications",10th editionPearson

MAPPINGofCOswithPOs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	0	2	0
CO2	2	3	3	1	0	3	1
CO3	2	3	2	2	0	2	1
CO4	2	3	3	3	1	3	2
TotalScore	9	11	9	7	1	10	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	1	1	1	2	0	0
CO2	3	1	2	2	2	1	0
CO3	3	2	2	2	2	2	1
CO4	3	2	2	3	3	2	1
TotalScore	12	6	7	8	9	5	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics) / Semester-I/Core-2

ADVANCED MICROPROCESSORS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Advanced Microprocessors	Core Theory – 2	**6**	**0**	**-**	**-**	**4**	**6**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	explain the architecture, instruction sets, memory management techniques, and operational features of advanced CISC, RISC, and special-purpose processors.	K1, K2
CO2	apply processor architecture concepts, addressing modes, instruction formats, and memory management techniques in solving microprocessor-based system problems.	K3
CO3	analyze the architectural features, performance characteristics, and operational differences among CISC, RISC, EPIC, DSP, network, and graphics processors.	K4
CO4	evaluate and design processor-based solutions by selecting appropriate architectures and processing techniques for embedded, communication, multimedia, and high-performance computing applications.	K5,K6

UNITI **L- 15Hrs**

CISC PRINCIPLES: Classic CISC microprocessors, Intelx86 Family: Architecture - register set – Data formats – Addressing modes – Instruction se t- Assembler directives – Interrupts, Segmentation, Paging, Real and Virtual mode execution –Protection mechanism,Task management 80186,286,386 and 486 architectures.

UNITII **L- 15Hrs**

PENTIUM PROCESSORS: Introduction to Pentium microprocessor –Special Pentium Registers – Pentium Memory Management – New Pentium instructions – Introduction to Pentium Pro and its special features – Architecture of Pentium-II, Pentium-III and Pentium 4 microprocessors.

UNITIII **L- 15Hrs**

RISC PRINCIPLES: RISC Vs CISC – RISC properties and evaluation – On- chip register FileVs Cache evaluation – Study of typical RISC processor – The PowerPC – Architecture &specialfeatures–PowerPC601 –IBMRS/6000, SunPARC Family–Architecture– SuperSPARC.

UNIT-IV **L- 15Hrs**

RISCPROCESSOR: MIPSRx000family – Architecture – Special features – MIPSR4000 and R4400 – Motorola 88000 Family – Architecture – MC88110 – MC88100 and MC88200.

UNITV **L- 15Hrs**

SPECIALPURPOSEPROCESSORS: EPIC Architecture – ASIPs – Network Processors –

DSPs – Graphics/Image Processors.

TEXTANDREFERENCEBOOKS:

1.Daniel Tabak, "Advanced Microprocessors", Tata Mc Graw-Hill,1995, 2nd Edition.2.The 80x86 family John Uffen beck - Design, Programming and Interfacing, III edition.

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	0	2	0
CO2	2	3	3	1	0	2	1
CO3	2	3	2	2	0	2	1
CO4	2	3	3	3	1	3	2
TotalScore	9	11	9	7	1	9	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	3	2	1	0	0
CO2	2	2	3	2	1	1	0
CO3	2	2	3	3	1	2	1
CO4	3	3	3	3	2	2	1
TotalScore	9	9	12	10	5	5	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics) /Semester-I /Core3-A

MATHEMATICAL METHODS AND NETWORK ANALYSIS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Mathematical Methods and Network Analysis	Core Theory-3 (Anyone)	**6**	**0**	**-**	**-**	**4**	**6**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the concepts of matrices, differential equations, statistics, transform techniques, network analysis, and Fourier series used in engineering applications.	K1, K2
CO2	Apply matrix operations, differential equations, statistical methods, integral transforms, and network theorems to solve engineering and signal-processing problems.	K3
CO3	Analyze engineering systems using eigenvalue methods, transform techniques, network parameters, state-variable models, and Fourier representations.	K4
CO4	Evaluate and formulate mathematical models for complex engineering networks, signals, and systems using advanced analytical and computational techniques.	K5,K6

UNITI **L- 15Hrs**

MATRIX: Elementary transformation–finding inverse and rank using elementary transformation–solutionoflineequationsusingelementarytransformations–Eigen values and eigen vectors – application of Cayley - Hamilton theorem – Diagonalization –Reduction of quadratic form into sum of squares using orthogonal transformation–nature of quadratic form.

UNITII **L- 15Hrs**

EQUATIONS, INTEGRALS AND SOLUTIONS: Differential equations and their solutions, Double integrals in Cartesian and polar co-ordinates – application in finding area and volume usingdoubleintegrals – change of variables using Jacobian - Introduction to Signal sand Systems, Bessel functions of first and second kind.

UNIT III: **L- 15Hrs**

STATISTICS AND TRANSFORM FUNCTIONS: Introduction to Statistics, Population andSample, Types of Data, Measures of Central Tendency, Measures of Dispersion and DiscreteProbability Distribution, Laplace transform and its applications, Analysis of LTI Continuous TimeSystemusingLaplaceTransform,Z-Transform.

UNITIV **L- 15Hrs**

NETWORK ANALYSIS: Network elements, Network Graphs, Nodal and Mesh analysis, Zeroand Poles, Bode Plots, Laplace transforms, Two-port Network Parameters, Transfer functions,Signal representation. Statevariablemethodofcircuitanalysis.ACcircuitanalysis,Transientanalysis

UNITV **L- 15Hrs**

FOURIER SERIES: Dirichlet conditions – Fourier series with period π and 2π – Half range sineandcosine series–simple problems–RMS value.

TEXTAND REFERENCE BOOKS:

1. Advanced Engg. Mathematics, Erwin Kreyszig, Willey Publication,10th Edition
2. Higher Engg.MathematicsGrewalB.S.,KhannaPublishers
3. GoonGupta andDasGupta:FundamentalsofStatistics,Vol.1,The WorldPressPvt.Ltd., Kolkata.
4. MillerandFruend:Modern ElementaryStatistics.PEARSONpublication.
5. SnedecorandCochran:StatisticalMethods,OxfordandIBHPublishers.
6. Engg.Mathematics: N.P.Bali
7. Laplace and FourierTransforms,GoyalandGupta
8. AdvancedMathematicsforengineers:.S.Sokolinokoff9.MethodsofAppliedMathematic

s:F.B. Hilderbrand.
9. MathematicalmethodsforPhysics:ArfkenA.G.AcademicPress.
10. DigitalSignalProcessing: SanjitMitra,McgrawHigherEdpublication.
11. MathematicalmethodsforphysicistsandEngineers:M.A.Boas
12. NetworkAnalysis:VonValkenberg,PEARSON

Web Resources

1. MIT Open Course Ware – Linear Algebra
   (Unit I – Matrices, Eigenvalues, Eigenvectors, Diagonalization)
2. Paul's Online Math Notes – Differential Equations and Fourier Series
   (Unit II & Unit V – Differential Equations, Fourier Series)
3. NPTEL – Network Analysis and Synthesis
   (Unit IV – Network Analysis, Two-Port Networks, Transfer Functions)

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	0	2	0
CO2	2	3	3	1	0	2	1
CO3	2	3	2	2	0	2	1
CO4	2	3	3	3	1	2	1
TotalScore	9	11	9	7	1	8	3

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	1	1	1	1	0
CO2	3	2	1	2	2	2	1
CO3	3	3	1	2	2	2	1
CO4	3	3	2	3	2	3	1
TotalScore	11	10	5	8	7	8	3

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-I/Core3-B

COMPUTERNETWORKS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Computer Networks	Core Theory-3 (Anyone)	**6**	**0**	**-**	**-**	**4**	**6**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the fundamentals of computer networks, reference models, transmission media, wireless communication, network protocols, routing mechanisms, transport services, and network security concepts.	K1, K2
CO2	Apply networking protocols, error-control techniques, addressing schemes, routing methods, and transport-layer services in communication network applications.	K3
CO3	Analyze the performance of data link, network, and transport layer protocols, communication channels, congestion control mechanisms, and quality-of-service requirements in computer networks.	K4
CO4	Evaluate and design reliable, scalable, and secure computer network solutions by integrating appropriate protocols, routing strategies, transmission technologies, and security mechanisms.	K5,K6

UNIT–I **L- 15Hrs**

Introduction – Network Hardware– Software– ReferenceModels– OSI and TCP/IPmodels – Example networks: Internet, 3G Mobile phone networks, Wireless LANs –RFIDand sensor networks - Physical layer – Theoretical basis for data communication - guidedtransmissionmedia

UNIT–II **L- 15Hrs**

Wirelesstransmission–CommunicationSatellites–Digitalmodulationandmultiplexing - Telephones network structure – local loop, trunks and multiplexing,switching.Datalinklayer:Designissues–errordetectionandcorrection.

UNIT–III **L- 15Hrs**

Elementarydatalinkprotocols–slidingwindowprotocols–ExampleDataLinkprotocols –PacketoverSONET,ADSL-MediumAccessLayer–ChannelAllocationProblem– MultipleAccessProtocols.

UNIT–IV **L- 15Hrs**

Network layer - design issues - Routing algorithms - Congestion control algorithms– Quality of Service – Network layer of Internet- IP protocol – IP Address – Internet ControlProtocol.

UNIT–V **L- 15Hrs**

Transportlayer–transportservice-Elementsoftransportprotocol-Addressing,Establishing & Releasing a connection– Error control, flow control, multiplexing andcrashrecovery-InternetTransportProtocol–TCP-NetworkSecurity:Cryptography.

TextBook:

1. S.Tanenbaum,2011,ComputerNetworks,FifthEdition,PearsonEducation, Inc.

ReferencesBooks:

1. Forouzan,1998,IntroductiontoDataCommunicationsinNetworking,TataMcGraw Hill,New Delhi.
2. F.Halsall,1995, Data Communications, Computer Networks and OpenSystems, AddisonWessley.
3. BertsekasandR.Gallagher,1992,DataNetworks,PrenticeHallofIndia,New Delhi.
4. Lamarca,2002,CommunicationNetworks,TataMcGrawHill,NewDelhi.
5. TeresaCPiliouras,"NetworkDesignManagementand TechnicalPerspectives,SecondEdition", AuerbachPublishers,2015.

Web Resources

1. Cisco Networking Academy – Networking Fundamentals
   (OSI/TCP-IP Models, Routing, Switching, Transport Layer Protocols)
2. RFC Editor – Internet Standards and Protocol Specifications
   (IP, TCP, UDP, ICMP, Internet Protocol Standards)
3. GeeksforGeeks – Computer Networks Tutorials
   (Comprehensive coverage of all five units)

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1	2	0
CO2	2	3	3	1	1	3	1
CO3	2	3	2	2	1	2	1
CO4	2	3	3	3	2	3	2
TotalScore	9	11	9	7	5	10	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	1	3	2	1	1	0	0
CO2	1	3	3	2	1	1	0
CO3	1	3	3	2	2	1	1

CO4	2	3	3	3	2	2	1
TotalScore	5	12	11	8	6	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/ Semester-I/Elective-1–A

ELECTRONICPROPERTIESOFMATERIALS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Electronic Properties of Materials	Elective-1(Anyone)	**4**	**0**	**-**	**-**	**4**	**4**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the electrical, dielectric, optical, magnetic, and nanoscale properties of materials and their significance in electronic applications.	K1, K2
CO2	Apply the principles of electronic material properties to analyze the behavior of metals, dielectrics, optical materials, magnetic materials, and nanomaterials in practical applications.	K3
CO3	Analyze the influence of material structure, defects, polarization mechanisms, magnetic ordering, optical transitions, and quantum confinement effects on material performance.	K4
CO4	Evaluate and select suitable electronic, magnetic, optical, and nanostructured materials for advanced electronic devices, photonic systems, sensors, and emerging technologies.	K5,K6

UNITI **L – 12 Hrs**

Electrical Properties of Metals: Conductivity, reflection and absorption, Fermi surfaces, superconductivity, thermoelectric phenomena. Conduction in metals oxides, amorphous materials.

UNITII **L – 12 Hrs**

Dielectric Properties of Materials: Macroscopic electric field, local electric field at anatom, dielectric constant and polarizability, ferro electricity, anti - ferroelectricity, phasetransition, piezoelectricity, ferroelasticity, electrostriction.

UNITIII **L – 12 Hrs**

Optical Properties of Materials: Optical constants and their physical significance, Kramers –Kronig Relations, Electronic internbondandintrabondtransitionsRelationsbetween
Optical properties and band structure – colour of material (Frenkel Excitons), BondStructure determination from optical spectra reflection, refraction, diffraction, scattering, dispersion, photo luminescence, Electro luminescence.

UNITIV **L – 12 Hrs**

Magnetic Properties of Materials: Diamagnetism, Para magnetism, various contributionstoparanddia-magnetism,Adia - baticde magnetization, Paramagnetic susceptibility. Ferromagnetism, ferrimagnetism, ferrites, anti-ferromagnetism, curic point, temperature dependence of saturation magnetization, saturation magnetizationat absolutezero, magnons and their thermalexcitation, dispersion relation, NeutronMagneticscattering,Ferrimagneticand anti-ferrimagnetic order, domains and domain walls, magnetic resonance. Coercive force, hysteresis, methods for parameters measurements.

UNITV **L – 12 Hrs**

Materials Properties at Nanoscale: Quantum Confinement in Nanomaterials – Prime materials in Nanotechnology - Nanomaterials: natural and man – made – Semiconductor Nanomaterials – Polymers and Composites – Metal Nanoparticles – Biomaterials – Unique properties of nanomaterials - Microstructure and defects in monocrystalline materials-Effectofnanodimensionsonmaterialbehavior(magnetic,electrical,opticalandthermalproperties).

Text Books:

1. Electronic Properties of materials, R.E.Hummel, Springer New York publication
2. Solid State Physics, Dekkar, Mc Graw Higher Ed Publication
3. Introduction to Solid State Physics, C.Kittlel, Wiley Publication
4. Principles of Electronic materials & dev,S.O.Kasap,Mc Graw Higher Ed Publication
5. ElementarySolid-statephysics,M.AliOmar;PearsonPublication.
6. Nanotechnology: The Science of Small-M.A Shah & K.A Shah, Wiley Publication - FirstEdition2013

Web Resources

1. MIT OpenCourseWare – Solid State Chemistry and Electronic Materials
   (Units I–IV: Electronic, Optical, Dielectric and Magnetic Properties of Materials)
2. NanoHub – Nanotechnology Learning Resources
   (Unit V: Nanomaterials, Quantum Confinement and Nanoscale Material Properties)
3. HyperPhysics – Solid State Physics and Material Properties
   (Comprehensive support for Units I–IV)

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1	1	0
CO2	2	3	2	1	1	2	0
CO3	2	3	2	2	1	2	0
CO4	2	3	3	3	2	2	1
TotalScore	9	11	8	7	5	7	1

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7

CO1	3	1	0	2	1	0	0
CO2	3	1	1	2	2	1	0
CO3	3	1	1	3	2	1	1
CO4	3	2	1	3	3	2	1
TotalScore	12	5	3	10	8	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-I/Elective-1-B

BIOMEDICAL INSTRUMENTATION

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Biomedical Instrumentation	Elective-1(Anyone)	**4**	**0**	**-**	**-**	**4**	**4**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the physiological principles, biomedical transducers, electrophysiological measurements, medical imaging techniques, and therapeutic devices used in healthcare systems.	K1, K2
CO2	Apply biomedical instrumentation techniques for measuring physiological parameters, recording bio-signals, and operating diagnostic and therapeutic equipment.	K3
CO3	Analyze the performance and characteristics of biomedical sensors, signal acquisition systems, medical imaging modalities, telemetry systems, and life-support devices.	K4
CO4	Evaluate and select appropriate biomedical instruments and healthcare technologies for diagnosis, monitoring, imaging, and therapeutic applications considering safety and clinical requirements.	K5,K6

UNIT – I: L – 12 Hrs

Physiology and transducers: Man instrument system, Cell andits structure, resting and actionpotential, propagation of action potentials, the heart and cardiovascular system, electrophysiology ofcardiovascular system, physiology of the respiratory system, nervous system, Electrode theory, biopotentialelectrodes

UNIT- II: L – 12 Hrs

Electrophysiological measurement: Lead system, recording methods and typical wave forms of ECG, Vector cardiograph, EEG Lead system, recording and methods and typical waveforms of EMG,ERG, EOG

UNIT - III: **L – 12 Hrs**

Nonelectrical parameter measurements

Measurementofbloodpressure,bloodflowandcardiacoutput,plethysmography, Measurementofheartsounds,GasAnalyzers,Bloodgasanalyzers,Oximeters

UNIT- IV: **L – 12 Hrs**

Medical Imaging and Telemetry

X-Ray machine, Echocardiography, computer tomography, MRI, Diagnostic ultrasound, PET,SPECT, Electrical impedance tomography, thermography, biotelemetry

UNIT – V: **L – 12 Hrs**

Assisting and therapeuticdevice: Pacemakers, Defibrillators, Ventilator, Heartlung machine, Kidney machine, Diathermy, endoscopes, Lasers applications in bio medicine.

TEXT BOOKS

1. Leslie Crom well,Fred, J.Weibell and Erich A. Pleiffer, "Biomedical Instrumentation and Measurements" 2nd Edition, Prentice Hall of India, 2014
2. Kandpur,R.S."HandbookofBiomedicalInstrumentation"2nd Edition,TataMcGrawHill,2011
3. K.S.Fu,R.C.Gonazlez,CSG,LeeRobotics,Controlsensingvisionandintelligence,TataMcGrawHill2008
4. M.Arumugam,"BiomedicalInstrumentation"AnuradhaPublications,2015

REFERENCE BOOKS

1. John G.Webster,Editor,"MedicalInstrumentation,ApplicationandDesign"JohnWileyand SonsInc.2009.
2. Morelli S Salerno S, Ahmed H, Piscioneri A, DeBartoloL, "Recent strategies combining biomaterials and Stemcells forbone, liver and skin Regenerations" Current stemcell Research & therapy,2016.

Web Resources

1. National Institute of Biomedical Imaging and Bioengineering (NIBIB) – Medical Imaging Overview
   (Unit IV – Medical Imaging Techniques: MRI, CT, Ultrasound, PET, SPECT)
2. OpenStax Anatomy and Physiology
   (Unit I – Human Physiology, Cardiovascular, Respiratory and Nervous Systems)
3. Biomedical Engineering Society Educational Resources
   (Biomedical Sensors, Instrumentation and Healthcare Technologies)

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	2	1	0
CO2	2	3	3	1	2	2	1
CO3	2	3	2	2	2	2	1
CO4	2	3	3	3	3	2	1
TotalScore	9	11	9	7	9	7	3

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	1	1	3	0	1
CO2	3	1	2	1	3	1	1
CO3	2	1	2	2	3	1	1
CO4	3	2	2	3	3	2	1
TotalScore	10	5	7	7	12	4	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-I/Elective: 1C

AUTOMOTIVE ELECTRONICS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Automotive Electronics	Elective-1(Anyone)	**4**	**0**	**-**	**-**	**4**	**4**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the fundamentals of automotive systems, engine management, ignition systems, fuel injection systems, braking systems, traction control, and vehicle safety electronics.	K1, K2
CO2	Apply the principles of automotive electronics to analyze engine control, ignition timing, fuel management, anti-lock braking, and vehicle safety systems.	K3
CO3	Analyze the performance and operation of electronic control systems used in automotive applications, including ignition systems, fuel injection systems, ABS, traction control, and safety devices.	K4
CO4	Evaluate and propose suitable automotive electronic solutions for vehicle control, safety enhancement, performance optimization, and intelligent transportation applications.	K5,K6

UNIT I: **L – 12 Hrs**

Automotive Fundamental: Evolution –Physical Configuration –Automotive Systems -Engine–Engine Block–CylinderHead–4Stroke Cycle-Engine Control–Ignition System–Ignition,Timing–Suspension–Brakes –SteeringSystem.

UNIT II: **L – 12 Hrs**

Ignition Systems Starting Systems -Requirements of the Starting Systems - IgnitionSystems: Fundamentals –Types –Generation –Timing –Fuel Consumption –Conventional IgnitionComponents–PlugLeads –IgnitionCoilCores-IntroductiontoElectronic Ignitionsystem.

UNIT III: **L – 12 Hrs**

Fuel Injection Overview of Programmed Ignition-Electronics Control of Carburetion – Basics–Areas of Control -Fuel Injection -System Overview -Advantages of Fuel Injection.

UNIT IV: **L – 12 Hrs**

Chassis Electrical System Anti-lock Brakes –Introduction –Requirements of ABS –General System Description –ABS components –Anti-lock Brake System Control.

UNIT V: **L – 12 Hrs**

Traction Control – Functions –System Operation –Safety Systems: Central Locking –Electric Windows –Air bags and Belt Tensionless - Wi-Fi.

TEXT and REFERENCES BOOKS

1. William B.Ribbens, "Understanding Automotive Electronics", SocietyofAutomotive EngineersInc,6thEdition,2002
2. TomDenton,"AutomobileElectricalandElectronicSystems",ElsevierPublicationsLtd., 4thEdition,2011.

Web Resources

1. Bosch Mobility – Automotive Technology and Vehicle Systems
   (Engine Management, ABS, Traction Control, Automotive Electronics)
2. Denso Automotive Technology Library
   (Ignition Systems, Fuel Injection Systems, Vehicle Electronics)
3. HowStuffWorks – Automotive Electronics Explained
   (Fundamentals of Automotive Systems and Electronic Controls)

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1	1	0
CO2	2	3	3	1	1	2	1
CO3	2	3	2	2	1	2	1
CO4	2	3	3	3	2	2	1
TotalScore	9	11	9	7	5	7	3

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	1	1	3	0	1

CO2	3	1	2	1	3	1	1
CO3	3	1	2	2	3	1	1
CO4	3	2	3	3	3	2	1
TotalScore	11	5	8	7	12	4	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-I/ Practical-1

Analog Electronic Design Lab

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Analog Electronic Design Lab	Core Practical -1	-	-	4	-	2	4	50	50	100

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the operating principles, characteristics, and applications of multivibrators, amplifiers, filters, PLL circuits, oscillators, and analog communication circuits used in electronic system design.	K1, K2
CO2	Construct and test analog electronic circuits such as waveform generators, amplifiers, filters, modulators, and PLL-based systems using appropriate hardware and software tools.	K3
CO3	Analyze the performance of analog circuits by interpreting experimental results, frequency responses, waveforms, gain characteristics, and modulation parameters.	K4
CO4	Design, evaluate, and troubleshoot analog electronic systems to meet specified performance requirements in signal processing and communication applications.	K5,K6

ANALOG ELECTRONIC DESIGN LAB
(ANY 10 USING HARDWARE/SOFTWARE) **P- 60 Hrs**

1. Wave form generators: Multivibrators - Astable
2. Monostable
3. Bistable
4. Triangular wave generator(Usingop-amp),
5. Wave shaping circuits,
6. S.M.P.S
7. Voltage controlled oscillator
8. Amplifiers: RC coupled amplifier/FET amplifier.
9. Filters: Butter worth filters, Low pass filter - High pass filters - Band pass filters –Band reject filters)
10. IGMFfilters,Lowpassfilters-Highpassfilters-Bandpassfilters-BandrejectfiltersUniversalfilters Communication:
11. FrequencymodulationusingPLL
12. PAMusingOP AMP
13. AmplitudemodulationusingOPAMP
14. FrequencyshiftkeyingbyPLL
15. SimulationofinductanceusingOPAMP
16. Negative impedanceconverter
17. FrequencymultiplicationbyusingPLL

Web Resources

1. Texas Instruments Analog Engineer's Circuit Cookbook
2. Analog Devices Education Library
3. LTspice Simulation Tutorials and Resources

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	0	0	2	0
CO2	2	3	3	1	0	3	1
CO3	2	3	2	2	0	2	1
CO4	2	3	3	3	1	3	2
TotalScore	9	10	9	6	1	10	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	1	0	1	2	0	0
CO2	3	2	1	1	3	1	0
CO3	3	2	1	2	3	1	1
CO4	3	2	2	2	3	2	1
TotalScore	12	7	4	6	11	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics) / Semester-I / Practical-2

DIGITAL ELECTRONIC DESIGN LAB

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Digital Electronic Design Lab	CorePractical -2	-	-	4	-	2	4	50	50	100

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the operating principles and functional characteristics of timer circuits, logic gates, combinational circuits, sequential circuits, and CMOS-based digital systems.	K1, K2
CO2	Implement and test digital electronic circuits such as multivibrators, adders, subtractors, encoders, decoders, multiplexers, flip-flops, registers, and counters using hardware and simulation tools.	K3
CO3	Analyze the performance and logical behavior of combinational and sequential circuits through waveform observation, truth-table verification, timing analysis, and simulation results.	K4
CO4	Design, evaluate, and troubleshoot digital electronic systems by integrating combinational and sequential building blocks to meet specified functional requirements.	K5,K6

DIGITAL ELECTRONIC DESIGN LAB

List of Experiments
(ANY 10 USING HARDWARE/SOFTWARE) P- 60 Hrs

1. Astable-Timerexperimentsusing555timer.
2. Monostable -Timerexperimentsusing555timer
3. StudyofIC's.Usebreadboards.
4. Astablemultivibrator usinglogicgates.
5. monostablemultivibratorusinglogicgates

<u>Study of combinational, sequential & CMOS circuits (Using SPICE)</u>

6. Combinational Circuits
7. Adder
8. Subtractor.
9. Comparators
10. Encoder
11. Decoder.
12. MUX

13. DEMUX.

Sequential Circuits

14. Flip-Flops(RSandJK)
15. ShiftRegisters.
16. BinaryCounters
17. Ringcounters

SequenceGenerations.

18. UniversalGates.
19. BooleanExpressions.

Web Resources:

1. Multisim Live – Online Circuit Simulation
2. All About Circuits – Digital Electronics Textbook
3. Falstad Digital Circuit Simulator

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	0	0	2	0
CO2	2	3	3	1	0	3	1
CO3	2	3	2	2	0	2	1
CO4	2	3	3	3	1	3	2
TotalScore	9	10	9	6	1	10	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	1	1	1	2	0	0
CO2	3	1	3	1	2	1	0
CO3	3	1	3	2	2	1	1
CO4	3	2	3	3	2	2	1
TotalScore	12	5	10	7	8	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics) /Semester-II/Core-4

DIGITAL COMMUNICATION SYSTEM

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Digital CommunicationSystem	Core Theory-4	6	0	-	-	5	4	25	75	100

CourseObjectives: The main objectives of this course are to

- Understand the fundamental concepts of information theory, source coding, channel coding, and digital communication systems.
- Study error control coding techniques, cryptographic methods, and digital modulation schemes used in modern communication systems.
- Analyze the performance of coding, decoding, modulation, and spread spectrum techniques under various communication environments.
- Develop the ability to design reliable and secure digital communication systems for contemporary applications.

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the principles of information theory, source coding, channel coding, cryptography, digital modulation, and spread spectrum communication techniques.	K1, K2
CO2	Apply coding and decoding techniques, cryptographic methods, and digital modulation schemes for reliable transmission of information in communication systems.	K3
CO3	Analyze the performance of error control codes, modulation techniques, spread spectrum systems, and secure communication methods using appropriate theoretical models.	K4
CO4	Evaluate and design efficient digital communication systems by selecting suitable coding, modulation, security, and spread spectrum techniques for specific applications.	K5,K6

UNITI: L – 15Hrs

INTRODUCTION: Information, Entropy, Information rate, Classification of codes, KraftMcMillaninequality,sourcecodingtheorem,Shanon-Fanocoding,Huffmanncoding,Extended Huffmann coding, Shanon's channel capacity theorem, joint and conditionalentropy,mutualinformation,discretememory-lesschannel,BSC,BEC

UNIT II: L – 15Hrs

CODING AND DECODING-1: Hamming weight, Hamming distance, Types of codes,Linear

Block codes, Repetition codes, Syndrome decoding, Syndrome property, minimumdistance decoding, Cyclic codes, Syndrome calculation, encoder and decoder, importantcycliccodes.

UNITIII: **L – 15Hrs**

CODING AND DECODING-2: Convolutional codes- Quad tree Trellis state diagram,encoding-decoding, time domain approach and transform domain approach, SequentialsearchandViterbialgorithm,Principleofturbocoding,Cryptography,Secretkeycryptography,blockandstreamciphers,DES,dataencryptionstandard,publickeycryptography,digitalsignatures.

UNITIV: **L – 15Hrs**

DIGITALMODULATIONTECHNIQUES: PhaseShiftKeying,AmplitudeShiftKeying, Frequency Shift Keying, Coherent Detection of PSK and FSK, Non-CoherentDetection of Differential Phase Shift Keying, Binary Differential Phase Shift Keying andFSK, QPSK, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK),M-ary Signaling, Probability of Error in each Scheme, Comparison of Digital ModulationTechniques.

UNITV: **L – 15Hrs**

SPREAD SPECTRUM TECHNIQUES: Over view of Spread Spectrum Techniques, Pseudo-noise (PN) Sequences, Properties of Pseudo-noise, Sequences, Theory of Spread Spectrum Modulation, Model of Spread Spectrum Digital Communication System, Direct-Sequence Spread Spectrum (DSSS) Systems: Generation and Detection, Example of Direct Sequencing, Processing Gain and Performance, Frequency Hopping Spread-Spectrum(FHSS) Systems: Example, Robustness, Frequency Hopping with Diversity, Fast Hopping versus Slow Hopping, FFH/MFSK Demodulator.

TEXTBOOKS:

1. Digital Communications -SimonHaykin,4th Edition, JohnWiley&Sons,Inc.
2. Taub'sPrinciples of Communication Systems by HTaub, D L Schillingand G Saha, Third Edition2008, TMH Education Pvt Ltd, New Delhi.
3. Analog and Digital Communications by H wei P.Hsu, Schaum's Outline Series, Mc Graw Hill EducationPvt.Ltd

References Books

1. Bernard Sklar, Digital Communications: Fundamentals and Applications, 2nd Edition, Pearson Education.
2. John G. Proakis and MasoudSalehi, Digital Communications, 5th Edition, McGraw-Hill Education.
3. Simon Haykin, Digital Communications, 4th Edition, John Wiley & Sons.
4. B. P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, 5th Edition, Oxford University Press.
5. Taub, Schilling and Saha, Principles of Communication Systems, 3rd Edition, Tata McGraw-Hill.
6. Theodore S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education.

Web Resources

1. MIT OpenCourseWare – Digital Communication Systems
2. NPTEL – Digital Communication Course
3. Electronics Tutorials – Digital Modulation Techniques

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1	2	0
CO2	2	3	3	1	1	3	1
CO3	2	3	2	2	1	2	1
CO4	2	3	3	3	2	3	1
TotalScore	9	11	9	7	5	10	3

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	3	1	1	1	0	0
CO2	2	3	2	1	1	1	0
CO3	2	3	2	2	1	1	1
CO4	3	3	2	3	2	2	1
TotalScore	9	12	7	7	5	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-II/Core-5

MICROCONTROLLERS, EMBEDDEDSYSTEM AND IOT APPLICATIONS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Microcontrollers, Embedded System and IOT Applications	**Core Theory-5**	**6**	**0**	**-**	**-**	**5**	**6**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT

CO1	Explain the architecture, instruction sets, programming concepts, timers, interrupts, peripheral interfaces, and IoT fundamentals associated with microcontroller-based embedded systems.	K1, K2
CO2	Apply assembly language and Embedded C programming techniques to develop microcontroller-based applications using timers, interrupts, serial communication, sensors, and peripheral devices.	K3
CO3	Analyze the operation and performance of embedded systems, interfacing modules, communication protocols, and IoT devices for real-time monitoring and control applications.	K4
CO4	Design and evaluate embedded and IoT-based solutions by integrating microcontrollers, sensors, communication modules, displays, and actuators for specific engineering applications.	K5,K6

UNITI: **L – 15Hrs**

8051 MICROCONTROLLERS: Microcontrollers and Embedded Processors-Over view of the 8051 Family – 8051 Architecture – Pin Configuration of 8051- Instruction Set –Addressing Modes. 8051 Assembly Language Programming-Assembling and Running an 8051 Program - Program Counter and ROM Space on8051 - Data Types and Directives - 8051 Flag - Bits and the PSW Register – Register Banks and Stack-Timer and Counter – Interrupts.

UNITII: **L – 15Hrs**

PIC MICROCONTROLLERS: Hardware Architecture and Pipelining - ProgramMemory - Register Pile Structure and Addressing Modes - CPU Register - InstructionSet - Simple Programs. 8-bit addition, subtraction, multiplication and division, MP-ASMAssemblerandits use.

UNITIII: **L – 15Hrs**

TIMER & INTERRUPTS: Timer 2 use – Interrupt Logic – Timer 2 Sealer Initialization - Interrupt Service Routine- Loop Time Subroutine - Code Template -Interrupt Constrains - Improved Interrupt Servicing - External Interrupts and Timers –Timers 0-Compare Mode-Capture Mode.

UNITIV: **L – 15Hrs**

I/O PORT EXPANSION AND PERIPHERAL INTERFACING: Synchronous Serial Port Module- Serial Peripheral Interface- Output Port and Input Port Expansion – DAC Output –Temperature Sensor-Serial EEPROM.

UNITV: **L – 15Hrs**

APPLICATIONS OF IOT: Introduction to Arduino IDE – writing code in sketch,compiling-debugging, uploading the file to Arduino board, role of serial monitor.Embedded 'C' Language basics - Interfacing sensors – The working of digital versus analog pin sin Arduino platform, interfacing LED, Button, Sensors - DHT, LDR,MQ135, IR. Display the data on Liquid Crystal Display (LCD), interfacing keypadserial communication – interfacing HC-05(Bluetooth module)- Control/handle 220VAC supply–interfacing relay module.

TEXTBOOKS:

1. Muhammad Ali Mazidi, Jarrice Gillispie Mazidi &Rolin D. Mckinlay – The 8051Microcontroller and Embedded Systems 2nd Edition-Prentice Hall India PrivateLtd.
2. JohnPickamn- Microcontroller Based Embedded System-Pearson education
3. The 8051microcontroller & Embedded systems using Assembly and C –Kennth.J

.Ayala,DhananjayV.Gadre.

Reference Books

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. Mc Kinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2nd Edition, Pearson Education.
2. Kenneth J. Ayala and Dhananjay V. Gadre, The 8051 Microcontroller and Embedded Systems, Cengage Learning.
3. John Peatman, Design with PIC Microcontrollers, Pearson Education.
4. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 3rd Edition, McGraw Hill Education.
5. Shibu K. V., Introduction to Embedded Systems, 2nd Edition, McGraw Hill Education.
6. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley Publications.

Web Resources

1. Arduino Documentation and Tutorials
2. Microchip Developer Help – PIC Microcontrollers
3. NPTEL – Embedded Systems Design Course

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1	3	0
CO2	2	3	3	1	1	3	1
CO3	2	3	2	2	1	3	1
CO4	2	3	3	3	2	3	2
TotalScore	9	11	9	7	5	12	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	3	1	1	0	0
CO2	3	1	3	2	2	1	0
CO3	2	2	3	2	2	1	1
CO4	3	2	3	3	2	2	1
TotalScore	10	6	12	8	7	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics) /Semester-II/Core6–A:

OPTO-ELECTRONICS AND OPTICAL FIBER COMMUNICATION

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Optoelectronics and Optical Fiber Communication	**Core-6 (Anyone)**	**6**	**0**	**-**	**-**	**5**	**6**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the operating principles, characteristics, and applications of optoelectronic devices, optical fibers, optical transmitters, receivers, sensors, and communication systems.	K1, K2
CO2	Apply the concepts of optical sources, photodetectors, fiber parameters, modulation techniques, and sensing technologies in optical communication and instrumentation systems.	K3
CO3	Analyze the performance of optical fiber communication systems by evaluating dispersion, attenuation, noise, bandwidth limitations, nonlinear effects, and system design parameters.	K4
CO4	Design and evaluate optical fiber communication links and optoelectronic systems using suitable devices, transmission techniques, power budgets, and dispersion compensation methods.	K5,K6

UNITI: L – 15Hrs

OPTO ELECTRONICS-I: Lamps and illumination systems, LEDs – working principleand applications, LED lighting, Display devices, indicators, numeric, alphanumeric andspecial function displays, Liquid Crystal Display elements, Plasma Displays, Multimediaprojectors, Semiconductor lasers, - Fabry-Perot lasers, Distributed Feedback, (DFB) lasers,DistributedBragg Reflection(DBR)lasers

UNITII: L – 15Hrs

OPTOELECTRONICS-II:

Photodetectorstypesandapplications,PNandPINPhotodiodes,AvalanchePhotodiodes(APD),Opto couplers,Opto-interrupters,LASERused in safety interlocks, power isolators, rotary and linear encoders and remote control.IntrinsicandExtrinsicFiberopticsensors.

UNITIII: L – 15Hrs

OPTICALFIBER-1: Optical Fiber Theory, Parameters of Optical Fibers, Types of Optical Fibers-Single Mode and Multi-Mode Fibers, Step Index & Graded Index Fibers. Modal Properties-Waveguide Parameter (V Number), Cut-off wavelength, Dispersion-Intermodal and Intra modal dispersion. Loss Mechanism in Optical Fibers.

UNITIV: **L – 15Hrs**

OPTICAL FIBER-II: Fiber-Optic transmitters and receivers, Direct Modulators, External Modulators - Electro-Optic Modulators, Electro-Absorption Modulators, Noise in detection process, Noise Equivalent Power(NEP).

UNITV: **L – 15Hrs**

OPTICAL FIBER-III: Single Channel System Design, Power budgeting, Transmission Capacity Budgeting, Dispersion Compensation, Nonlinear effects in optical fibers-StimulatedBrillouinScattering(SBS),Self-PhaseModulation(SPM),Cross-Phase Modulation (XPM), Four-Wave Mixing(FWM).

TEXTBOOKS:

1. Optical Engineering Fundamentals B.H.Walker, PHI
2. Electro-Optical Instrumentation Sensing and Measuring with Lasers: Silvano Donati, Pearson
3. Fiberoptics and Optoelectronics: R.P.Khare, OxfordPress.
4. Optical Fiber Communication Principles and Systems A. Selvarajan, S.Kar and Srinivas,TMH

Reference Books

1. **B. H. Walker**, *Optical Engineering Fundamentals*, Prentice Hall of India (PHI).
2. **SilvanoDonati**, *Electro-Optical Instrumentation: Sensing and Measuring with Lasers*, Pearson Education.
3. **R. P. Khare**, *Fiber Optics and Optoelectronics*, Oxford University Press.
4. **A. Selvarajan, S. Kar and T. Srinivas**, *Optical Fiber Communication: Principles and Systems*, Tata McGraw-Hill Education.
5. **Gerd Keiser**, *Optical Fiber Communications*, 5th Edition, McGraw-Hill Education.
6. **John M. Senior and M. YousifJamro**, *Optical Fiber Communications: Principles and Practice*, 3rd Edition, Pearson Education.

Web Resources

1. Fiber Optic Association (FOA) – Fiber Optic Learning Center
2. RP Photonics Encyclopedia – Optoelectronics and Fiber Optics

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1	2	0
CO2	2	3	3	1	1	2	1
CO3	2	3	2	2	1	2	1
CO4	2	3	3	3	2	2	1
TotalScore	9	11	9	7	5	8	3

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	3	1	1	1	0	0
CO2	2	3	1	1	2	1	0
CO3	2	3	2	2	2	1	1
CO4	3	3	2	3	2	2	1
TotalScore	9	12	6	7	7	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-II/Core–6B:

SOLAR ENERGY SYSTEMS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Solar Energy Systems	**Core-6 (Anyone)**	**6**	**0**	**-**	**-**	**5**	**6**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the fundamentals of solar energy conversion, semiconductor physics, photovoltaic effects, solar cell materials, and advanced solar cell technologies.	K1, K2
CO2	Apply semiconductor principles and photovoltaic concepts to characterize solar cells and evaluate their performance under different operating conditions.	K3
CO3	Analyze the electrical, optical, and material properties of conventional and advanced solar cells, including thin-film, multi-junction, and nanostructured photovoltaic devices.	K4
CO4	valuate and design efficient photovoltaic systems by selecting suitable solar cell materials, structures, and emerging technologies for renewable energy applications.	K5,K6

UNITI: SOLARENERGYFUNDAMENTALS L- 15 Hrs

Nature of solar energy, conversion of solar energy, photochemical conversion of solarenergy, photovoltaic conversion, photo-physics of semiconductors and semiconductorparticles,photo-catalysis.

UNITII: FUNDAMENTALS OF SOLAR CELLS L- 15 Hrs

Basic of Semiconductor Physics- the p-n junction, charge carriers in semiconductors,opticalpropertiesofsemiconductors,Hetero-junctions.

UNITIII: SOLAR CELL: L- 15 Hrs

Different types of materials – Availability – Advantages – Disadvantages - applications. Spectral response of solar cells – Dark conductivity – I –V characterization – Introduction to physics of semiconductor devices.

UNITIV: TYPESOFSOLARCELLS L- 15 Hrs

High efficiency solar cells - PERL Si solar cell - LGBC solar cell - III-V, II-VI highefficiency solar cells - thin film technology - GaAs solar cells - tandem and multijunctionsolarcells-solarPVconcentratorcellsandsystems.

UNITV:DIFFERENT MATERIALS USED FOR SOLAR CELLSL- 15 Hrs

Nano –micro and polycrystalline Siforsolarcells-Monomicro silicon composite structure - Silicon and non-silicon thin film deposition techniques Advancedsolarcell concepts and technologies – Amorphoussiliconthin filmtechnologies - Multi junction solar cells – CDTE – CIGS - Quantum dots Peroskvite.

TEXTBOOKS

1. Solar cells: Operating principles, technology and system applications by Martin AGreen, Prentice HallInc, Engle wood Cliffs, NJ,USA,1981.
2. Semiconductors for Solarcells, HJMoller, Artech House Inc,MA,USA,1993.
3. Solid State Electronic devices ,Ben G Streetman, Prentice Hall of India Pvt Ltd., New Delhi1995.
4. Carbonnanotubesandrelatedstructures:Newmaterialfortwentyfirstcentury,PJFHarris,CambridgeUniversityPress,1999.
5. ThinkFilm crystalline silicon solar cells: Physics and technology, R.Brendel, Wiley VCH, Weinheim,2003.

REFERENCEBOOKS

1. Clean Electricity from photovoltaics,M.D.Archer,R.Hill,Imperial collegepress,2001.
2. Organic photo voltaics: Concepts and realization, V Barbec, V.Dyak
3. Fuel cell and their applications, K. Kordesch, G. Simader, VCH, Weinheim,Germany,1996.
4. Battery technology handbook, H.A.Kiehne,MarcelDekker,NewYork,1989.

Web Resources

1. National Renewable Energy Laboratory (NREL) – Solar Research
2. PV Education – Solar Cell Fundamentals and Photovoltaics
3. International Energy Agency Photovoltaic Power Systems Programme (IEA PVPS)

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	2	2	0
CO2	2	3	3	1	2	2	1
CO3	2	3	2	2	2	2	1
CO4	2	3	3	3	3	2	1
TotalScore	9	11	9	7	9	8	3

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	1	2	1	3	0	0
CO2	3	2	2	1	3	1	0

CO3	3	2	3	2	3	1	1
CO4	3	3	3	3	3	2	1
TotalScore	12	8	10	7	12	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-II/Elective–2A

ELECTROMAGNETICS, MICROWAVE AND ANTENNA

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Electromagnetic, Microwave and Antenna	Elective - 2(Anyone)	**4**	**0**	**-**	**-**	**3**	**4**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the principles of electromagnetic wave propagation, transmission lines, waveguides, microwave devices, antennas, and their associated parameters.	K1, K2
CO2	Apply electromagnetic and microwave engineering concepts to analyze transmission lines, waveguide structures, microwave components, and antenna systems.	K3
CO3	Analyze the performance of microwave circuits and antenna systems using propagation characteristics, scattering parameters, impedance matching techniques, and radiation parameters.	K4
CO4	Design and evaluate microwave communication and antenna systems by selecting suitable microwave devices, matching networks, antenna configurations, and performance optimization techniques.	K5,K6

UNITI: L- 12 Hrs

Maxwell's equations, correspondence of field and circuit equations, characteristic impedance and admittance, S-matrix, lossless and lossy Transmission lines, standingwave and standing wave ratio, impedance matching techniques like λ/4 transformer, single anddoublestubsuseof Smith's chart. Skin depth.

UNITII: L- 12 Hrs

Waveguides: propagation modes, types of waveguides, waveguide components- E andH plane T, Magic 'T' microwave couplers, matched terminations, directional couplers,circulators and isolators, Phase shifters, cables, connectors and Adapters

UNITIII: L- 12 Hrs

Microwave: Klystron and Magnetron, travelling wave tube, Microwave switches, Micro wave transistors, microwave diodes: Varactor, GUNNdiode, PINdiode, IMPATT, TRAPATT, GaAs FET.Power Thermistor, diode, shortkeydiode.

UNITIV: **L- 12 Hrs**

Antennas: Types of antennas: short dipole antennas, antenna arrays, isotropic, dipole,broadside and end fire arrays, Yagi-Uda, log periodic and rhombic antenna, Reflectorantennas, Reconfigurable antennas, Phased array antennas, Cognitive radio, MicrostripAntennas.

UNITV: **L- 12 Hrs**

Antenna parameters: S parameter, VSWR, Gain,Radiation resistance, Radiationpattern, beam width, bandwidth, efficiency, Polarization. Fris Transmission equation, Radar- cross equation

TEXTANDREFERENCEBOOKS:

1. Electromagnetic J.D. Kraus, Mc Graw Hill.
2. Microwavedevicesandcircuits: S.Y.Liao,PrenticeHall.;
3. Solid StateElectronicDevices:BenG.Streetman,PearsonPublication,seventhedition.
4. Antenna Theory: Analysis and Design: Constantine A.Balanis,Wiley Publication.4th Edition.
5. Antenna theory and design: Robert S.Elliott, Prentice- Hall Publication.
6. Broadband Microstrip Antennas :GirishKumar,K.P.Ray,Artech House Publication.
7. Microwave and Radar Engineering: M.Kulkarni, Umesh Publication.

Web Resources

1. Microwaves101 – Microwave Engineering Resources
2. Antenna-Theory.com – Antenna Theory and Design Tutorials
3. NPTEL – Electromagnetic Waves and Antennas

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1	2	0
CO2	2	3	3	1	1	2	1
CO3	2	3	2	2	1	2	1
CO4	2	3	3	3	2	2	1
TotalScore	9	11	9	7	5	8	3

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	1	2	1	1	0	0
CO2	3	2	2	1	1	1	0
CO3	3	2	3	2	1	1	1
CO4	3	3	3	3	2	2	1
TotalScore	12	8	10	7	5	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-II/Elective-2B

ARTIFICIAL INTELLIGENCE USING MACHIN ELEARNING

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Artificial Intelligence Using Machine Learning	Elective - 2 (Anyone)	**4**	**0**	**-**	**-**	**3**	**4**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the principles of Artificial Intelligence, problem-solving methods, search techniques, machine learning paradigms, and intelligent system applications.	K1, K2
CO2	Apply heuristic search methods, machine learning algorithms, regression models, neural networks, and clustering techniques to solve practical problems.	K3
CO3	Analyze the performance of AI and machine learning models using classification, regression, validation, regularization, and clustering methodologies.	K4
CO4	Design and evaluate intelligent systems using machine learning algorithms, ensemble methods, neural networks, and optimization techniques for real-world applications.	K5,K6

UNITI: L- 12 Hrs

Introduction: AI Problems – AI techniques – Criteria for success. Problems, Problem Spaces,Search: State space search – Production Systems – Problem Characteristics – Issues in design ofSearch.

UNIT–II: L- 12 Hrs

Heuristic Search techniques: Generate and Test – Hill Climbing – Best-Fist, Problem Reduction,ConstraintSatisfaction,Means-endanalysis.

UNIT–III: L- 12 Hrs

Machine Learning - Machine Learning Foundations –Overview – applications - Types of machinelearning-basicconceptsinmachinelearning-Examples ofMachineLearning-Applications

UNIT–IV: L- 12 Hrs

LinearModels:Linearclassification–univariatelinearregression–multivariatelinearregression–regularizedregression–Logisticregression–perceptions–multilayerneuralnetworks–learningneuralnetworksstructures–supportvectormachines–softmarginSVM–generalizationandoverfitting– regularization–validation

Unit –V: L- 12 Hrs

Distance-Based Models: Nearest neighbor models – K-means – clustering around medoids – silhouettes – hierarchical clustering – k- d trees – locality sensitive hashing – non - parametricregression– ensemblelearning – baggingand randomforests– boosting–metalearning.

TEXTBOOKs:

1. ElainRich&KevinKaight–ArtificialIntelligence-TataMcGrawHill–SecondEdition,

REFERENCES BOOKS:

2. Stuart Russell and Peter Norvig, "Artificial Intelligence–A Modern Approach", Fourth Edition ,Pearson Education,2021.
3. Ethem A lpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
4. DanW.Patterson,"IntroductiontoArtificialIntelligenceandExpertSystems",PearsonEdu cation,2007
5. KevinNight,Elaine Rich,andNairB.,"ArtificialIntelligence",McGrawHill,2008
6. PatrickH.Winston,"ArtificialIntelligence",ThirdEdition,PearsonEducation,2006
7. DeepakKhemani,"ArtificialIntelligence",TataMcGrawHillEducation,2013
8. TomMitchell,"MachineLearning",McGrawHill,3rdEdition,1997.
9. CharuC.Aggarwal,"DataClassificationAlgorithmsandApplications",CRCPress,2014
10. MehryarMohri,AfshinRostamizadeh,AmeetTalwalkar,"FoundationsofMachine Learning",MITPress,2012.
11. IanGoodfellow,YoshuaBengio,AaronCourville, "Deep Learning",MITPress,2016.

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1	3	0
CO2	2	3	3	1	1	3	1
CO3	2	3	2	3	1	3	1
CO4	2	3	3	3	2	3	2
TotalScore	9	11	9	8	5	12	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	3	1	1	1	0
CO2	2	3	3	2	1	2	1
CO3	2	3	3	3	1	2	1
CO4	3	3	3	3	2	3	1

TotalScore	9	11	12	9	5	8	3

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-II/Practical -3

MICROCONTROLLER'S LAB

(ANY 10 USING HARDWARE/SOFTWARE)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Microcontroller's Lab	Core Practical–3	-	-	3	-	2	3	50	50	100

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the architecture, instruction set, programming environment, and interfacing concepts of 8051 and AVR microcontrollers used in embedded systems.	K1, K2
CO2	Apply Assembly language and Embedded C programming techniques to develop and execute microcontroller-based applications involving arithmetic operations, display devices, timers, and communication interfaces.	K3
CO3	Analyze the operation and performance of microcontroller programs and interfaced peripherals such as LCDs, keypads, motors, serial devices, timers, interrupts, and PWM modules.	K4
CO4	Design, implement, test, and troubleshoot embedded system applications using 8051 and AVR microcontrollers for real-time monitoring, control, and automation tasks.	K5,K6

MICROCONTROLLER'SLAB

(ANY 10 USING HARDWARE/SOFTWARE)

List of experiments: **P- 45 Hrs**

PARTI: 8051MicroController Programming

1. Familiarize an Integrated Development Environment to create a project, Compiling anEmbeddedCprogram,AssemblingandSimulation/DebuggingINMCU8051IDE
2. Write 8051 Programs in Assembly Language to verify arithmetic and logicaloperations.
3. Write8051ProgramsinC/ AssemblyLanguagefindthelargest/smallestnumber.
4. Write8051 Programsin C/AssemblyLanguageforsorting numbersinascending/descendingorder.
5. LEDInterfacingand DelayProgramming.
6. Squarewave,TriangularandSawtoothwaveformgeneration.
7. Interfacing alphanumeric Liquid Crystal Display.
8. Interfacing4x4keypad.
9. Interfacingsevensegmentdisplay.

PARTII:AVR Experiments

1. Basic AVR Programming using Assembly OR C (usingAVR Studio/any compatibleIDE) Addition, Subtraction, Multiplication, Ascending Order, Descending Order, CodeConversion,MemorySwapping.
2. LED Interfacing and Delay Programming.
3. Interfacing16x2alphanumericLiquidCrystalDisplay.
4. Interfacing 4x4keypad.
5. Interfacingsteppermotor.
6. Interfacing seven segment display.
7. DCmotorspeedcontrol.
8. Interfacing serial devicessuchasGSMmodem/GPSsystemsetc.
9. Timerprogramming
10. Serial programming
11. Interrupthandling
12. PWM Generation

REFERENCE BOOKS:

1. Mazidi, The 8051 Microcontrollers & Embedded Systems, Pearson Education.
2. The8051Microcontroller Architecture,programmingandapplicationsbyKenneth J.Ayala,Westpublishingcompany
3. TheAVRMicrocontrollerandEmbeddedSystemsUsingAssemblyandC,ByMuhammadAli Mazidi,SarmadNaimiandSepehrNaimi,PearsonEducation.
4. Programming and customizing the AVR Micro controller, By DhananjayGadre,McGraw HillEducation
5. AVRATmega32datasheet
6. ARM System Developer's Guide -Designing and Optimizing System Software by Andrew N Sloss, Dominic Symes and Chris Wright; Morgan Kaufman publishers, animprintofElsevier
7. The Definitive Guide to the ARM Cortex -M3 - Second Edition, by Joseph yiu, NewnespublishersanimprintofElsevier
8. ARMSystem-on-ChipArchitecture,2/e,SteveFurber,Pearson

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	1	0	2	0
CO2	2	3	3	1	0	3	1
CO3	2	3	2	2	0	3	1
CO4	2	3	3	3	1	3	2
TotalScore	9	10	9	7	1	11	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7

CO1	3	2	1	1	1	0	0
CO2	3	3	2	2	1	1	0
CO3	3	3	3	2	1	1	1
CO4	3	3	3	3	2	2	1
TotalScore	12	11	9	8	5	4	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-II/Practical–4 /

EMBEDDEDSYSTEMDESIGNANDIOTLAB

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Embedded System Design and IOT Lab	Core Practical–3	**-**	**-**	**3**	**-**	**2**	**3**	**50**	**50**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain the architecture, development tools, communication protocols, peripheral interfaces, and IoT concepts used in embedded system design.	K1, K2
CO2	Apply programming techniques to implement PIC microcontroller-based applications involving ADC, DAC, PWM, displays, motors, serial communication, and sensor interfacing.	K3
CO3	Analyze the performance of embedded systems, wireless sensor networks, cloud-connected devices, and communication interfaces for real-time applications.	K4
CO4	Design, develop, and evaluate embedded and IoT solutions using PIC microcontrollers, ARM Cortex-M platforms, sensor networks, and cloud-based architectures for automation and smart systems.	K5,K6

EMBEDDED SYSTEM DESIGN AND IOT LAB
(ANY 10 USING HARDWARE/SOFTWARE)

List of experiments: **P- 45 Hrs**

PARTI: PIC16F87X BASED EMBEDDED SYSTEMS & RTOS

1. Arithmetic and Logical programs
2. Square wave generation using ports
3. Matrix Key Board &LED interfacing
4. Single digit timer using seven segment displays

5. DC motor driving via H Bridge
6. DAC interface
7. ADC INTERFACE
8. LCD interface
9. Stepper motor control
10. PWM generation
11. Compare and capture operation program
12. Serial communication using RS232C
13. PIC to PIC Communication using I2C bus

PARTII: IOT APPLICATIONS

i) WIRELESS DATA ACQUISITION USING SNSOR NODES

1. Setting up a WSN for smart home like applications
2 Implementandsimulatenetworktopologiesusingtools.
3. Connectingdevicesat theedgeand tothecloud.
4. Processingdataofflineandinthecloud.

ii) VARIOUS CONCEPTS OF EMBEDDED SYSTEM DESIGN

1. IDE's.Simulationanddevelopmenttools
2. ImplementingsimplesystemsusingARMCortexMdevices
3. Design and implement interfaces for various applications
4. Designandrealizeapplicationsystems

MAPPING of COs with POs

CO-PO Mapping (Course Articulation Matrix)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	1	0	2	0
CO2	2	3	3	1	0	3	1
CO3	2	3	2	2	1	3	1
CO4	2	3	3	3	1	3	2
TotalScore	9	10	9	7	2	11	4

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	1	1	1	0	0
CO2	3	3	2	2	1	1	0
CO3	3	3	3	2	1	2	1
CO4	3	3	3	3	2	2	1
TotalScore	12	11	9	8	5	5	2

Level of Correlation between COs and POs

0–No Correlation 1–Low 2–Medium 3–High

M.Sc (Electronics)/Semester-II/Skill Enhancement Course(SEC)-1

PCB DESIGNING TOOLS

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	PCB Designing Tools	Skill Enhancement Course (SEC)-1	**2**	**0**	**-**	**-**	**2**	**2**	**25**	**75**	**100**

Course Outcomes

COs	On completion of this course, students can able to	RBT
CO1	Explain PCB fabrication processes, schematic capture techniques, component libraries, PCB layout fundamentals, and design workflows using Altium Designer and KiCad.	K1, K2
CO2	Apply PCB design tools to create schematics, generate netlists, define design rules, place components, and perform PCB routing for electronic circuits.	K3
CO3	Analyze PCB layouts, routing strategies, layer configurations, component footprints, and manufacturing outputs to ensure design accuracy and functionality.	K4
CO4	Design, verify, and optimize complete PCB systems using Altium Designer and KiCad, including custom components, footprints, and fabrication-ready documentation.	K5,K6

UNIT-I: **Fabricating Printed Circuit Boards:** **L- 6 Hrs**

Schematic Capture – Schematic symbols – symbol properties – schematic generations – Generating a Net list – Circuit Board placement and Routing basics –placement and routing guidelines – general placement considerations – General routing considerations.

UNIT-II: ALTIUM DESIGNER-1 **L- 6 Hrs**

Creating a New PCB Project-Creating a New Schematic Sheet-Adding Schematic Sheets to a ProjectSetting the Schematic Options-Drawing the Schematic-Locating the Component and Loading theLibraries-Placing the Components on Your Schematic-Wiring up the Circuit-Nets and Net Labels-SettingUpProjectOptions- CheckingtheElectricalPropertiesofYourSchematic-CompilingtheProject.

UNIT-III: ALTIUM DESIGNER-2 **L- 6 Hrs**

Creating a New PCB Document-Transferring the Design- Updating the PCB-Designing the PCB-Setting Up the PCB Workspace-Defining the Layer Stack and Other Non-electrical Layers in a ViewConfiguration -Setting Up New Design Rules-Positioning the Components on the PCB-ManuallyRouting the Board-Automatically Routing theBoard-Viewing Your Board Design in 3D Mode-Creating and Importing 3D Bodies for Component Footprints-Verifying Your Board Design-OutputDocumentation-Manufacturing OutputFiles.

UNIT-IV: KiCad-1 **L- 6 Hrs**

KiCad Workflow-KiCadWorkflow Overview-Forward and backwardannotation-Draw electronicschematics-Using E schema-Bus connections in KiCad-Layout printed circuit boards-

Using Pcbnew-Generate Gerber files- Using GerbView-Automatically route with FreeRouter-Forward annotation inKiCad

UNIT-V: KiCad -2 **L- 6 Hrs**

Make schematic components in KiCad-Using Component Library Editor- Export, import and modifylibrary components-Make schematic components with quicklib-Make a high pin count schematiccomponent-Makecomponentfootprints-UsingFootprintEditor

TEXTBOOKS

1. J. Varteresian, Fabricating Printed Circuit Boards, Newnes Publications, 2002.
2. Altium Limited, Getting Started with PCB Design using Altium Designer, Altium Documentation.
3. https://docs.kicad.org/8.0/en/getting_started_in_kicad/getting_started_in_kicad.html

Reference Books

1. Chris Robertson, PCB Designer's Reference: Basics, Prentice Hall.
2. Klyde Morgan, Printed Circuit Board Design Techniques for EMC Compliance, IEEE Press.
3. Simon Monk, Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards, McGraw-Hill Education.
4. Peter Dalmaris, KiCad Like a Pro – PCB Design and Electronics CAD, Tech Explorations Publishing.
5. Miles Burton, Beginning KiCad: A Practical Introduction to PCB Design, Apress.

Web Resources

1. Altium Designer Documentation and PCB Design Tutorials
2. KiCad Official Documentation and Tutorials
3. https://www.4pcb.com/pcb-design-tutorial.html?utm_source=chatgpt.com

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MAPPING of COs with PSOs

CO-PSO Mapping (Course Articulation Matrix)

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TotalScore	12	10	11	8	5	4	2

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