MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI – 12

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 2023 - 2024)

TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION,

CHENNAI – 600 005

M.Sc., ELECTRONICS

Objectives:

The course content, and assessment for postgraduate (PG) degree in Electronics should be designed to develop research-oriented technocrats and entrepreneurs. The syllabus for M.Sc. Electronics programme should include a wide range of topics to suit industry and research expectations. This will help the PG students in their development as research scholars and engineers. It is important to stay up-to-date with current developments in the subject, and we believe that this program will provide the necessary skills and knowledge for success in this field.

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

Durations of the course: Two Years divided into **Four semesters**. Each semester willbe of 90 working days.

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

Theory Paper Internal Mark Distribution:

Cycle Test and Model Exam	: 15 marks
Assignment	: 5 marks
Seminar	: 5 marks

Marks For External: (Max. Marks:75, Passing minimum:38, Time:3 Hours)

Part A (10 x 1=10 marks), Answer All questions, Two questions from each unit
Part B (5 x 5=25 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: 3 Hours, Maximum Marks:50(External) and 50(Internal)

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

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

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.		Core Theory–1	Analog and Digital System Design	7	5	3	25	75	100
2.		Core Theory–2	Advanced Microprocessors	7	5	3	25	75	100
3.		Core Theory-3 (Any one)	A. Mathematical Methods and Network Analysis / B. Computer Networks	6	5	3	25	75	100
4.		Elective-1 (Any one)	A. Electronic Properties of Materials / B. Biomedical Instrumentation C. Automotive Electronics	4	3	3	25	75	100
5.		Core Practical -1	Analog Electronic Design Lab	3	1	3	50	50	100
6.		Core Practical -2	Digital Electronic Design Lab	3	1	3	50	50	100
Subtotal				**30**	**20**				**600**
SEMESTER –II									
7.		CoreTheory-4	Digital Communication System	6	5	3	25	75	100
8.		CoreTheory-5	Microcontrollers, Embedded System And IOT applications	6	5	3	25	75	100
9.		Core-6 (Any one)	A. Optoelectronics and Optical Fiber Communication / B. Solar Energy Systems	6	5	3	25	75	100
10.		Elective -2 (Any one)	A. Electromagnetics, Microwave and Antenna / B. Artificial Intelligence Using Machine Learning	4	3	3	25	75	100
11.		Core Practical– 3	Microcontroller's Lab	2	1	3	50	50	100
12.		Core Practical– 4	Embedded System Design and IoT Lab	2	1	3	50	50	100
13.		Skill Enhancement course (SEC)-1	PCB Designing Tools	4	2	3	25	75	100
Subtotal				**30**	**22**				**700**
SEMESTER –III									
14		Core Theory-7	Advanced Power Electronics and Virtual Instrumentation	6	5	3	25	75	100

15		Core Theory-8	bile, Optical and DataCommunication stems	6	5	3	25	75	100
16		Core -9 (Any one)	A. Research Methodology B. Smart manufacturing	6	5	3	25	75	100
17		Elective-3 (Any one) - Industry module	A. Digital Signal and ImageProcessing / B. 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	DSP MAT 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 (Any one)	Internship / Industrial Activity	0	2	-	25	75	100
Subtotal				**30**	**26**				**800**
SEMESTER –IV									
22.		Core Theory-11	Introduction of 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 (Any one)	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			
29.		Extension Activity-1	Extension Activity – Human Rights	-	1	-	-	-	-
Subtotal				**30**	**23**	**-**	**-**		**700**
TOTAL				**120**	**93**				**2800**

Program Educational Objectives (PEOs)	
The M. Sc. Electronics and Communication program should describe the accomplishments that graduates are expected to attain within seven years after graduation. This will help students set goals and align their efforts towards achieving success in their careers. It is essential to have a clear understanding of the expectations of the industry and research field to be able to make informed decisions and plan for the future. By designing the program with this in mind, graduates will be well-equipped to tackle the challenges and opportunities they may encounter in their professional lives	
PEO1	To provide the necessary foundation and advanced techniques on computational and software platforms related to the field of Electronics and Communication
PEO2	Keep themselves abreast of new research developments in the field of Electronics and Communication
Program Outcomes (POs)	
On successful completion of the M. Sc. Electronics and Communication program	
PO1	Understand and apply the Electro Magnetic theory, communication, advanced microprocessor, VLSI Design, Medical Electronics and image Processing concepts of Electronics and Communication.
PO2	Identify, analyze and solve the Electronics and medical Instrumentation problem the imported tools.
PO3	Understand, analyze and apply Embedded Systems, LabVIEW, VLSI Design, Automation concepts in various industrial applications.
PO4	Understanding and executing of Electronics and Instrumentation principles and to apply these to one's own work as a member / leader in a team to manage Electronics / Instrumentation / Mobile communication and Robotics Automation projects.
PO5	Self and life-long learning, keeping pace with advanced technological challenges in the broadest sense.
PO6	Ability to analyze complex problems in Communication domain and recommend right solutions with acquired mastery technical knowledge in Electronics and Instrumentation.
PO7	Applying the knowledge to acquired research methods including design of experiments, analysis and interpretation of data and synthesis of information and to arrive at significant conclusion.
PO8	An ability to independently carry out research and developmental work and arrive at well-founded solutions for complex Electronics and e-vehicle problems
PO9	Select and apply relevant techniques, Engineering and IT tools for Engineering activities like modeling and control of systems/processes and also being Conscious of the limitations.
PO10	Comprehend professional and ethical responsibility in the field of Electronics and communication.

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

ANALOG AND DIGITAL SYSTEM DESIGN

OBJECTIVES: To acquire and understand the basic knowledge of analog circuits and digital logic design

CO1	Understand and analyze about the P-SPICE tool and applications.	K1, K4
CO2	Comprehend the characteristics of various amplifiers and characteristics	K2, K4
CO3	Analyze the BJT and FET concepts and its applications.	K3, K5
CO4	Analyze conversion concepts and PLL.	K2, K4, K5
CO5	Develop digital system design and memory concepts.	K2, K3, K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create		

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**P O7**	**PO8**	**PO 9**	**PO10**
CO1	S	M	S	M	S	M	S	S	S	S
CO2	S	S	S	M	S	M	S	S	S	S
CO3	M	M	S	M	S	M	M	S	M	S
CO4	S	M	S	M	M	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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.

UNIT VI

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

TEXT AND REFERENCE BOOKS:

1. Analysis and Design of Analog Integrated Circuits: Grey and Mayer.

2. Electronic Circuit analysis and design: D.A.Neaman, Mc GrawHill.
3.Microelectronic Circuits Analysis and Design: Rashid PW Spub.
4.Electronic Devices and circuit theory: R. L Boylestad and L.Nashelsky ,Pearson
5.M.Mano,Digital Logic and Computer Design ,Prentice-Hall India.
6.M.Morris Mano, Michael D.Ciletti,"Digital Design", Pearson,2013. 7.Tocci, Wedmer and Moss, "Digital systems principles and applications",10th edition Pearson

COURSE RESULTS: Analog and digital system design is must for students to construct their own design in electronics.

M.Sc., Electronics / Semester-I/Core-2

ADVANCED MICROPROCESSORS

OBJECTIVES: Study of architecture, features and programming of 8086 and advanced microprocessors

Expected Course Outcomes (CO):

After the completion of the course, the student will be able to:

CO1	Understand and analyze about the various register and architecture concepts.	K3,K4
CO2	Analyze the Pentium I, II, III and IV processors with memory management systems.	K2,K5
CO3	Analyze the CISC and RISC processors and SPARC family.	K3,K4
CO4	Design and analysis of RISC processors and its architectures.	K2,K4, K5
CO5	Analyze the architecture of Special Purpose Processors and Its applications.	K2,K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

*S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	M	S	S	S	M
CO2	S	M	M	M	S	M	S	S	M	S
CO3	S	M	S	M	S	M	S	M	S	S
CO4	M	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

CISC PRINCIPLES: Classic CISC microprocessors, Intelx86Family: Architecture-register set – Data formats - Addressing modes - Instruction set - Assembler directives – Interrupts, Segmentation, Paging, Real and Virtual mode execution– Protection mechanism, Task management 80186,286,386 and 486 architectures.

UNIT II

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 Pentium4 microprocessors.

UNIT III

RISC PRINCIPLES: RISC Vs CISC – RISC properties and evaluation – On- chip register File Vs Cache evaluation – Study of typical RISC processor – The PowerPC – Architecture &special features – Power PC 601 – IBM RS/6000, Sun PARC Family – Architecture – Super SPARC.

UNIT-IV

RISC PROCESSOR: MIPS Rx000 family – Architecture – Special features – MIPSR4000 and R4400– Motorola 88000 Family–Architecture–MC 88110–MC88100 and MC88200.

UNIT V

SPECIAL PURPOSE PROCESSORS: EPIC Architecture–ASIPs–Network Processors–DSPs– Graphics /Image Processors.

TEXTANDREFERENCEBOOKS:

1. Daniel Tabak, "Advanced Microprocessors", Tata McGraw-Hill, 1995, 2nd Edition.
2. The80x86 family John Uffenbeck-Design, Programming and Interfacing, III edition.

COURSE RESULTS: Students can understand the need of microprocessors and their features.

M.Sc . Electronics / Semester-I / Core 3-A:

MATHEMATICAL METHODS AND NETWORK ANALYSIS

OBJECTIVES: This course is to familiarize students with a range of mathematical methods and networks and these are essential for solving problems related to electronics.

CO1	Understand and analyze about elementary transformations and application of Cayley and Reduction of quadratic form into sum of squares.	K3,K4
CO2	Analyze the Double integrals and - Introduction to Signal sand Systems,	K2,K5
CO3	Analyze the Statistics and Transform Functions.	K3,K4
CO4	Design and analysis of Network elements.	K2,K4, K5
CO5	Analyze the Fourier Series and its applications.	K2,K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

*S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	S	S	S	S	S
CO2	S	S	M	M	S	M	S	S	M	S
CO3	S	M	S	M	S	M	S	M	S	S
CO4	S	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

MATRIX: Elementary transformation–finding inverse and rank using elementary transformation–solution of line equations using elementary transformations–Eigen values and eigenvectors – application of Cayley-Hamilton theorem – Diagonalization – Reduction of quadratic form into sum of squares using orthogonal transformation–nature of quadratic form.

UNIT II

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

UNIT III

STATISTICS AND TRANSFORM FUNCTIONS: Introduction to Statistics, Population and Sample, Types of Data, Measures of Central Tendency, Measures of Dispersion and Discrete Probability Distribution, Laplace transform and its applications, Analysis of LTI Continuous Time System using Laplace Transform, Z-Transform.

UNIT IV

NETWORK ANALYSIS: Network elements, Network Graphs, Nodal and Mesh analysis, Zero and Poles, Bode Plots, Laplace transforms, Two-port Network Parameters, Transfer functions, Signal representation. State variable method of circuit analysis.AC circuit analysis, Transient analysis

UNIT V

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

TEXTAND REFERENCE BOOKS:

1. Advanced Engg. Mathematics, Erwin Kreyszig, Willey Publication, 10th Edition
2. Higher Engg. Mathematics G rewal B.S., Khanna Publishers
3. Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. 1, The World PressPvt. Ltd., Kolkata.
4. Millerand Fruend: Modern Elementary Statistics. PEARSON publication.
5. Snedecor and Cochran:Statistical Methods, Oxford and IBH Publishers.
6. Engg. Mathematics: N.P.Bali
7. Laplace and Fourier Transforms, Goyaland Gupta
8. Advanced Mathematics for engineers: .S.Sokolinokoff
9. Methods of Applied Mathematics: F.B. Hilderbrand.
10. Mathematical methods for Physics: Arfken A.G. Academic Press.
11. Digital Signal Processing: SanjitMitra, Mc graw Higher Ed publication.
12. Mathematical methods for physicists and Engineers: M.A. Boas
13. Network Analysis: Von Valkenberg, PEARSON

COURSE RESULTS: The students will be able to solve various differential equations, functions, signals, networks, Fourier series and integral transformations, etc.,

M.Sc . Electronics / Semester-I/Core 3-B:

COMPUTER NETWORKS

OBJECTIVES: Learn the concepts of N/W communication network protocols, different communication layer structure and security mechanism for data communication system.

CO1	Understand and analyze about OSI and TCP/IP architecture concepts.	K3,K4
CO2	Analyze the multiplexing and switching management systems.	K1, K5
CO3	Analyze the various protocols family.	K3, K4
CO4	Design and analysis of QOS and layer support and control.	K2, K4, K5
CO5	Analyze the security and Its applications.	K2, K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

*S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	M	S	S	S	S
CO2	S	M	M	M	S	M	S	S	M	S
CO3	S	M	S	M	S	M	S	M	S	S
CO4	M	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT - I

Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP models – Example networks: Internet, 3G Mobile phone networks, Wireless LANs –RFID and sensor networks - Physical layer – Theoretical basis for data communication - guided transmission media

UNIT - II

Wireless transmission – Communication Satellites – Digital modulation and multiplexing - Telephones network structure – local loop, trunks and multiplexing, switching. Data link layer: Design issues – error detection and correction.

UNIT - III

Elementary data link protocols – sliding window protocols – Example Data Link protocols – Packet over SONET, ADSL - Medium Access Layer–Channel Allocation Problem– Multiple Access Protocols.

UNIT - IV

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

UNIT - V

Transport layer – transport service- Elements of transport protocol - Addressing, Establishing & Releasing a connection– Error control, flow control, multiplexing and crash recovery - Internet Transport Protocol – TCP- Network Security: Cryptography.

Text Book:

1. S. Tanenbaum, 2011, Computer Networks, Fifth Edition, Pearson Education, Inc.
2. References Books:
3. B. Forouzan, 1998, Introduction to Data Communications in Networking, Tata McGraw Hill, New Delhi.
4. F.Halsall,1995, Data Communications, Computer Networks and Open Systems, Addison Wessley.
5. D. Bertsekas and R. Gallagher, 1992, Data Networks, Prentice Hall of India,New Delhi.
6. Lamarca, 2002, Communication Networks, Tata McGraw Hill, New Delhi.
7. TeresaC Piliouras,"Network Design Management and Technical Perspectives, Second Edition", Auerbach Publishers, 2015.

COURSE RESULTS: Students will be able to master in the concepts of protocols, network interfaces, and designing performance issues in local area networks and wide area networks.

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

ELECTRONIC PROPERTIES OF MATERIALS

OBJECTIVES: To understand the basic electronic properties of materials to explore the novel devices in electronics industries.

CO1	Understand and analyze about the various properties, characteristics and applications of materials.	K2,K4
CO2	Comprehend the characteristics of various like piezo, ferro and anti ferro with its applications.	K2,K4
CO3	Analyze the Optical properties of materials inter and intra bond concepts.	K3,K4
CO4	Analyze the Magnetic Properties of Materials	K1,K4 ,K5
CO5	Develop an ability to differentiate Materials Properties at Nanoscale.	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

*S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**P O7**	**PO8**	**PO 9**	**PO1 0**
CO1	S	M	S	M	S	M	S	M	S	S
CO2	S	M	S	M	S	S	S	S	S	S
CO3	S	M	S	S	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	M	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

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

UNIT II

Dielectric Properties of materials: Macroscopic electric field, local electric field at an atom, dielectric constant and polarizability, ferro electricity, anti-ferroelectricity, phase transition, piezoelectricity, ferro elasticity, electrostriction.

UNIT III

Optical properties of materials: Optical constants and their physical significance, Kramers – Kronig Relations, Electronic intern bond and intra bond transitions Relations between Optical properties and band structure – colour of material (Frenkel Excitons), Bond Structure determination from optical spectra reflection, refraction, diffraction, scattering, dispersion, photoluminescence, Electroluminescence.

UNIT IV

Magnetic Properties of Materials: Diamagnetism, Para magnetism, various contributions to par and dia-magnetism, Adia-batic demagnetization, Paramagnetic susceptibility. Ferromagnetism, ferrimagnetism, ferrites, anti-ferromagnetism, curic point, temperature dependence of saturation magnetization, saturation magnetization at absolute zero, magnons and their thermal excitation, dispersion relation, Neutron Magnetic scattering, Ferrimagnetic and anti-ferrimagnetic order, domains and domain walls, magnetic resonance. Coercive force, hysteresis, methods for parameters measurements.

UNIT V

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-Effect of nano dimensions on material behavior (magnetic, electrical, optical and thermal properties).

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, McGraw Higher Ed Publication
5.Elementary Solid-state physics, M. Ali Omar; Pearson Publication.
6.Nanotechnology: The Science of Small-M.A Shah & K.A Shah, Wiley Publication -First Edition 2013

COURSE RESULTS: The knowledge of materials in electronics should be useful to students for further device development.

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

BIOMEDICAL INSTRUMENTATION

OBJECTIVES: To understand the basics of bio medical instrumentation system, amplifiers, sensorand medical scanning system.

CO1	Understand and analyze about the basics of biological systems, respiratory, and bio potential electrodes.	K3,K4
CO2	Update and understand the new concepts implemented in ECG, EMG, ERG, EOG and its applications.	K2,K4
CO3	Analyze the Non electrical parameter measurements concepts.	K3,K4
CO4	Analyze the Magnetic imaging systems.	K1,K4,K5
CO5	Develop an ability to differentiate therapeutic device and its applications.	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create		

*S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**P O7**	**PO8**	**PO 9**	**PO1 0**
CO1	S	M	S	M	S	M	S	M	S	S
CO2	M	M	S	M	S	S	S	S	S	S
CO3	S	M	S	S	S	M	S	S	S	S
CO4	S	M	S	M	M	M	S	S	M	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT1

Physiology and transducers: Man instrument system, Cell and its structure, resting and action potential, propagation of action potentials, the heart and cardiovascular system, electrophysiology of cardiovascular system, physiology of the respiratory system, nervous system, Electrode theory, bio potential electrodes

UNIT II

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

UNIT III

Non electrical parameter measurements

Measurement of blood pressure, blood flow and cardiac output, plethysmography Measurement of heart sounds, Gas Analyzers, Blood gas analyzers, Oximeters

UNIT IV

Medical Imaging and Telemetry
X-ray machine, Echocardiography, computer tomography, MRI, Diagnostic ultrasound, PET,SPECT, Electrical impedance tomography, thermography, biotelemetry

UNIT V

Assisting and therapeutic device: Pacemakers, Defibrillators, Ventilator, Heart lung machine, Kidney machine, Diathermy, endoscopes, Lasers applications in biomedicine.

TEXT BOOKS

1. Leslie Cromwell, Fred, J. Weibell and Erich A. Pleiffer, " Biomedical Instrumentation and
2. Measurements" 2nd Edition, Prentice Hall of India, 2014
3. Kandpur, R.S. "Handbook of Biomedical Instrumentation" 2nd Edition, Tata Mc Graw Hill,2011
4. K.S.Fu,R.C. Gonazlez, CSG, Lee Robotics, Control sensing vision and intelligence, Tata McGraw Hill 2008
5. M.Arumugam, "Biomedical Instrumentation" Anuradha Publications, 2015

REFERENCE BOOKS

1. John G. Webster, Editor, "Medical Instrumentation, Application and Design" John Wiley and Sons Inc. 2009
2. Morelli S Salerno S, Ahmed H, Piscioneri A, DeBartolo L, "Recent strategies combining biomaterials and Stem cells for bone, liver and skin Regenerations" Current stem cell Research & therapy, 2016

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

AUTOMOTIVE ELECTRONICS

OBJECTIVES: To know fundamentals of Automotive Electronics, fuel injection and ignition systems, provide knowledge about application of electronics in Automobile engineering, impart knowledge about automotive engines.

CO1	Understanding and analyzing the concepts of ignition, stroke, break and steering systems.	K2, K3
CO2	Justification of starting, ignition and fuel consumptions concepts.	K3, K4, K5
CO3	Know the applications of fuel injection programming and controls.	K3, K6
CO4	Ability and to understand ABS, seat belt application and anti-lock braking systems.	K4, K6
CO5	Designing and understanding of Protocols CAN, LIN, Flexray, J1850 and Wi-Fi.	K5, K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create		

*S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	M	S	M	S	M
CO2	M	M	S	M	S	S	S	S	S	M
CO3	S	M	S	S	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	M	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I: Automotive Fundamental: Evolution –Physical Configuration –Automotive Systems - Engine–Engine Block –Cylinder Head –4 Stroke Cycle -Engine Control –Ignition System – Ignition, Timing –Suspension –Brakes –Steering System.

UNIT II: Ignition Systems Starting Systems -Requirements of the Starting Systems - Ignition Systems: Fundamentals –Types –Generation –Timing –Fuel Consumption –Conventional Ignition Components –Plug Leads –Ignition Coil Cores -Introduction to Electronic Ignition system.

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

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

UNIT V: Traction Control – Functions –System Operation –Safety Systems: Central Locking - Electric Windows – Airbags and Belt Tensioners- Wi-Fi.

TEXT BOOKS

1. William B. Ribbens, "Understanding Automotive Electronics", Society of Automotive Engineers Inc, 6thEdition, 2002
2. Tom Denton, "Automobile Electrical and Electronic Systems", Elsevier Publications Ltd., 4thEdition, 2011.

REFERENCES BOOKS

1. www.flexray.com
2. www.can-cia.org

M.Sc. Electronics and Communication/Semester-I/ Practical-1

ANALOG ELECTRONIC DESIGN LAB (ANY 10 USING HARDWARE /SOFTWARE)

OBJECTIVES: To get the practical training in analog electronic circuit design.
List of experiments consists of:

1. Waveform generators: Multivibrators- Astable
2. Monostable
3. Bistable
4. Triangular wave generator (Using op-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. IGMF filters, Low pass filters-High pass filters- Band pass filters -Band reject filters Universal filters Communication:
11. Frequency modulation using PLL
12. PAM using OP AMP
13. Amplitude modulation using OP AMP
14. Frequency shift keying by PLL
15. Simulation of inductance using OPAMP
16. Negative impedance converter
17. Frequency multiplication by using PLL

COURSE RESULTS: Students can able to troubleshoot the analog electronic circuit design experiments with various applications.

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

DIGITAL ELECTRONIC DESIGN LAB

(ANY 10 USING HARDWARE /SOFTWARE)

1. Astable- Timer experiments using 555 timer.
2. Monostable -Timer experiments using 555 timer Study of IC's. Use bread boards.
3. Astable multivibrator using logic gates.
4. monostable multivibrator using logic gates

Study of combinational, sequential & CMOS circuits (Using SPICE)

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

Sequential Circuits

13. Flip-Flops (RS and JK)
14. Shift Registers.
15. Binary Counters
16. Ring counters

Sequence Generations.

17. Universal Gates.
18. Boolean Expressions.

COURSE RESULTS: Students can able to troubleshoot digital electronic circuit design experiments with bread board**.**

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

DIGITAL COMMUNICATION SYSTEM

OBJECTIVES: To understand information theory and coding, familiarize various coding techniques and methods and understand convolution codes and cryptography

CO1	Understand and analyze about the various digital coding concepts.	K2, K4
CO2	Analyze The Concepts Of coding and decoding of data.	K3, K5
CO3	Analyze the cryptography and digital data concepts.	K3, K4
CO4	Design and analysis of digital modulation and demodulation commutation techniques	K1, K4,K5
CO5	Analyze spread spectrum concepts and its types.	K2, K3, k5
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	M	S	S	S	M
CO2	S	M	S	M	S	M	S	S	S	S
CO3	S	M	S	M	S	M	S	S	S	S
CO4	M	M	S	M	S	S	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

INTRODUCTION: Information, Entropy, Information rate, Classification of codes, Kraft McMillan inequality, source coding theorem, Shanon-Fano coding, Huffmann coding, Extended Huffmann coding, Shanon's channel capacity theorem, joint and conditional entropy, mutual information, discrete memory-less channel, BSC, BEC

UNIT II

CODING AND DECODING-1: Hamming weight, Hamming distance, Types of codes, Linear Block codes, Repetition codes, Syndrome decoding, Syndrome property, minimum distance decoding, Cyclic codes, Syndrome calculation, encoder and decoder, important cyclic codes.

UNIT III

CODING AND DECODING-2: Convolutional codes- Quad tree Trellis state diagram, encoding-decoding, time domain approach and transform domain approach, Sequential search and Viterbi algorithm, Principle of turbo coding, Cryptography, Secret key cryptography, block and stream ciphers, DES, data encryption standard, public key cryptography, digital signatures.

UNIT IV

DIGITAL MODULATION TECHNIQUES: Phase Shift Keying, Amplitude Shift Keying, Frequency Shift Keying, Coherent Detection of PSK and FSK, Non-Coherent Detection of Differential Phase Shift Keying, Binary Differential Phase Shift Keying and FSK, QPSK, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK), M-ary Signaling, Probability of Error in each Scheme, Comparison of Digital Modulation Techniques.

UNIT V:

SPREAD SPECTRUM TECHNIQUES: Overview 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.

TEXT BOOKS:

1. Digital Communications - Simon Haykin, 4th Edition, John Wiley & Sons, Inc.
2. Taub's Principles of Communication Systems by H Taub, D L Schilling and G Saha, Third Edition 2008, TMH Education Pvt Ltd, New Delhi.
3. Analog and Digital Communications by Hwei P. Hsu, Schaum's Outline Series, McGraw Hill Education Pvt. Ltd.

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

MICROCONTROLLERS, EMBEDDED SYSTEM AND IoT APPLICATIONS

OBJECTIVES: To familiarize the students in microcontrollers, embedded concepts and Internet of Things (IoT) applications.

CO1	Understand and analyze 8051 ARCHITECTURE concepts.	K1, K3
CO2	Analyze The Concepts Of PIC. .	K2, K5
CO3	Analyze The timer and interrupts concepts.	K3, K4
CO4	Design and analysis of port and interfacing techniques	K1, K4, K5
CO5	Analyze the IOT concepts and its applications.	K2, K3, K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	S	M	S	M	S	S	S	M
CO2	S	M	S	M	S	M	S	S	S	S
CO3	S	M	S	M	S	M	S	S	M	S
CO4	S	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT 1

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

UNIT II

PIC MICROCONTROLLERS: Hardware Architecture and Pipelining - Program Memory - Register Pile Structure and Addressing Modes - CPU Register - Instruction Set - Simple Programs. 8-bit addition, subtraction, multiplication and division, MP-ASM Assembler and its use.

UNIT III

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 - Timers0 - Compare Mode - Capture Mode.

UNIT IV

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.

UNIT V

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 pins in Arduino platform, interfacing LED, Button, Sensors-DHT, LDR, MQ135, IR. Display the data on Liquid Crystal Display (LCD), interfacing keypad serial communication – interfacing HC-05(Bluetooth module)- Control/handle 220V AC supply – interfacing relay module.

TEXT AND REFERENCE BOOKS:

1. Muhammad Ali Mazidi, Jarrice Gillispie Mazidi & Rolin D. Mckinlay - The 8051Microcontroller and Embedded Systems 2nd Edition-Prentice Hall India Private Ltd.
2. John Pickamn - Microcontroller Based Embedded System - Pearson education
3. The 8051 microcontroller & embedded systems using assembly and C –Kennth. J .Ayala, Dhananjay V.Gadre.

COURSE RESULTS: The students shall be able to develop embedded application.

M.Sc. Electronics / Semester -II / Core 6 – A:

OPTO-ELECTRONICS AND OPTICAL FIBER COMMUNICATION

OBJECTIVES:
Understand the basic operating principles of light sources, detectors. Basic principles of light propagation and modal analyses of optical fiber and system modulation.

CO1	Understand and analyze about the opto-device and Laser applications.	K1, K4
CO2	Analyze the concepts of diodes and detectors and its Types.	K2, K5
CO3	Analyze The fibers and its applications concepts.	K2, K4
CO4	Design and analysis of optical modulators and detectors.	K3, K4,K5
CO5	Analyze the transmission of signals and modulator concepts.	K2, K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	M	S	S	S	S
CO2	M	M	S	M	S	M	S	S	S	S
CO3	S	M	S	M	S	M	S	S	S	S
CO4	M	M	S	M	S	M	S	S	M	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I
OPTO ELECTRONICS-I: Lamps and illumination systems, LEDs – working principle and applications, LED lighting, Display devices, indicators, numeric, alphanumeric and special function displays, Liquid Crystal Display elements, Plasma Displays, Multimedia projectors, Semiconductor lasers, - Fabry-Perot lasers, Distributed Feedback, (DFB) lasers, Distributed Bragg Reflection (DBR) lasers

UNIT II
OPTOELECTRONICS-II: Photo detectors types and applications, PN and PIN Photodiodes, Avalanche Photodiodes (APD), Optocouplers, Opto-interrupters, LASER used in safety interlocks, power isolators, rotary and linear encoders and remote control. Intrinsic and Extrinsic Fiber optic sensors.

UNIT III
OPTICAL FIBER-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.

UNIT IV

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).

UNIT V

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

TEXT AND REFERENCE BOOKS:

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

COURSE RESULTS: Students can get awareness about optical sources, fiber optics and optical communication through fibers.

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

SOLAR ENERGY SYSTEM

OBJECTIVES: To learn the concept of various materials using for photovoltaic cells and get exposure of latest developments in PV technology.

CO1	Understand the fundamentals of solar energy concepts.	K1,K4
CO2	Analyze the Concepts Of properties of semiconductors and types.	K2,K5
CO3	Analyze the Advantages – Disadvantages - applications. Concepts.	K3,K4
CO4	Design and analysis efficiency techniques	K1, K4,K5
CO5	analyze the materials used for solar cells and its applications.	K2, K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	M	S	S	S	S
CO2	S	M	S	M	S	M	S	S	S	S
CO3	M	M	S	M	S	M	S	S	S	M
CO4	S	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I SOLAR ENERGY FUNDAMENTALS

Nature of solar energy, conversion of solar energy, photochemical conversion of solar energy, photovoltaic conversion, photo-physics of semiconductors and semiconductor particles, photo-catalysis.

UNIT II FUNDAMENTALS OF SOLAR CELLS

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

UNIT III SOLAR CELL:

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

UNIT IV TYPES OF SOLAR CELLS

High efficiency solar cells - PERL Si solar cell - LGBC solar cell - III-V, II-VI high efficiency solar cells - thin film technology - GaAs solar cells - tandem and multi junction solar cells - solar PV concentrator cells and systems.

UNIT V DIFFERENT MATERIALS USED FOR SOLAR CELLS

Nano - micro and poly crystalline Si for solar cells - Mono micro silicon composite structure - Silicon and non-silicon thin film deposition techniques Advanced solar cell concepts and technologies – Amorphous silicon thin film technologies - Multi junction solar cells – CDTE – CIGS - Quantum dots Peroskvite.

TEXT BOOKS

1. Solar cells: Operating principles, technology and system applications by Martin A Green, Prentice Hall Inc, Englewood Cliffs, NJ, USA, 1981.
2. Semiconductors for solar cells, HJ Moller, Artech House Inc, MA, USA, 1993.
3. Solid State electronic devices, Ben G Streetman, Prentice Hall of India Pvt Ltd., New Delhi 1995.
4. Carbon nanotubes and related structures: New material for twenty first century, PJF Harris, Cambridge University Press, 1999.
5. Think Film crystalline silicon solar cells: Physics and technology, R. Brendel, Wiley VCH, Weinheim, 2003.

REFERENCE BOOKS

1. Clean Electricity from photovoltaics, M. D. Archer, R. Hill, Imperial college press, 2001.
2. Organic photovoltaics: 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, Marcel Dekker, New York, 1989.

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

ELECTRO MAGNETICS, MICROWAVE AND ANTENNA

OBJECTIVES: It is intended as a resource for understanding electromagnetics required in current, emerging and future broadband communications systems essential for solving problems in electronics.

CO1	Understand the Maxwell equations and characteristics concepts.	K3, K4
CO2	Analyze the propagation modes, types of waveguides, waveguide components,	K2, K5
CO3	Analyze the wave tube and special diodes Functions.	K3,K4
CO4	Design and analysis of antennas and micro strip antennas.	K1, K4, K5
CO5	Analyze the Antenna parameters and applications.	K2, K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

*S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	S	M	S	S	S	S	S	S
CO2	S	S	M	M	S	M	S	S	M	M
CO3	S	M	S	M	S	M	S	M	S	S
CO4	S	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

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

UNIT II

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

UNIT III

Microwave: Klystron and Magnetron, travelling wave tube, Microwave switches, Microwave transistors, microwave diodes: Varactor, GUNN diode, PIN diode, IMPATT, TRAPATT, GaAs FET. Power Thermistor, diode, short key diode.

UNIT IV

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

UNIT V

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

TEXT AND REFERENCE BOOKS:

1. Electromagnetic: J.D. Kraus, McGraw Hill.
2. Microwave devices and circuits: S.Y. Liao, Prentice Hall.;
3. Solid State Electronic Devices: Ben G. Streetman, Pearson Publication, seventh edition.
4. Antenna Theory: Analysis and Design: Constantine A. Balanis, WileyPublication.4th edition.
5. Antenna theory and design: Robert S. Elliott, Prentice-Hall publication.
6. Broadband Micro strip Antennas: Girish Kumar, K. P. Ray, Artech Housepublication.
7. Microwave and Radar Engineering: M. Kulkarni, Umesh Publication.

COURSE RESULTS: It's a foundation of electronic communication systems.

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

ARTIFICIAL INTELLIGENCE USING MACHINE LEARNING

OBJECTIVES: Artificial Intelligence and machine learning techniques and make the students to understand Machine Learning Models and Enrich the student skill in suggesting machine learning strategy applicable to the given problems.

CO1	Understanding AI problems and techniques	K3,K4
CO2	Understanding searching techniques	K2,K5
CO3	Acquiring knowledge about basics of machine learning`	K3,K4
CO4	Understand Linear Classification, Understand Multilayer neural Networks, Understand and analyze SVM and Soft SVM.	K1,K4,K5
CO5	Understanding nearest neighbor models, k-means clustering, k-d trees, Meta learning`	K2,K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

*S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	S	M	S	S	S	S	S	S
CO2	S	S	M	M	S	M	S	S	M	M
CO3	S	M	S	M	S	M	S	M	S	S
CO4	S	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

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

UNIT - II

Heuristic Search techniques: Generate and Test – Hill Climbing – Best-Fist, Problem Reduction, Constraint Satisfaction, Means-end analysis.

UNIT - III

Machine Learning - Machine Learning Foundations –Overview – applications - Types of machine learning - basic concepts in machine learning- Examples of Machine Learning - Applications

UNIT - IV

Linear Models: Linear classification – univariate linear regression – multivariate linear regression – regularized regression – Logistic regression – perceptions – multilayer neural networks – learning neural networks structures – support vector machines – soft margin SVM – generalization and over fitting – regularization – validation

Unit - V

Distance-Based Models: Nearest neighbor models – K-means – clustering around medoids – silhouettes – hierarchical clustering – k- d trees – locality sensitive hashing – non - parametric regression – ensemble learning – bagging and random forests – boosting – meta learning.

TEXT BOOKs:

1. Elain Rich & Kevin Kaight – Artificial Intelligence - Tata McGraw Hill – Second Edition,

REFERENCES BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
3. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PearsonEducation,2007
4. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
5. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
6. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013
7. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition,1997.
8. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014
9. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
10. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

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

MICROCONTROLLER'S LAB

(ANY 10 USING HARDWARE /SOFTWARE)

OBJECTIVES: To get an in-depth knowledge on 8051 Microcontroller programming and its interfacing, and understand the programming and interfacing of AVR microcontroller

PART I: 8051 Micro Controller Programming

1. Familiarize an Integrated Development Environment to create a project, Compiling an Embedded C program, Assembling and Simulation/Debugging IN MCU 8051 IDE
2. Write 8051 Programs in Assembly Language to verify arithmetic and logical operations.
3. Write 8051 Programs in C/ Assembly Language find the largest/smallest number.
4. Write 8051 Programs in C/ Assembly Language for sorting numbers in ascending/descending order.
5. LED Interfacing and Delay Programming.
6. Square wave, Triangular and Sawtooth wave form generation.
7. Interfacing alphanumeric Liquid Crystal Display.
8. Interfacing 4x4 keypad.
9. Interfacing seven segment display.

PART II: AVR Experiments

1. Basic AVR Programming using Assembly OR C (using AVR Studio/any compatible IDE) Addition, Subtraction, Multiplication, Ascending Order, Descending Order, Code Conversion, Memory Swapping.
2. LED Interfacing and Delay Programming.
3. Interfacing 16x2 alphanumeric Liquid Crystal Display.
4. Interfacing 4x4 keypad.
5. Interfacing stepper motor.
6. Interfacing seven segment display.
7. DC motor speed control.
8. Interfacing serial devices such as GSM modem/GPS systems etc.
9. Timer programming
10. Serial programming
11. Interrupt handling
12. PWM Generation

REFERENCE BOOKS:

1. Mazidi, The 8051 Microcontrollers & Embedded Systems, Pearson Education.
2. The 8051 Microcontroller Architecture, programming and applications by Kenneth J. Ayala, West publishing company
3. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.
3. Programming and customizing the AVR Micro controller, By Dhananjay Gadre, McGraw Hill Education
4. AVR ATmega32 data sheet
5. ARM System Developer's Guide -Designing and Optimizing System Software by Andrew N Sloss, Dominic Symes and Chris Wright; Morgan Kaufman publishers, an imprint of Elsevier
7. The Definitive Guide to the ARM Cortex -M3 - Second Edition, by Joseph yiu, Newnes publishers an imprint of Elsevier
8. ARM System-on-Chip Architecture, 2/e, Steve Furber, Pearson

COURSE RESULTS: Students can get an in-depth knowledge of 8051 and AVR microcontrollers programming and their interfacing.

M.Sc. Electronics / Semester -II / Practical - 4

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

OBJECTIVES: To provide a hands-on experience with PIC, ARM microcontrollers programing and interfacing and Wireless IOT applications

List of experiments:

PART I: PIC 16F87X BASED EMBEDDED SYSTEMS & RTOS

1. Arithmetic and Logical programs
2. Square wave generation using ports
3. Matrix Key Board & LEDinterfacing
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 I2 C bus

PART II: IOT APPLICATIONS

i) WIRELESS DATA ACQUISITION USING SENSOR NODES

1.Setting up a WSN for smart home like applications
2.Implement and simulate network topologies using tools.
3.Connecting devices at the edge and to the cloud.
4.Processing data offline and in the cloud.

ii) VARIOUS CONCEPTS OF EMBEDDED SYSTEM DESIGN

1. IDE's. Simulation and development tools
2. Implementing simple systems using ARM Cortex M devices
3. Design and implement interfaces for various applications
4. Design and realize application systems

COURSE RESULTS: Students can receive assembly level programming skills for future robotic and IOT applications.

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

PCB DESIGNING TOOLS

OBJECTIVES: To understand the basic concepts of power electronic devices and virtual instrumentation with paradigm of programming languages.

CO1	Understand and review the fabrication of PCB.	K2,K5
CO2	Explain steps for designing of PCB.	K2,K5
CO3	Applythe layer designing concepts.	K3,K4
CO4	Analyze the Kicard concepts pts.	K1,K4,K5
CO5	Learn the KiCard tools designing and its applications.	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	S	M	S	M	S	S	S	S
CO2	S	M	S	M	S	M	S	S	S	S
CO3	M	M	S	M	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	M	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT-I: **Fabricating Printed Circuit Boards:**

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

UNIT -II: ALTIUM DESIGNER-1

Creating a New PCB Project-Creating a New Schematic Sheet-Adding Schematic Sheets to a Project Setting the Schematic Options-Drawing the Schematic-Locating the Component and Loading the Libraries-Placing the Components on Your Schematic-Wiring up the Circuit-Nets and Net Labels-Setting Up Project Options- Checking the Electrical Properties of Your Schematic -Compiling the Project.

UNIT-III: ALTIUM DESIGNER-2

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 View Configuration -Setting Up New Design Rules-Positioning the Components on the PCB-Manually Routing the Board-Automatically Routing the Board-Viewing Your Board Design in 3D Mode-Creating and Importing 3D Bodies for Component Footprints-Verifying Your Board Design-Output Documentation-Manufacturing Output Files.

UNIT-IV : KiCad -1

KiCad Workflow-KiCad Workflow Overview-Forward and backward annotation-Draw electronic schematics-Using E schema-Bus connections in KiCad-Layout printed circuit boards-Using Pcbnew-Generate Gerber files- Using GerbView-Automatically route with FreeRouter-Forward annotation in KiCad

UNIT-V :KiCad -2

Make schematic components in KiCad-Using Component Library Editor- Export, import and modify library components-Make schematic components with quicklib-Make a high pin count schematic component-Make component footprints-Using Footprint Editor

TEXT AND REFERENCE BOOKS

Varteresian J.-Fabricating Printed Circuit Boards-Newnes (2002)
Altium_Getting Started with PCB Design
Getting Started in KiCad

COURSE RESULTS: The outcome of the students will be expertise theoretically and designing of PCB circuits using tool.

M.Sc. Electronics / Semester -III / Core -7

ADVANCED POWER ELECTRONICS AND VIRTUAL INSTRUMENTATION

OBJECTIVES: To understand the basic concepts of power electronic devices and virtual instrumentation with paradigm of programming languages.

CO1	Understand and review the concepts of Power electronics.	K2,K5
CO2	Explain steps for evolution of vi and its architecture concepts.	K2,K5
CO3	Apply various technology GUI programming concepts.	K3,K4
CO4	Analyze the various statement concepts.	K1,K4,K5
CO5	Learn the multi-paradigm programming concepts and its applications.	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	S	M	S	M	S	S	S	S
CO2	S	M	S	M	S	M	S	S	S	S
CO3	M	M	S	M	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	M	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

POWER ELECTRONIC DEVICES: Thyristor- characteristics - Turn-on methods-characteristics-PUT-TRIAC-UJT- Phase controlled rectifier-Single phase half wave with RL load-Full wave-controlled converters-Commutation Techniques-Load-Resonant-pulse-Complementary-Impulse-External pulse- Line commutation. Chopper-Operation-Step Up-Types-Inverter-single phase bridge inverter-AC voltage controller-single phase voltage controller with R & RL load-Cycloconverter-single phase-step-up-step-down.

UNIT II

INTRODUCTION OF VI: Evolutions of VI, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, Graphical programming, and comparison with conventional programming. Advantages of Virtual Instruments over conventional instruments– Hardware and software.

UNIT III

GUI PROGRAMMING: Graphical user interfaces – Controls and indicators – 'G' programming – Labels and Text –Shape, size and color – Owned and free labels – Data

type, Format, Precision and representation – Data types – Data flow programming – Editing – Debugging and Running a Virtual Instrument – Graphical programming palettes and tools – Front panel objects – Functions and libraries.

UNIT IV

FILE STATEMENTS: Loops, WHILE Loops, CASE Structure, Formula nodes, Sequence structures – Arrays and Clusters– Array Operations – Bundle – Bundle/Unbundle by name, graphs and charts – String and file I/O – High-level and Low-level file I/O's – Attribute modes - Local and Global variables.

UNIT V

MULTI-PARADIGM PROGRAMMING: Introduction to multi-paradigm programming- basic features, creating variables, mathematical functions, basic plotting - overview, creating simple plots, adding titles, axis labels, and annotations, multiple data sets in one plot, specifying line styles and colours. Matrix generation - Entering a vector, entering a matrix, Matrix indexing, Colon operator, Linear spacing, Colon operator in a matrix, creating a sub-matrix, deleting row or column.

TEXT BOOKS:

1. Power Electronics - Dr.P.S. BIMBHRA
2. Gary Johnson, Richard Jennings, "Lab VIEW Graphical Programming", Third Edition, McGraw Hill, New York, 2006.
3. Sanjay Gupta and Joseph John, "Virtual Instrumentation using Lab VIEW", Tata McGraw-Hill, First Edition, 2005.
4. "MATLAB A Practical Approach" by Stormy Attaway.

REFERENCE BOOKS:

1. Power Electronics –MUHAMMAD H RASHID
2. "Virtual Instrumentation using LabVIEW" by Jovitha Jerome second edition 2010.PHI Publishers, New Delhi.
3. Octave/Matlab Primer and Applications: EZ Guide to Commands and Graphics (GNU Octave Matlab Tutorial Series) by Dr S. Nakamura, Published by Create Space Independent Publishing Platform
4. GNU Octave Beginner's Guide by Jesper Schmidt Hansen, Packt Publishing.
5. Python Tricks: A Buffet of Awesome Python Features by Dan Bader, Publisher: Dan Bader
6. Python for Everybody: Exploring Data in Python 3by Dr. Charles Russell Severance (Author), Sue Blumenberg (Editor), Elliott Hauser (Editor). Publisher: Create Space Independent Publishing Platform.

COURSE RESULTS: The outcome of the students will be expertise theoretically with a virtual instrumentation by LABVIEW programming.

M.Sc. Electronics / Semester -III / Core - 8

MOBILE, OPTICAL AND DATA COMMUNICATION SYSTEMS

OBJECTIVES: Expanding use of mobile, optical, and digital communication systems will benefit significantly to the students.

CO1	Understand the mobile communication and the technology concepts.	K2,K4
CO2	Explain steps for networking concepts and generation developments.	K2,K5
CO3	Apply various technology in optical fibers systems.	K3,K4
CO4	Analyze data communication concepts	K1,K4,K5
CO5	Understand the data networks and blue tooth configurations .	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**P O7**	**PO8**	**PO 9**	**PO10**
CO1	M	M	S	M	S	M	S	S	S	M
CO2	S	M	S	M	S	M	S	S	S	S
CO3	S	M	S	M	S	M	S	S	S	S
CO4	M	M	S	M	S	M	M	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

MOBILE COMMUNICATION: Mobile communication systems, cellular concepts, role of base station and mobile switching centres, Hands-off considerations, frequency reuse, roaming, SMS, GSM, GPRS, CDMA and EDGE architecture, SAR and IMEI.

UNIT II

TELECOMMUNICATION NETWORKS: Telecommunication Network management overview, Wireless Network fundamentals, OSI model layers, architecture, broadband systems. Introduction to Emerging technologies IP multimedia systems, GSM/CDMA, Wi-Fi, Wi-Max, Blue Tooth, 3G/4G &5G Next Gen. Networks (NGN), IP/ mobile TV

UNIT III

OPTICAL FIBERS: Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations –Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes – Single Mode Fibers-Graded Index fiber structure. Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination.

UNIT IV

DATA COMMUNICATION: Data communication networks and services, application and layered architecture, OSI model, IEEE 802.3 and IEEE 802.11, Network topologies, LAN and MAC, Data link control, Bridging, switching, addressing, Transmission systems, circuit switching networks, routing, signaling and traffic management

UNIT V

DATA NETWORKING: Packet switching networks, Internetworking – Repeaters, bridges, routers and gateways. Introduction to Routing protocols TCP/IP and Internetworking, TCP/IP protocol suite TCP/IP Sockets Client-Server, computing, Name Service, Application protocols over TCP/IP, IPV6, network architectures and protocols, network security, ATM Networks, High speed LANs – Fast and Gigabit Ethernet, FDDI. Wireless LANs. Bluetooth and Wi-Fi WLAN.

TEXT AND REFERENCE BOOKS:

1. Telecommunication T.Vishwanathan, PHI

2. Mobile Cellular Telecommunications, W.C.Y. Lee, McGraw Hill

3.Future Developments in Telecommunication, J. Martin, PrenticeHall

4. Gerd Keiser, "Optical Fiber Communication" McGraw –Hill International, Singapore, 3rd ed.,2000

5. Data Networks D. Bertsekas, R. Gallagher

6.Computer Networking Tanenbaum, PHI

7.Computer Networks U.Black, PHI

COURSE RESULTS: Students can understand the growing importance of mobile, optical and data communication system.

M.Sc. Electronics / Semester -III / Core 9 A:

RESEARCH METHODOLOGY

OBJECTIVES: It is a way to systematically solve a research problem and It is a science of studying how research is done scientifically.

CO1	Understand the basics of Research, Types of Research, Research Methods and Methodology	K2,K5
CO2	Explain steps of Sampling Design, Steps in Sampling Design, Types of Sampling Design	K2,K5
CO3	Learning and apply the various data acquisition and analysis technology .	K3,K4
CO4	Analyze the various research techniques.	K1,K4,K5
CO5	Apply and of Variance and Covariance ANOVA, One way ANOVA and Two Way ANOVA.	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	M	S	M	S	S	S	S
CO2	S	M	S	S	S	M	S	S	S	S
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	M	S	M	S	M	S	S	S	S
CO5	S	S	S	M	S	M	S	S	S	S

UNIT I

RESEARCH METHODOLOGY: An Introduction Objectives of Research, Types of Research, Research Methods and Methodology, defining a Research Problem, Techniques involved in Defining a Problem. Research Design Need for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs.

UNIT II

SAMPLES: Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination, Random sampling. Measurement and Scaling Techniques Measurement in Research, Measurement Scales, Sources in Error, Techniques of Developing Measurement Tools, Scaling, Meaning of Scale, Scale Construction Techniques.

UNIT III

DATA ACQUISITION AND ANALYSIS: Methods of Data Collection and Analysis Collection of Primary and Secondary Data, Selection of appropriate method Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of Skewness, Regression Analysis, Correlation.

UNIT IV

RESEARCH TECHNIQUES: Techniques of Hypotheses, Parametric or Standard Tests Basic concepts, Tests for Hypotheses I and II, Important parameters limitations of the tests of Hypotheses. Chi-square Test, Comparing Variance, As a nonparametric Test, Conversion of Chi to Phi, Caution in using Chi-square test.

UNIT V

ANOVA TECHNIQUES: Analysis of Variance and Covariance ANOVA, One way ANOVA, Two Way ANOVA, ANOCOVA Assumptions in ANOCOVA, Multivariate Analysis Technique Classification of Multivariate Analysis, factor Analysis, R-type Q Type Factor Analysis, Path Analysis.

TEXT AND REFERENCE BOOKS:

1. "Research Methodology", C.R. Kothari, Wiley Eastern.
2. "Formulation of Hypothesis", Wilkinson K.P, L Bhandarkar, Himalaya Publication Bombay.
3. "Research in Education", John W Best and V. Kahn, PHI Publication.
4. "Research Methodology A step by step guide for beginners", Ranjit Kumar, Pearson Education
5. "Management Research Methodology Integration of principles, methods and Techniques", K.N. Krishna swami and others, Pearson Education.

COURSE RESULTS: Students get an idea about research and research methodologies

M.Sc. Electronics / Semester -III / Core-9 B:

SMART MANUFACTURING

Objectives: To introduce students to fundamentals of Manufacturing, To familiarize with selection of sensors for various application, and to learn the basics of agent-based manufacturing and Understand Cyber physical Manufacturing systems.

CO1	Appraise concepts and basic framework necessary for smart manufacturing.	K2,K3
CO2	Discuss current trends at system level in manufacturing organizations	K3,K5
CO3	Selection of sensors for various applications.	K3,K4
CO4	Dramatize IoT based manufacturing systems.	K1,K2,K5
CO5	Describe industry 4.0 concepts at manufacturing systems.	K3,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	L	S	L	M	S	M	L	S
CO2	M	S	L	S	M	L	S	L	S	L
C03	L	S	M	L	S	M	S	L	M	L
C04	S	L	M	L	S	L	M	S	L	M
C05	M	L	S	M	L	S	M	L	M	M

UNIT I

Introduction – Role of sensors in manufacturing automation – operation principles of different sensors – electrical, optical, acoustic, pneumatic, magnetic, electro-optical and vision sensors. Condition monitoring of manufacturing systems – principles – sensors for monitoring force, vibration and noise, selection of sensors and monitoring techniques. Automatic identification techniques for shop floor control – optical character and machine vision sensors – smart /intelligent sensors – integrated sensors, Robot sensors, Micro sensors, Nano sensors

Unit II

Data Analytics: Introduction to Data and Analytics in a Digital Context (Internet of Things), Product Data Management for Design and Manufacturing (PLM Tools), Typical data challenges (data quality, enrichment, integration of ERP & PLM data), Preparing data for analytics (techniques to improve data quality, integration - ETL) Advances in data visualization & related tools- Statistical Techniques for Analytics, Descriptive Statistics, Inferential statistics, Regression and ANOVA

Unit III

Cyber Physical Systems:
Concept of Cyber Physical Systems (CPS) and Cyber Physical Production System (CPPS), System Architecture for implementation of CPPS, Components for CPPS, Communication for CPPS.

UNIT IV

E- Manufacturing: Introduction of Agent based manufacturing- agent based Manufacturing, Cloud Based Manufacturing Information technology-based Supply chain, Concept of agile manufacturing and E-manufacturing

UNIT V

Industry 5.0: Evaluation of industries, Introduction to Industry 5.0, Challenges in industry 5.0, Impact of Industry 5.0, Case studies on industry 5.0, Introduction to Internet of Things (IoT) and its applications, Smart supply chain and Case studies.

TEXT BOOK(S)

1. Bahga and V. Madisetti, Internet of Things, A hands-on approach, Create Space Independent Publishing Platform, 1st edition, 2014, ISBN: 978-0996025515
2. Bahga and V. Madisetti, Cloud Computing, A hands-on approach, Create Space Independent Publishing Platform, 1st edition, 2013, ISBN: 978-1494435141
3. M. Skilton and F. Hovsepian, The 4th Industrial Revolution: Responding to the Impact of Artificial Intelligence on Business, Springer Nature, 2017, ISBN: 978-3-319-62479-2

REFERENCE BOOKS

1. Gilchirst, Industry 4.0: The Industrial Internet of Things, Apress (Springer), 1st Edition, 2016, ISBN: 978-1-4842-2046-7
2. S. Jeschke, C. Brecher, H. Song, and D. B. Rawat, Industrial Internet of Things: Cyber manufacturingSystems, Springer, 1st edition, 2017, ISBN: 978-3319425580
3. T. Erl, Z. Mahmood, and R. Puttini, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 1st edition, 2013, ISBN: 978-0133387520.
4. N. Viswanandham, Y. Narhari "Performance Modeling of Automated Manufacturing Systems" Prentice-Hall, 1st Edition, 1994, ISBN: 978-8120308701
5. S. K. Saha, Introduction to Robotics, Tata Mcgraw Hill Education Private Limited, 2nd Edition, ISBN: 978-9332902800

M.Sc. Electronics / Semester -III / Elective -3 A:

DIGITAL SIGNAL AND IMAGE PROCESSING

OBJECTIVES: It gives the knowledge to transform an image into digital form and performs some process of it, and o understands the operations, analysis and applications of image processing and to study about discrete time systems and to learn about FFT algorithms.

CO1	Understand The Concepts of Signals And Systems And Filter Concepts.	K2,K5
CO2	Explain The Concepts o f Finite Impulse Response (Fir) Filters	K2,K5
CO3	Apply Various Discrete Fourier Transform.	K3,K4
CO4	An analyze The Finite Word Length Effects in Digital Filters.	K1,K4,K5
CO5	Understand The Filters And Processing Of Image And Digital Processing	K2,K6
K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	M	S	S	S	S
CO2	S	M	S	M	S	M	S	S	S	S
CO3	S	M	S	M	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

REVIEW OF SIGNALS AND SYSTEMS: Introduction - advantages and limitations of Digital Signal Processing. Infinite Impulse Response (IIR) Filters - Signal Flow graph- Basic Network structure for IIR filter- Direct- Cascade- Parallel Forms. Design of IIR Digital filters from analog filters- Butterworth design- Chebyshev design- design based on numerical solutions of differential equations- Impulse Invariant Transformation.

UNIT II

FINITE IMPULSE RESPONSE (FIR) FILTERS: Linear phase FIR filters- Frequency response of linear phase FIR filters - Location of the zeros of linear phase FIR filters. Realization of FIR- cascade - lattice design-Fourier Series method- using windows- rectangular- triangular or Barlett windows- Hanning- Hamming- Blackman- Kaiser windows.

UNIT III

DISCRETE FOURIER TRANSFORM: Properties-Circular convolution- Linear Convolution using DFT- relation between Z- Transform and DFT- Fast Fourier Transform; decimation – in time and Frequency - FFT algorithms – General Computation using Radix 2 algorithm.

UNIT IV

FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS: Introduction- Number Representation - Fixed Point- Sign-Magnitude - One's- complement- Two's - complement forms -Addition of two fixed point numbers- Multiplication in Fixed Point arithmetic - Floating point numbers- Block floating point numbers- quantization - truncation- rounding - effects due to truncation and rounding- Input quantization error - Product quantization error - Co-efficient quantization error- zero-input limit cycle Oscillations - Overflow limit cycle Oscillations - Scaling- Quantization in Floating Point realization IIR digital filters - Finite Word Length Effects in FIR Digital Filters- Quantization effects in the Computation of the DFT- quantization errors in FFT algorithms.

UNIT V

IMAGE AND DIGITAL PROCESSING: Image acquisition, Image representations, Image digitalization, Sampling, Quantization, Histograms, Image Quality, Noise in Images, Basic operations on images, Image Enhancement, Pixel intensity transformations, Histogram equalization and matching, noise removal, Edge sharpening, Spatial Filtering, Image smoothing, Morphological operations: erosion, dilation. Image processing applications, Machine Vision, Blob analysis, Metrology, Feature extraction, Pattern Matching. Speech Processing- speech analysis- speech coding- sub band coding- channel vecoder- homomorphic vocoder- digital processing of audio signals- Radar signal processing- DSP based measurements systems.

TEXT AND REFERENCE BOOKS:

1. Digital signal processing: If echor- Pearson edn.
2. Desecrate time signal processing: Oppenhiem- Pearson edn.
3.Digital signal processing: Oppenhiem and Sheffer- PHI
4.Introduction to Digital signal processing: Johny R Johnson
5.Digital signal processing: Proakis and Manolakis.
6. Digital signal processing: P Ramesh Babu- Scitech Pub
7. Digital Image Processing Rafael C. Gonzalez, Richard E. Woods, Prentice Hall
8.Fundamentals of Digital Image Processing, A.K. Jain, Prentice Hall

COURSE RESULTS: Students can able to understand the properties of the random signals and images and how to process it.

M.Sc. Electronics / Semester -III / Elective -3B

INDUSTRIAL AUTOMATION

OBJECTIVES:
Provide knowledge about industrial automation process and controlling concepts using plc etc..

CO1	learn the introduction of plc, ladder diagram fundamentals	K1,K5
CO2	understand the programmable logic controller &fundamental programming	K2,K5
CO3	learn the concepts advanced programming techniques and overview of mnemonic programming code	K3,K4
CO4	provide the basic knowledge of wiring techniques, analog i/o & sensors	K1,K4,K5
CO5	impart knowledge on working in omron & keyence ide with ladder logic	K2,K6
K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	M	L	L	M	M	S	S	S
CO2	M	S	M	L	L	S	M	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S

UNIT I INTRODUCTION TO PLC, LADDER DIAGRAM FUNDAMENTALS

Introduction to PLC – PLC Vs Microcontroller – Basic Components and their Symbols – Control Transformers – Fuses – Switches – Relays – Time Delay Relays – Fundamentals of Ladder Diagram – Basic diagram framework – Wiring Reference Designators – Boolean Logic & Relay Logic – AND-OR & OR-AND

– Ground Test– The Latch – Two handed Anti-Tie Down, Anti-Repeat – Combined Circuit – Machine Control Terminology.

UNIT-II: PROGRAMMABLE LOGIC CONTROLLER &FUNDAMENTAL PROGRAMMING

PLC Configurations – System Block Diagram – Update – Solve the Ladder – Physical Components Vs Program components – Light Control – Internal Relays – Disagreement Circuit - Majority Circuits – Oscillators – Holding Contacts - Always ON& OFF Contacts –Ladder Diagrams having complex Rung.

UNIT - III: ADVANCED PROGRAMMING TECHNIQUES AND OVERVIEW OF MNEMONIC PROGRAMMING CODE

Ladder Program execution Sequence – One Shot– JK-Flip Flop – Counters – Sequencers – Timers – Master control relays and control Zones – AND Ladder Rung – Entering Normally Closed Contacts – OR Ladder Rung – Simple Branches – Complex Branches.

UNIT- IV: WIRING TECHNIQUES, ANALOG I/O & SENSORS

PLC Power Connection – input wiring – Inputs having a single common – Isolated inputs – Output wiring – Relay outputs – Solid state outputs – Analog (A/D) inputs – Analog (D/A) output – Sensor Output classification – Connecting Discrete sensors to PLC inputs – Proximity sensors – Optical Proximity Sensors.

UNIT- V: WORKING IN OMRON & KEYENCE IDE WITH LADDER LOGIC

Introduction to OMRON & KEYENCE – Creating a project – Ladder Programming – Compiling and Executing – Ladder Programs – Logic Gate functions (AND, OR, NOT, NAND, NOR, XOR) – Using Timers (ON delay timer, OFF delay timer, one shot pulse, flashing pulse), Counters – Using Calendar functions

TEXT BOOKS:

1. John R. Hackworth, Frederick D. Hackworth, Jr., "Programmable Logic Controllers, Programming Methods and Applications", New Delhi: Pearson Education, 3rd edition.

COURSE RESULTS: students can able to understand automated system concepts and plc mnemonic coding procedures.

M.Sc. Electronics / Semester -III / Core 10 Practical – 5

ADVANCED COMMUNICATION LAB
(ANY -10 USING HARDWARE /SOFTWARE)

OBJECTIVES: The students can familiarize with basic analog communication systems. Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course.

List of Experiments:

1.Pulse amplitude modulation and demodulation
2.Verification of sampling theorem
3.Pulse position modulation
4.Pulse width modulation
5.Amplitude shift keying modulation and demodulation
6.Frequency shift keying modulation and demodulation
7.Phase shift keying modulation and demodulation
8.Mixer
9. Automatic gain control
10. P.C.M system using codec
11. Delta Modulation, Adaptive Delta Modulation
12. PLL and Frequency synthesizer
13. Frequency multiplier
14. P.R.B.S. Generator

MATLAB Experiments

15. Digital Modulation and Demodulation ASK
16. FSK
17. PSK
18. QPSK
19. Generation of Signals
20`Sampling and Effect of aliasing

COURSE RESULTS: Students acquired the knowledge of different types of communication signals, modulation, demodulation, mixing and so on.

M.Sc. Electronics / Semester -III /Ppr.no.22 / Core10 practical– 6

DSP MATLAB ANDLAB VIEW INSTRUMENTATION LAB

OBJECTIVES:
To familiarize MATLAB programming and its applications in DSP and the students familiarize with DSP AND LABVIEW software's. Integrate theory with experiments using these software's so that the students receive knowledge from the theory course.

Experiments should be completed at least 50% of the both labs.

PART -1: DSP MATLAB experiments:

1. Verification of sampling theorem.
2. Impulse response of a given system
3. Linear convolution of two given sequences.
4. Circular convolution of two given sequences
5. Autocorrelation of a given sequence and verification of its properties. Cross correlation of given sequences and verification of its properties Solving a given difference equation.
6. Computation of N point DFT of a given sequence and to plot magnitude and phase Spectrum. Linear convolution of two sequences using DFT and IDFT.
7. Circular convolution of two given sequences using DFT and IDFT
8. Design and implementation of FIR filter to meet given specifications.
9. Design and implementation of IIR filter to meet given specifications.
10. Implementation of FFT of a given sequence.
11. Generation of DTMF signals.
12. Implementation of Decimation Process.
13. Implementation of Interpolation Process.

PART -2: Virtual Instrumentation by LABVIEW:

1. Create a VI for performing addition/subtraction/multiplication/division of given numbers. If answer is above 100 indicate it using LED.
2. Design a display for the basic calculator keypad. (Event structure)
3. Creating a VI for waveform generation and manipulations.
4. Design a water level control system. (Shift register)
5. Create a VI to acquire waveform data from signal generator and store the waveform data in array. (Accuracy of stored data)
6. Create a VI to acquire and plot temperature sensor data. (Sampling parameter variations)

TEXT AND REFERENCE BOOKS:

1. Analog electronics with LabVIEW- Kenneth L. Ashley
2. Virtual-Instrumentation-Using-LabVIEW- Jovitha Jerome, PHI Learning Private Limited(2010)
3.PC Interfacing for Data Acquisition and Process Control- Gupta, S. and Gupta,
4.J. P. Instrument Society of America (1988).
5. Ashok Ambardar. 'Analog and Digital Signal Processing'
6. MATLAB: An Introduction with Applications, 4ed Paperback – 2012by Amos Gila- Wiley

COURSE RESULTS: Students will be well-versed with MATLAB and LABVIEW programming.

M.Sc. Electronics / Semester -III / Skill Enhancement Course (SEC)-2

ROBOTICS AND AUTOMATION

OBJECTIVES:

1. Study the various parts of robots and fields of robotics.
2. Study the various kinematics and inverse kinematics of robots.
3. Study the Euler, Lagrangian formulation and trajectory planning of Robot dynamics.
4. Study the control of robots for some specific applications.

educate on various path planning techniques and dynamics and control of manipulators

CO1	Understand the evolution of Robot technology and mathematically represent different types of robot.	K2,K5
CO2	Get exposed to the case studies and design of robot machine interface.	K2,K5
CO3	Familiarize various control schemes of Robotics control.	K3,K4
CO4	Analyze the integration of steps in CMOS IC chip fabrication.	K1,K4,K5
CO5	Apply intrusion prevention techniques to prevent intrusion Build CMOS-based used in the electronics industry	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	M	M	S	M	S	S
CO2	S	M	M	S	M	M	S	S	S	S
CO3	S	M	S	S	M	S	S	S	S	S
CO4	S	M	M	S	M	M	S	S	S	S
CO5	S	M	S	S	M	S	S	S	S	S

Unit: I **Basic Concept :**

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Robot classifications and specifications- Asimov's laws of robotics – dynamic stabilization of robots

Unit: II Power Sources, Sensors and Actuators

Hydraulic, pneumatic and electric drives: Design and control issues – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

Unit: III Manipulators and Grippers Differential Motion

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

Unit: IV Kinematics and Path Planning

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance Solution kinematics problem – robot programming languages.

Unit: V Dynamics and Control and Applications

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation - Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator. Multiple robots – machine interface – robots in manufacturing and non-manufacturing applications – robot cell design – selection of robot.

TEXT BOOK(S)

1 Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore, 2015.

2 Saeed B Niku, Introduction to Robotics, Analysis, Systems, Applications Prentice Hall, 3 edition 2104.

REFERENCE BOOKS

1 Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.

2 Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.

3 Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.

4 R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005

5 John J.Craig, Introduction to Robotics Mechanics and Control, Third edition, Pearson Education,2009.

6 Issac Asimov I Robot, Ballantine Books, New York, 1986.

COURSE RESULTS: Students can able to Identify ROBOTICS operations and architecture designing procedures.

M.Sc. Electronics / Semester -III / INTERNSHIP/ INDUSTRIAL ACTIVITY

OBJECTIVES:

i) To develop skills by visiting nearby industries / organizations**.**
ii) Acquire the knowledge and receive guidance from other various tasks or sources of their field visitsor survey or study.
iii) Formulate and identify the real-world problem, practical difficulties, identify the requirement and develop the solutions according to their field work or internship study.
iv) Identify technical ideas, strategies and methodologies.
v) Utilize the new tools, algorithms, techniques that contribute to obtain the solution ofthe work.
vi) Explain the acquired knowledge through preparation of report and oral presentations.

This can be an individual work or activity for PG students. Students are advised to select their own field work or study as per the expert guidance receive from the teaching faculties of their own institution. Periodical assessment may be done to evaluate their skills. Students will be permitted to visit nearby industries without affecting their regular theory and practical subjects. No marks will be given for field work.

M.Sc. Electronics / Semester -IV / Core – 11

INTRODUCTION OF PYTHON AND ANDROID APPLICATION TOOLS DEVELOPMENT

OBJECTIVES:

- Understand the Python programming basics including functions, variables, and data types, classes and objects, etc.,
- Manipulate and output data using arrays, loops, and operators
- Have a solid understanding of Python syntax
- Understand the Android programming basics with developing application tools

CO1	Understand the python language and programming concepts and its applications.	K2,K5
CO2	Applying the various statements and concepts.	K2,K5
CO3	Understand the classes and objects.	K3,K4
CO4	Analyze exception concepts and applications	K1,K4,K5
CO5	Understand and Apply android concepts.	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

- S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	M	S	S	S	S
CO2	S	M	S	M	S	M	S	S	S	S
CO3	S	M	S	M	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

PYTHON INTRODUCTION: Introduction to Python – Features of Python, Python Virtual Machine (PVM), Memory management in Python, Comparison between C and Python. Writing and execution of a Python program, Input & Output statements. Datatypes – Built-in type, Bold data type, Sequences, Sets, Literals, Constants, Identifiers and Reserved words, Naming conventions in Python. Strings and Characters – Creating Strings, Escape Characters, String formatting operators, String formatting functions. **Operators** - Arithmetic, Assignment, Unary minus, Relational, Logical, Boolean, Bitwise, Membership and Identity Operators, Mathematical functions. Lists – creating lists, updating the elements in a list, Built in list operators - concatenation, repetition & membership, Built-in List Methods. Tuples – creating tuples, accessing tuple elements, basic operations on tuples, functions to process tuples. Dictionaries – creating dictionaries, Operations on Dictionaries, Dictionary Methods, Datatype conversions.

UNIT II

STATEMENTS AND FUNCTIONS: Control statements – Conditional Statements: if statement, if…else statement, nested if statement, Looping: while loop, for loop, infinite loops, nested loops, Control Statements: break statement, continue statement, pass

statement, assert statement, return statement.

Arrays- creating an array, Importing the array module, Indexing and Slicing on arrays, Types of arrays, working with arrays using numpy, Mathematical operations on arrays.

Functions – Function definition, Function call, returning from a function, returning multiple values, Function arguments- formal & actual, positional, keyword, default, variable length arguments, Local & Global variables, passing a group of elements to a function, Recursive functions, Anonymous functions or Lambada's.

UNIT III

CLASSES AND OBJECTS: Creating a Class, the self-variable, Constructor, Types of variables, Namespaces, Types of Methods, passing members of one class to another class, Inner classes, Inheritance and Polymorphism- Constructors in Inheritance, Overriding super class constructors and Methods, the super () Method, Types of Inheritance. Polymorphism-Operator over loading, Method overloading, Method overriding.

UNIT IV

EXCEPTIONS: Errors in Python Programing, Exceptions, Exception handling, Types of Exceptions, the except block, the assert statement, user defined exceptions, logging the Exceptions.

Files- Types, Opening and Closing a file, working with text and binary files, knowing whether a file exist or not, the with statement, Pickles, seek () and tell methods, Working with Directories, Regular expressions, Sequence characters, Quantifiers and Special Characters in regular expressions, using regular expressions on files.

UNIT V

DEVELOPING FOR ANDROID: Downloading and Installing the Android SDK – Developing with Eclipse – Using the Android Developer tools Plug-In for Eclipse – Support Package. First Android Application: New Android Project – Android Virtual Device – Launch Configurations – Running and Debugging Android Application – Types of Android applications – Android Development Tools.

TEXT AND REFERENCE BOOKS:

1.Core Python Programming – Dr. Nageswara Rao, 2017 edition, Dreamtech Press.
2.Introduction to Computing and Problem-Solving Using Python – E Balaguruswamy, 1e/Mc Graw Hill.
3.Reto Meier. 2012. Professional Android 4 Application Development. Wiley India Pvt Ltd.
4.Charlie Collins and Michael Galpin. 2012. Android in Practice. Manning Publications Co.
5.Zigurd Mednieks and Laird Dornin. 2011. Programming Android. O'Reilly Media,Inc, New York.

COURSE RESULTS: Students can able to design and programming in python and android applications.

M.Sc. Electronics / Semester -IV / Core –12

VLSI DESIGN AND VHDL PROGRAMMING

OBJECTIVES: To study HDL based design approach and to learn digital CMOS logic design.

CO1	Relate technology changes from semiconductor manufacturing industry	K2,K5
CO2	Explain steps for making silicon wafers from sand	K2,K5
CO3	Apply various technology involved in manufacturing.	K3,K4
CO4	Analyze the integration of steps in CMOS IC chip fabrication.	K1,K4,K5
CO5	Apply intrusion prevention techniques to prevent intrusion Build CMOS-based used in the electronics industry	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**P O7**	**PO8**	**PO 9**	**PO10**
CO1	S	M	S	M	S	M	S	S	S	S
CO2	S	M	S	M	S	M	S	S	S	S
CO3	S	M	S	M	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

CMOS TECHNOLOGY: MOS TRANSISTOR – Switches – CMOS Logics – Inverter – Combinational logic – NAND gate – NOR gate Compound gates – Multiplexer – Physical design of NAND, NOR gates –SI semiconductor technology overview – wafer processing – oxidation – epitaxy deposition – Ion Implantation – Diffusion – SI gate insulator process – CMOS technology - n-well process – p well process – Twin-Tub process – silicon on insulator–CMOS process enhancements

UNIT II:

INTRODUCTION OF VHDL: History of VHDL – capabilities of VHDL – hardware abstraction – basic terminology –entity declaration - architecture body declaration – Basic language elements –identifiers – Data objects– Data type operators.

UNIT III:

MODELING TECHNIQUES OF VHDL: Behavioral modeling: Entity declaration – architecture declaration – process statements- variable assignment statements – signal assignments statements – Wait statement – IF statement – Case statement – Null statement – Loop statement – Exit statement – Next statement – Assertion statement – Report statements –More on signal assignment statement – multiple process – postponed process – Data flow style of modeling

UNIT IV

VHDL STATEMENTS: Concurrent signal assignment statement versus signal assignment – Delta delay revisited – Multiple drivers – Conditional signal assignment statement – Selected signal assignment statement – The unaffected value – Block statement- Concurrent

assertion statement – Value of the signal. Structural modeling: Component declaration – Component instantiation – Resolving signal value – examples – Half adder – Full adder – Fourto one multiplexer – Decoders and encoders.

UNIT V:

ADVANCED FEATURES IN VHDL: Generics – configuration – configuration specification – Configuration declaration –Default rules – Conversion functions – Direct instantiation – Incremental binding -Sub programs – Sub program overloading - operator overloading - signatures – default value of parameters –package declaration - package body – design file – design libraries – order of analysis – implicit Visibility – explicit visibility – attributes in VHDL.

TEXT BOOKS:

1.Neil H.E. West Kamaran Eshraghin, " PRINCIPLES OF CMOS VLSI DESIGN"
2.J.Bhasker, "VHDL PRIMER", Low price Edition, 2001 PHI 3.Charles H.Roth, and Jr. DIGITAL SYSTEM DESIGN USING VHDL, Brooks/Cole Thomson Learning PWS Publishing, ISBN-981-240-052-4

COURSE RESULTS: Students have to realize importance of testability in logic circuit design.

M.Sc. Electronics / Semester -IV / Elective-4

A: RF CIRCUIT AND SATELLITE COMMUNICATION

OBJECTIVES:

- To understand the basic RF frequency, filter design, amplifier design and circuit design process.
- To understand the fundamentals of satellite communication system.

CO1	Understand The RF Transceiver Architectures:	K1,K5
CO2	Analyzing If Rf Filter Design	K2,K5
CO3	Implementing The Concepts Of Amplifier Design.	K3,K4
CO4	Analyze The Satellite Communication.	K1,K4,K5
CO5	Apply And Analyze Satellite Subsystem	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	S	M	S	M	S	S	S	S
CO2	S	M	S	M	S	M	S	S	S	S
CO3	S	M	S	M	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	M	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT I

RF TRANSCEIVER ARCHITECTURES: Receiver front end general design philosophy, Inter modulation, 3rd order intercept point (IP3), Noise Figure, sensitivity, selectivity.

UNIT II

RF FILTER DESIGN: Ideal and approximate filter types, Transfer function and basic filter concepts, filter design issues, RF filter design.

UNIT III

AMPLIFIER DESIGN: Stability consideration, Amplifier design for maximum gain, constant gain circles, and constant noise figure circles, Low noise amplifier, RF Power amplifier.

Other RF circuits: Power combiner/divider, directional couplers, hybrid coupler, isolator.

UNIT IV

SATELLITE COMMUNICATION: Fundamentals: concepts, history, developments. Orbital mechanics and launching: Keplers law, perturbation, orbital effects, types of orbits, launching satellite, launch vehicle technology.

UNIT V

SATELLITE SUBSYSTEM: Attitude and orbit control, thermal control, Power supply, propulsion, telemetry, tracking and command, transponder and antennas. Satellite link design. Applications of satellites and advances in satellite communication.

TEXT AND REFERENCE BOOKS:

1. Analog Communication Kennedy and Davies
2. Microwave devices, circuits & Subsystems for Communication Engineering, Glover,Pennock, and Shepherd
3. RF circuit design, by Chris Bowick
4. RF circuit design by R. Ludwig and P.Bretchko
5. RF Circuit Design, Reinhold Ludwig, Pavel Bretchko, Pearson
6. Satellite communications: Dennis Roddy

COURSE RESULTS: The student will be able to understand the RF design and distinguish between the oscillators and amplifiers. Application of satellite communication will also be essential for signals and modern communication system.

M.Sc. Electronics / Semester -IV / Elective-4

B:\ELECTRIC VEHICLES TECHNOLOGIESOBJECTIVES:

- Choose a suitable drive scheme for developing an electric of hybrid vehicle depending on resources
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
- Understanding electric car energy resources
- Experience of electric car storage technology
- Learn the electrical vehicle motors and controls

CO1	To present a comprehensive overview of Electric and Hybrid Electric Vehicle	K1,K5
CO2	To know about the sources of energy for electrical vehicles	K2,K5
CO3	To obtain knowledge on storage techniques on electrical vehicles	K3,K4
CO4	To learn about the propulsion system used in electrical vehicle	K1,K4,K5
CO5	To understand the drive system and characteristics of electrical vehicle	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	M	S	S	S	S
CO2	S	M	S	M	S	M	S	S	S	S
CO3	S	M	S	M	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	M	S
CO5	S	M	S	M	S	M	S	S	S	S

UNIT-I : INTRODUCTION

The Electric Vehicle Debate, Primary Energy Sources and Alternative Fuels for Transportation, History of electric Vehicles, Electrochemical Power Sources –Secondary Batteries and Fuel Cells

UNIT – II: SOURCES

Aqueous Electrolyte Batteries –Lead Acid, Nickel – Iron, Nickel – Zinc, Metal – Air Zinc – Halogen - Non-Aqueous Electrolyte Batteries- High Temperature Batteries, Organo Electrolyte and Solid-State Batteries

UNIT– III: OVERVIEW OF HYBRID ELECTRIC VEHICLES

Combustion Engine Hybrid Electric Vehicles, Laboratory Test of Electric Vehicle Batteries, Vehicle tests with Electric Vehicle Batteries, Future of Electric Vehicles

UNIT– IV EV PROPULSION- ELECTRIC MOTOR & REQUIRED POWER ELECTRONICS & CONTROL

Choice of electric propulsion system, block diagram of EV propulsion system, concept of EV Motors, single motor and multi-motor configurations, fixed & variable geared transmission, In wheel motor configuration, classification of EV motors, Electric motors used in current vehicle applications, Recent EV Motors, Comparison of Electric Motors for EV applications - Basics of Microcontroller & Control Strategies

UNIT– V EV MOTOR DRIVES

DC Motor: Type of wound-field DC Motor, Torque speed characteristics DC-DC Converter, Two quadrant DC Chopper, two quadrant zero voltage transition converter-fed dc motor drive, speed control of DC Motor Induction Motor Drive: Three Phase Inverter Based Induction Motor Drive, Speed Control of Induction Motor, FOC, Adaptive Control, Model Reference Adaptive Control (MARS), Sliding mode Control.

REFERENCEBOOKS

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., NewYork 2001
2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003
3. MehrdadEhsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and FuelCell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
4. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
5. Hand Book of Batteries and Fuel cells, 3rd Edition, Edited by David Linden and Thomas. B. Reddy,McGraw Hill Book Company, N.Y. 2002.
6. Fuel Cells, Principles and Applications, Viswanathan, B. and Scibioh, Aulice M, Universities Press,2006.
7. The Essential Hybrid Car Handbook: A Buyer's Guide (Paperback) by Nick Yost, The LyonsPress,N.Y. 2006.

COURSE RESULTS: To Be Expert In E- Vehicle And Drives**.**

M.Sc. Electronics / Semester -IV / Practical -7

VLSI AND ANDROID APPLICATION DEVELOPMENT LAB

(ATLEAST 5 EXPERIMENTS IN EACH LABS USING HARDWARE & SOFTWARE)

OBJECTIVES:

- To learn Hardware Descriptive Language (Verilog/VHDL).
- To learn the fundamental principles of VLSI circuit design in digital and analog domain.
- Have to create a simple Android App (HelloWorld) and be able to manage it within the Android Studio environment Using 8051 microcontroller.

Android Lab:

1. Creating an app to display Hello World.
2. Creating an Android Simple Login Application.
3. Creating Calculator App in Android.
4. Creating simple Home Screen Widget in Android.
5. Creating Android Chat App in Android.
6. Creating Simple Android Camera Application.
7. Creating Basic List View Demo in Android
8. Creating Google Map in Android.

VHDL Lab:

1. Write a program to Verify the Logic Gates
2. Write a program for Half Adder and Full Adder
3. Write a program for Half Subtractor and Full Subtractor
4. Write a program for Encoder
5. Write a program for Decoder
6. Write a program for Multiplexer
7. Write a program for Demultiplexer.

COURSE RESULTS: Write VHDL code for basic as well as advanced digital integrated circuits. Students can learn the Android Studio Application environment.

M.Sc. Electronics / Semester -IV / Practical -8

OBJECT ORIENTED PROGRAMMING USING PYTHON LAB
(ANY 10 USING HARDWARE/SOFTWARE)

OBJECTIVES:

- To acquire programming skills on Object-Oriented Programming concepts in Python
- To get a practical knowledge on interfacing Raspberry Pi with Python.

PART I – Basic Programs using Python:

1.Programs based on datatypes, Input & Output and Control Statements
2.Programs based on Arrays
3.Programs based on Strings
4.Programs based on Functions
5.Programs based on Lists and Tuples
6.Programs based on Dictionaries
7.Programs based on Classes
8.Programs based on Objects
9.Programs based on Inheritance
10. Programs based on Polymorphism
11. Programs based on Exceptions
12. Programs based on Files
13. Programs based on Regular Expressions

PART II - Programs for interfacing with Raspberry Pi:

1.Push switch and LED interfacing
2.Buzzer interfacing
3.Speed control of DC motor
4.Direction control of DC motor
5.Keypad interfacing
6.Measurement of Light
7.Measurement of Temperature
8.LCD display interfacing

REFERENCE BOOKS:

1.Core Python Programming – Dr. Nageswara Rao, 2017 edition, Dream tech Press.

2.Introduction to Computing and Problem-Solving Using Python – E Balaguruswamy, 1e/Mc Graw Hill.

3. Raspberry Pi Cookbook – Simon Monk, 1e/ O'Reilly Media, Inc.

4. https://learn.sparkfun.com/tutorials/python-programming-tutorial-getting-started-with-the-raspberry-pi/all

COURSE RESULTS: Students can learn Python scripting elements and discover how to work with scripts, variables, lists, control flow structures, sequence data and so on. They can learn Python language interfaced with Raspberry Pi kit.

M.Sc. Electronics / Semester -IV / Core project – 1

PROJECT WORK: INT:100, EXT:100 MARKS, TOTAL:200 MARKS.

The objective of the project work is to motivate the students for doing research and to inculcate in them the self-confidence to work independently. each student should do an individual project and they can freely choose their own topic of experimental nature. The project should be of investigative type not a hobby project. Students are encouraged to take the project work as a challenge so that their project will boost up theirindustrial career. Periodic Seminars should be conducted to assess the students. The students should present the progress of the project to their respective guides and get the required assistance from them. The students will submit Project Report in the form of Dissertation which will be examined by the examiners.

The examination shall consist of

i) Evaluation of the Dissertation copy and

ii) Comprehensive Viva-voice examination

M.Sc. Electronics / Semester -IV / Skill Enhancement course (SEC) -3 / Professional Competency Skill:

NANO-ELECTRONICS

OBJECTIVES:

- Students need to understand about "NANO" and their requirements of modern society in a focused area to solve the all-world problems.

CO1	Relate technology changes from semiconductor devices in silicon technology.	K2,K5
CO2	Understanding Nano tube for memory applications	K2,K5
CO3	apply various technology quantum electronic devices.	K3,K4
CO4	An analyze the Single electron devices for logic applications	K1,K4,K5
CO5	Apply NANO-BIO DEVICES concepts for device fabrication	K2,K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

UNIT I

INTRODUCTION: Region of nanostructures, scaling of devices in silicon technology, estimation of technology limits, Uncertainty principle, Experiments on duality, Schrodinger's equation and its applications to square well potential, square potential barrier (1D). Infinite array of potential wells, Barrier penetration, applications to tunnel diode, Josephson effect, Perturbation theory and its applications, Scattering. Binomial and related distributions, Phase space, Statistical ensembles, applications of classical statistical mechanics, Quantum statistics, Brownian motion, Random walk problem.

UNIT II

CARBON NANOTUBES: Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs – Nano tube for memory applications – prospects of carbon nanotube nanoelectronics.

UNIT III

QUANTUM ELECTRONIC DEVICES: Concept of Chemical potential, partition function and its applications in computing thermodynamic quantities. Quantum electronic devices, electrons in mesoscopic structures, short channel MOSFET, split-gate transistor, electron wave transistor, electron spin transistor, quantum cellular automata

UNIT IV

QUANTUM BASED RTDS: Quantum transport devices based on resonant tunnelling: - Electron tunnelling – resonant tunnelling diodes (RTDs)- three terminal RTDS, RTD based memory, Single electron devices for logic applications: - Single electron devices – applications of single electron devices to logic circuits.

UNIT V

NANO-BIO DEVICES: Bioelectronics, molecular processor, DNA analyzer as biochip, Molecular electronics, Fullerenes, nanotubes, switches based on Fullerenes and nanotubes, basic logic gates and dynamic logic gates, principle of single electron transistor, Coulomb blockade.

TEXT AND REFERENCE BOOKS:

1.Nanoelectronics and Nano systems: K.Goser, P. Glosekotter, J. Dienstuhl, Springer (2005)2.Quantum Mechanics: Schiff L.I.

3. Fundamentals of Statistical Mechanics and Thermal Physics: Reif
4. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall /CRC, 2002
5. T.Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007
6. Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003

COURSE RESULTS: Students must be capable of addressing problems that require interdisciplinary skills.

M.Sc. Electronics / Extension Activity:

HUMAN RIGHTS

OBJECTIVES: To understand the fundamental rights of Human rights

Course Outcomes	On completion of this course, students will / can;	
CO1	Understand the basic facets of human rights	K4, K6, K1
CO2	Comprehend the Constitutional provisions of human rights in India	K1, K2
CO3	Grasp the rights of the marginalized and other disadvantaged people in India	K4, K5
CO4	Know the historical background of the various human rights movement in India.	K6
CO5	Understand the redressal mechanism of the human rights violations	K3, K6
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create		

S-Strong; M-Medium; L-Low

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	S	S	S	S	M	S	S	S	S	S
CO 2	S	S	S	S	S	S	M	S	S	S
CO 3	S	M	S	S	S	S	S	S	S	S
CO 4	M	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	M	S	M	S	S	S

UNIT 1:

Introduction: Meaning and Definitions of Human Rights – Characteristics and Importance of Human Rights – Evolution of Human Rights – Formation, Structure and Functions of the UNO - Universal Declaration of Human Rights – International Covenants– Violations of Human Rights in the Contemporary Era.

UNIT II:

Human Rights in India: Development of Human Rights in India – Constituent Assembly and Indian Constitution – Fundamental Rights and its Classification – Directive Principles of State Policy – Fundamental Duties.

UNIT III:

Rights of Marginalized and other Disadvantaged People: Rights of Women – Rights of Children – Rights of Differently Abled – Rights of Elderly - Rights of Scheduled Castes – Rights of Scheduled Tribes – Rights of Minorities – – Rights of Prisoners – Rights of Persons Living with HIVAIDS – Rights of LGBT.

UNIT IV:

Human Rights Movements: Peasant Movements(Tebhaga and Telangana) – Scheduled Caste Movements (Mahar and Ad-Dharmi) – Scheduled Tribes Movements (Santhal and Munda) – Environmental Movements (Chipko and Narmada Bachao Andolan) – Social Reform Movements (Vaikom and Self Respect).

UNIT V:

Redressal Mechanisms: Protection of Human Rights Act, 1993 (Amendment 2019) – Structure and Functions of National and State Human Rights Commissions – National Commission for SCs – National Commission for STs – National Commission for Women – National Commission for Minorities – Characteristics and Objectives of Human Rights Education.

Text Books:

1. Dr. S. Mehartaj Begum, Human Rights in India: Issues and perspectives, APH Publishing Corporation, New Delhi, 2010.
2. Asha Kiran, The History of Human Rights, Mangalam Publications, Delhi, 2011.
3. Bani Borgohain, Human Rights, Kanishka Publishers & Distributors, New Delhi-2, 2007.
4. Jayant Chudhary, A Textbook of Human Rights, Wisdom Press, New Delhi, 2011.
5. Anju Soni, Human Rights in India, Venus Publication, New Delhi,2019.

References Books:

1. Sudarshanam Gankidi, Human Rights in India: Prospective and Retrospective, Rawat Publications, Jaipur, 2019.
2. Satvinder Juss, Human Rights in India, Routledge, New Delhi, 2020.
3. Namita Gupta, Social Justice and Human Rights in India, Rawat Publications, Jaipur, 2021.
4. Mark Frezo, The Sociology of Human Rights, John Willy & Sons, U.K.2014.
5. Chiranjivi J. Nirmal, Human Rights in India: Historical, Social and Political Perspectives, Oxford University Press, New York, 2000.

Web resources:

1. www.un.org/rights/HRToday
2. www.amnesty.org
3. www.hrweb.org
4. https://www.youtube.com/watch?v=vDizUvyQTuo
5. https://www.youtube.com/watch?v=WJsUfck01Js

COURSE RESULTS: The outcome of the students can understand the theoretical knowledge of human rights movements and its mechanism.