

M.Sc. (Electronic Science/Electronics)
(Semesters I, II, III and IV)

Each paper will be of 5 credits meaning there by that the Total course will be of 100 credits. Maximum of 10 hours will be devoted to each credit

In Post Graduate course there will be four semesters in all, each of six months duration. The structure of M.Sc. Course in Electronic Science/Electronics is shown in Table as per CBCS ordinance and regulation for 2 year Post Graduate degree course in the faculty of science. This course of M.Sc. in Electronic Science/Electronics shall consist of 20 papers spread over four semesters. There shall be five papers in first semester, 6 papers in 2nd and 3rd semester each and three papers in 4th semester carrying 100 marks in each paper. The entire curriculum shall be of 2000 marks taken together. However, the class shall be awarded on the performance of the candidate on 16 papers including 14 CC and 2 EC papers having an aggregate of 1600 marks

Table-01 Description of Papers for M.Sc. (Electronic Science/Electronics) under CBCS

SEMESTER	COURSE/PAPER CODE	Name of Course/Paper	Credits	Marks	Marks of CIA	Marks of ESE	Passing Criteria	Qualifying Criteria
I	ELECC-01	Engineering Mathematics	5	100	30	70	45% in CIA 45% in ESE	Marks decide class CGPA
	ELECC-02	Solid State Electronics	5	100	30	70	45% in CIA 45% in ESE	Marks decide class CGPA
	ELECC-03	Fundamentals of Computer Programming	5	100	30	70	45% in CIA 45% in ESE	Marks decide class CGPA
	ELECC-04	Practical (Based on E,EE,EEE)	5	100	30	70	45% in CIA 45% in ESE	Marks decide class CGPA
	ELECC-05	Ability Enhancing Compulsory Elective	5	100	30	70	45% in CIA 45% in ESE	Qualify
II	ELECC-06	Computer Electronics and Environmental Impacts	5	100	30	70	45% in CIA 45% in ESE	Marks decide class CGPA
	ELECC-07	Microprocessor and Microcontroller	5	100	30	70	45% in CIA 45% in ESE	Marks decide class CGPA
	ELECC-08	Advanced Analog and Digital Electronics	5	100	30	70	45% in CIA 45% in ESE	Marks decide class CGPA
	ELECC-09	Signals and Systems	5	100	30	70	45% in CIA 45% in ESE	Marks decide class CGPA

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	ELECC-09	Practical (Based on 16.10,17 &18)	5	100	50	75	45% in CIA 45% in ESE	Marks decide class CGPA	
	AEC-1	Ability Enhancing Elective Paper	5	100	50	75	45% in CIA 45% in ESE		
III	ELECC-10	Control Theory and Instrumentation	5	100	50	75	45% in CIA 45% in ESE	Marks decide class CGPA	
	ELECC-11	Electronic Communication System	5	100	50	75	45% in CIA 45% in ESE	Marks decide class CGPA	
	ELECC-12	Electromagnetics and Radiating Systems	5	100	50	75	45% in CIA 45% in ESE	Marks decide class CGPA	
	ELECC-13	Microelectronics	5	100	50	75	45% in CIA 45% in ESE	Marks decide class CGPA	
	ELECC-14	Practical (Based on 16.11,12 &13)	5	100	50	75	45% in CIA 45% in ESE	Marks decide class CGPA	
	AEC-2	Ability Enhancing Compulsory Elective	5	100	50	50	45% in CIA 45% in ESE	Qualifying	
IV	ELECC-01	1. Artificial Intelligence and Robotics 2. Theory and operation of Telecommunication-II 3. Digital Communications 4. Internet Applications 5. Embedded Systems 6. Speech Processing 7. Computer networking and web programming 8. Nanoelectronics 9. Or other special papers decided by the respective university/departmental steps	5	100		Will be decided by the Department/BOCS	Will be decided by the Department or/BOCS	45% in CIA 45% in ESE	
	ELECC-02	Project Work in any branch of Electronics, Computer, Information and Communication Science	5	100		Will be decided by the Department/BOCS	Will be decided by the Department or/BOCS	45% in CIA 45% in ESE	Marks decide class CGPA
	GE-01		5	100	50	75		Qualifying	
	GE-02		5	100	50	75		Qualifying	

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SEMESTER - I

ELECC-03

Fundamentals of Computer Programming

- 1. Fundamentals of computers & OS** Software & hardware, system software's/it applications software, generation of languages, machine language, high level language and assembly language, compilers and interpreters, boot strap loader and booting sequence, operating system, DOS, Windows OS administration and installation, Introduction to Unix/Linux, Commands and statements
- 2. Data Structure with C** Introduction to C/C++, Data Types and Operators, Statement and Control Flow, Function and Program Structure, Strings, the Processor, Pointers, Memory Allocation, Input and Output, Subprogram, Return, File Access
Data structure- Linked Lists, Trees, Stack, Queue, Graph, Related operation, Traversing, Inserting, Deletion, Merging, Binary Search, Sorting Algorithm, Bubble sort, Quick sort, Heap sort, Merge sort,
- 3. Programming Languages** Flow Charting and basic concept of programming, Development of an algorithm, Design of an Algorithm, analysis of complexity of an algorithm, flow-Chart, Top-Down programming and Bottom - Up programming techniques, Structured programming Programming in FORTRAN & MATLAB, Their Applications in problems involving solutions of Polynomial - simultaneous - Matrix - differential - equations and use in Electric Circuit analysis.
- 4. Introduction to Software Engineering** Characteristics of Software Engineering, Differences with Conventional Engineering Software requirement specification, Software Life Cycle, Software Design Approach Function and Object Oriented Software, Software testing, Open Source Softwares
- 5. Organisation, Modelling and Mathematical Programming** Formulation of linear programming and dynamic programming problems, Simplex method, Duality, Introduction to queuing theory.

Books recommended:

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| 1. Fundamentals of Computer | - Rajaraman, PII |
| 2. Programming in BASIC | - E Balagurusamy, PII |
| 3. IT Tools | - Tazal |
| 4. Essential Matlab for Engineers and Scientists Brian Hahn D V John Wright | |
| 5. Computer Programming in Fortran 90 & 95 | - Rajaraman - PII |
| 6. UNIX operating Systems | - Sumitabha Das , TMH |

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SEMESTER-I

ELECC-02

Solid State Electronics

1. Crystal Structure and Theory of Solids Introduction to Crystal, Free electron theory of metal, Band theory of solids, Bloch Theorem, Kronig-Penney Model, Introduction to Superconductivity, Ferro-electricity, Piezo-electricity.
2. Semiconductor Physics Energy Band and Carrier concentration, Carrier transport phenomena: drift, diffusion, injection, Generation & recombination of processes, Continuity equations and its application
3. Solid State Devices MOSFET, CMOS, Gunn, Read, IMPATT, TRAPATT diodes, Tunnel Diode, Microwave BJT and FET, Structure and Characteristics
4. MASERS and LASERS Development of Masers, Einstein's A and B coefficients (Spontaneous and stimulated transitions), Possibility of amplifications, Two- and three-level MASER System, Optical Pumping, Population inversion, LASER Action, Fabry - Perot Lasing, Oscillation frequency, Three and four level Lasers, Solid State Lasers (Ruby laser, YAG laser, Nd Glass Laser), Semiconductor laser, Liquid laser (Dye laser), Laser properties, Laser power, Laser detection
5. Dielectric and Magnetic Materials Dielectric materials, Ferroelectric materials, piezoelectric materials, Introduction to diamagnetic, paramagnetic and ferromagnetic materials

Books recommended :

1. Kittel C., Introduction to Solid State Physics, John Wiley
2. Dekker A. J., Solid State Physics, Macmillan, India.
3. Streetman, Ben G. And Sanjay Banerjee, Solid State Electronic Devices, Prentice Hall Pub. N.A.
4. Udo Samuel Y., Microwave Devices and Circuits, Prentice Hall Pub. N. D.
5. See S.M. Semiconductor Devices, Wiley Pub.

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SEMESTER - I

ELECC-03

Fundamentals of Computer Programming

1. Fundamentals of computers & OSSoftware & hardware, system software's all applications software, generation of languages, machine language, high level language and assembly language, compilers and interpreters, boot strap loader and booting sequence, operating system, DOS, Windows OS administration and installation, Introduction to Unix/Linux, Commands and statements
2. Data Structure with CIntroduction to C/C++, Data Types and Operators, Statement and Control Flow, Function and Program Structure, Strings, the Processor, Pointers, Memory Allocations, Input and Output, Subprogram, Recursion, File Access
Data structure- Linked Lists, Trees, Stack, Queue, Graph, Related operation, Traversing, Inserting, Deletion, Merging, Binary Search, Sorting Algorithms, Bubble sort, Quick sort, Heap, sort, Merge sort,
3. Programming LanguageFlow Charting and basic concept of programming, Development of an algorithm, Design of an Algorithm, analysis of complexity of an algorithm, flow-Chart, Top-Down programming and Bottom - Up programming techniques, Structured programming Programming in FORTRAN & MATLAB, Their Applications in problems involving solutions of Polynomial - simultaneous - Matrix - differential - equations and use in Electric Circuit analysis.
4. Introduction to Software EngineeringCharacteristics of Software Engineering, Differences with Conventional Engineering Software requirement specification, Software Life Cycle, Software Design Approach Function and Object Oriented Software, Software testing, Open Source Softwares
5. Optimization, Modelling and Mathematical Programmingformulation of linear programming and dynamic programming problems, Simplex method, Duality, Introduction to queuing theory.

Books recommended:

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| 1. Fundamentals of Computer | - Rajaraman, PHI |
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| 3. IT Tools | - Tatai |
| 4. Essential Matlab for Engineers and Scientists Brian Hahn D V John Wright | |
| 5. Computer Programming in Fortran 90 & 95 | - Rajaraman - PHI |
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SEMESTER - I

ELECC-03

Practical based on papers ELECC-01,02,03

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SEMESTER - II

ELECC-05

Consumer Electronics and Environmental Impact

1. **Hand Tools and their uses** Commonly used instruments and hand tools in Electronic Labs, Identification and use of screw drivers, pliers, tweezers, tester, wire stripper etc. Different types of soldering guns related to temperature and wattage, types of tips, solder materials, flux and other materials, soldering and desoldering stations, Different types of switches, electronic components- specifications and uses.
2. **AC and DC Measurements** Basic terms of AC and DC, Identification of meter for measuring AC and DC parameters, use of multimeter, use of CRO, function generator, signal analyzer, spectrum analyzer
3. **Electronic Gadgets and Domestic Appliances** MICROWAVE OVENS - Microwaves (Range used in Microwave ovens), Microwave oven block diagram, Wiring and Safety instructions, Washing machines controller, TV and Video systems-Digital camera, Home security system, CCTV, Digital cable TV - Video on demand, Electronic toy industry and its stakeholders, DIGITAL ACCESS DEVICES - Digital computer - Internet access - functions and networks - barcode scanner and decoder - Electronic Fund Transfer - Automated Teller Machines(ATMs), Mobile phones -GPS & Bluetooth, GPS Navigation system, Audio systems, PC trouble shootings, Digital India for higher education-steps taken and future, cyber security and cryptography
4. **E-waste** Composition of e-waste and its generation, e-waste management and its effect on health and society, Life cycle Analysis, role of e-waste management on the various initiative of the government including: Swachh Bharat Mission, Smart Cities etc., Electronic Recycling System
5. **Electromagnetic pollution** Causes of electropollution, ionizing and non-ionizing radiation, electromagnetic waves and its effect on biological tissues, growth and use of radio waves, radio wave safety, dangers of electromagnetic waves, radio wave pollution due to mobile phones, tower, home/office appliances such as computers, Wi-Fi, etc., consequences of electro pollution, electro-pollution exposure management.

Books recommended:

1. "Wu's Book," Modern Cryptography: Theory and Practice", Pearson Education.
2. Jonathan W. Valvano, "Embedded Systems: Computer Systems", Thomson Publications
3. Scott Murter, "Upgrading and Repairing PCs", 20th Edition, Pearson Education
4. R. P. Ball, "Consumer Electronics", Pearson Education (2008).
5. T. R. G. Gupta, "Audio and Video in Term", Tata McGraw Hill (2004).
6. **Electromagnetism and the Foundation of Life**
by Robert O. Becker & G. Selzer
7. S. Rainey (Editor), Ben Greenbaum Biological and Medical Aspects of Electromagnetic Fields (Handbook of Biological Effects of Electromagnetic Fields)

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SEMESTER - II

ELECC-46

Microprocessor and Microcontroller

1. Microprocessor Architecture Basic microcomputer architecture, evolution, organization and application of microprocessors, Pin description and their functions, Architecture of 8085 - ALU, Timing and control units Instruction and Dataflow, Timing Diagram, Memory Read and Memory Write machine cycles, IO Read and IO Write machine cycles, CISC and RISC Processors.
2. Instruction Set and programming of 8085 Introduction to Instruction set, Data manipulating instructions, Data transfer instructions, Arithmetic and Logical instruction, Program control instructions, Special instructions, Flag status, status, Addressing modes - Direct, Indirect, Register, Immediate and Implicit and addressing modes, of 8085, 8-Bit addition and subtraction, 16-Bit addition and subtraction, Data Array operations, Time Delay and code conversions, Microprocessor based system design.
3. Interfacing and Peripheral Devices Memory interfacing, IO interfacing, Special purpose interfacing chips- 8155 (memory + IO + timer), 8255 (I/O), 8251 (USART), 8253 (timer/counting), 8257 (DMA controller), 8259 (interrupt controller), 8279 (keyboard/display controller) Programmable controller, Microprocessor based data acquisition system ADC 0800, ADC 0801 series, ADC 0808/0809
4. 8086 microprocessors 8086 architecture & pin description, operating modes of 8086, memory addressing, addressing modes and instruction set, programming of 8086, interrupts of 8086
5. Microcontrollers Introduction to 8-bit microcontrollers- 8031/8051

Books recommended:

1. Ram B. - Fundamentals of Microprocessors and Micro Computers, Dhongat Pub., N.D.
2. Singh R.P. - Microprocessors Micro Controllers - A complete text, Galaxia Pub., N.D.
3. Microprocessor 8085 - R S Gaonkar, Pervam
4. Microprocessor 8085 - B Ram, Dhongat Rai
5. Microprocessor 8086 - 80486 - Barry B Brey, PHI
6. Microcontrollers - Ayala, PHI
7. 8051 Microcontrollers - Maridi, Pearson

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SEMESTER - II

ELECC-07

Advanced Analog and Digital Electronics

1. Differential amplifier and OP-Amps: Circuit design and performance characteristics. Adder, Timer and PLL, Comparator, Log and Antilog Amplifiers, Analog multiplier, Voltage follower, VCD, Constant Voltage source, Integrator, Differentiator, Inductor Simulation, Analog computation. Generation of Square wave: Triangular wave, Low pass, High pass, Band pass, All pass filters, Notch, Switched - capacitor filter
2. Combinational circuit design: Half adder & full adder, half subtractor: full subtractor, adder & subtractor, multiplexer, demultiplexer/decoder, encoder, priority encoder, comparator
3. Analog and digital converters: Design of DAC - Weighted-resistor DAC, Ladder DAC Design of ADC- Ramp type, successive approximation type, dual-slope type, flash type converter
4. Sequential circuit design: Shift registers: SISO, SIPO, PISO, PIPO and universal shift registers. Design of binary counters: asynchronous (ripple) counters, synchronous counters, Ring counter, Johnson counter
5. Memories: Memory organization, Static and dynamic memory cells, RAM using shift registers, ROM, PROM, EPROM, and EEPROM, CD-ROM, Hard Disk, Flash memory

Books recommended:

1. Malvino AP. - Digital Principles and Application, Mc - Graw - Hill pub. N.Y.
2. Jain R.P. - Modern Digital Electronics, Tata Mc-Graw-Hill publ. N.D.
3. Singh B. PandSingh B. - Advance Microprocessors and Microcontrollers, New Age Pub.
4. Nagrath I.L. - Electronics- Analog and Digital Prentice Hall Publ.
5. Malvino and Brown Digital computer electronics, Tata Mc-Graw-Hill publ. N.Y
6. Nagrath I.L. - Electronics-Analog and Digital Prentice Hall Pub.
7. Singh B.P. and Singh R. - Advance Microprocessor and Microcontrollers, New Age Pub.
8. Ramanan - Functional Electronics.
9. Operational Amplifiers: Theory and Design Hardcover - 7 Mar 2016 by Johan H. Hulzing

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ELECC-08

Signals and Systems

1. **Signal analysis** Introduction, Basic continuous time signals, Basic discrete time signals, Systems, properties of systems, Representation of signals in terms of impulses, continuous time systems, convolution integral, properties of LTI systems, Digital signal processing and its benefits, Discrete time LTI systems, Convolution sum.
2. **Fundamentals of discrete time system** Basic definitions, important sequence, Linear and time invariant systems, impulse response, shifting, convolution, stability, Linear constant coefficients difference equations, FIR, IIR systems, Illustrations of the above concepts using MATLAB, Frequency domain analysis.
3. **Fourier analysis** Fourier Series, Fourier transforms(FT), properties, Inverse FT, sampling of continuous time signal, Nyquist rate and aliasing problem, interpolation formula, frequency response of rectangular window, recovery of analog signal.
4. **Discrete Fourier Transform** DFT and its computation, properties, circular and linear convolution, FFT, Time and frequency discrimination, IDFT, Interpretation of DFT results, DFT/FT relationship. UNIT-IV Z-transform: Z-transform, properties, calculation of ZT, Application to the solution of difference equations, System function of a digital filter, combination of filter sections, implementation of digital filter using system function. Design of digital filter.
5. **Basis of biomedical signal processing** Introduction, bio-potential, cardio-vascular systems, Pressure pulses in the cardiac chamber, ECG, EEG & EMG. Blood pressure measurement.

Books recommended:

1. Fundamentals of Signals & Systems – M. J. Roberts (TMH)
2. Theory and Problems of Signals and Systems-Schaum Series
3. Fundamentals of Digital Signal Processing – B.C. Ludeman, Harper & Row
4. Introduction to Digital Signal Processing- Poeman Kuc, MGH
5. Introduction of Digital Signal Processing – J.G. Proakis, D.G. Manolakis
6. Digital Signal Processing – A.V. Oppenheim, R.W. Schaffer, Prentice Hall
7. Theory and applications of digital Signal Processing- R.L. Rabiner, B. Gold, PHI
8. Introduction of Digital Signal Processing – J. R. Johnson, PHI

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SEMESTER - II

ELECC-09

Practical based on papers ELECC-05,06,07& 08

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Control Theory and Instrumentation

- 1. Control Systems:** Basic elements and types of control systems – Open loop and closed loop control systems, Equations – Models of linear systems – Electrical and mechanical systems – Electrical analogous systems. Transfer function and impulse response, Block diagram representation and manipulation, Signal flow graphs, Mathematical modelling of simple physical systems, Introduction to Feedback control systems
- 2. Time domain analysis and Root Locus Technique:** Standard test signals, time domain performance of control systems, transient response of the first, the second order systems, stability, steady state errors, effect of adding zero to the system, Routh stability criterion. Root locus technique: The root locus concept, construction of root locus and analysis of control system.
- 3. Frequency domain analysis:** Basic control actions: Correlation between time and frequency response, Polar plots, Bode plots, experimental determination of transfer function, log magnitude versus phase plots, Nyquist stability criterion, Proportional, derivative and integral controllers, combined controllers, Effect of integral and derivative control on system, performance, PID controller.
- 4. Measurement of Physical Quantities:** Measurement of Displacement, Velocity, Strain, Pressure, Temperature, Light intensity, Signal Conditioner & Display/Recording System: Op-Amp Instrumentation Amplifier, Analog Ammeter, Digital Voltmeter, Strip-chart recorder, X-Y recorder
- 5. Transducers:** Passive electrical transducers – Resistive, Strain, Pressure, Moisture and optical radiation transducers, capacitive moisture transducers. Active electrical transducers – photoconductive, photovoltaic and photo emissive transducers, Digital transducers- Displacement transducers, tachometers, Transducer Oscillator

Books recommended :

1. Control system Engineering – J.J. Nagrah, M. Gopal, Wiley Eastern Ltd.
2. Modern Control Engineering – K. Ogata, PHI
3. Automatic control systems- B.C. Kuo, PHI
4. Principles of Electronic Instrumentation - Patra Nabis - PHI
5. Electrical & Electronic Measurement - Sawhney, Dhanpat Rai & Sons
6. Biomedical instrumentation and measurements -Cromwell et al., Pearson
7. Automatic Control System-Samarjeet Ghosh

SEMESTER - III

ELECC-II

Electronic Communication System

1. Principles of modulation Basic principles of AM, FM, PM. Pulse modulation systems-PAM, PWM, PPM. Code modulation systems-PCM, DPCM, DM
2. Noise External Noise, Internal Noise, Noise calculations, S/N ratio, Noise factor and Noise figure, Noise temperature
3. Transmission Lines Introduction & classification, distributed parameters of lines, Transmission line equations and solutions, characteristic impedance, propagation constant, attenuation constant & phase shift constant, impedance at a point on a line, lossless and distortionless transmission line, voltage reflection coefficient and VSWR, Quarter wave transformers, Smith Chart
4. Satellite Communication Kepler's Laws, Types of satellites, Geo-stationary Orbit, Altitude Control, Station Keeping, Antenna look angles, Limits of visibility, Frequency band and polarization, Transponders, Up-link and Down-link, Power Budget, Overall Link Power Budget, Digital Carrier Transmission, Multiple Access Method, Brief Introduction to digital communications by satellite.
5. Optical Communication Principles of optical communication system, Optical sources and Detectors, Optical Fibers, Modes of an optical fibers, Multimode fibers, Single mode fibers and their propagation characteristics, Dispersion Management in optical fibers and link design considerations, Integrated Optics - Planar and Channel wave guides, Directional couplers, Optical Switch, Electro-Optic and Acousto-Optic waveguide devices, Display devices, Holography and Optical Information processing.

Books recommended:

1. Radio Wave Propagation - Jordan
2. Optical Fiber Communication - Gaard Kester, McGraw Hill
3. Hand Book Of Electronics Gupta and Kumar, PragatiPrakashan
4. Electronic Communication Systems - Kennedy & Davis, TMH
5. Electronic Communication-Roddy & Coolen,
6. Principle of Communication Systems - Taub & Schilling, TMH

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Electromagnetics and Radiating Systems

- 1. Electromagnetic Theory** Maxwell's Equations, EM wave equations and its solution, characteristic impedance of free space, Poynting theorem.
- 2. Radio wave propagation** Ground waves, Tropospheric wave propagation, Sky waves, Ionosphere, Virtual height, Chapman's Theory of Layer formation, Refraction and Reflection of Radio waves, Refractive index of ionized medium, Critical frequency, MUF, SKP Distance fading.
- 3. Antennas** Alternating current element (Oscillation Electric dipole), Power radiated by current element, Application to short antenna, radiation from quarter wave monopole or half wave dipole, linear antenna arrays, directional properties, folded dipole antenna, Yagi-Uda Antenna, Parabolic reflection antenna, feed mechanism, log, periodic antenna, helical antenna.
- 4. Microwave Theory and Techniques** Rectangular wave guide, Solution of wave equation for rectangular wave guide, TE & H modes, introduction to circular wave guide, Microwave network representation, Scattering matrix representation, Microwave tubes - Two cavity & Reflex Klystron, Bunching, Travelling wave tube (Helix type), Magnetron
- 5. Radar Communication** Principles, arrangement, operating characteristic, maximum range of Radar set, Radar transmitting systems, Radar antennas, Duplexer, Radar receivers

Books recommended:

1. Micro Wave Devices - Liao, PHI
2. Radio Wave Propagation - Jordan
3. Optical Fibre Communication - Geard Keiser, McGraw Hill
4. Hand Book Of Electronics- Gupta and Kumar, Pragati/Prakashan
5. Electronic Communications - Kennedy
6. Antennas - John D Kraus, TMH
7. Electromagnetic waves and Radiating Systems - Jordan & Balmain, PHI


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SEMESTER - III

ELECC-13

Microelectronics

1. IC Fabrication Technology: Material properties; crystal growth and doping; diffusion; oxidation; epitaxy; ion implantation; deposition of films using CVD, LPCVD and sputtering techniques; wet and dry etching and cleaning; lithographic process; device and circuit fabrication; process modeling and simulation.
2. VLSI Design: Introduction to NMOS and CMOS circuits; NMOS and CMOS processing technology; CMOS circuits and logic design; circuit characterization and performance estimation; structured design and testing; symbolic layout systems; CMOS subsystem design; system case studies.
3. Physics and Modelling of Microelectronics: Physics and properties of semiconductor - a review; pn junction diode; bipolar transistor; metal semiconductor contacts; JFET and MESFET; MOSFET and scaling; CCD and photonic devices. MEL G612
4. Analog IC Design: Basic concepts; BiCMOS process and technology; current and voltage sources; differential and operational amplifiers; multipliers and modulators; phase-locked techniques; D-to-A and A-to-D converters; micropower circuits; high voltage circuits; radiation resistant circuits; filter design considerations.
5. Embedded System Design: Introduction to embedded systems; embedded architectures: Architectures and programming of microcontrollers and DSPs. Embedded applications and technologies; power issues in system design; introduction to software and hardware co-design.

Books recommended:

1. Microelectronics-Millman Jacob and Gabriel Arvin, McGraw Hill International Ed.
2. VLSI Technology - S M Seo, TMH
3. Embedded System Design-Vahid & Givargis
4. Embedded Systems-Rajkumar, TMH
5. An Embedded Software Primer-Simon, Pearson

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ELECC-14

Practical based on ELECC10,11,12&13

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Artificial Intelligence(AI) and Robotics

1. **Introducing AI applications and AI techniques**, Production systems, control strategies, reasoning - forward and backward chaining, Intelligent Agents: Definitions of a rational agent, reflex, model-based, goal-based, and utility-based agents, the environment in which a particular agent operates.
2. **Searching Techniques and Game Playing** Breadth first search, depth first search, iterative deepening, uniform cost search, hill climbing, simulated annealing, genetic algorithm search, heuristic search, Best first search, A* algorithm, AO* algorithm, Minimax and game trees, refining minimax.
3. **Knowledge Representation** First order predicate calculus, resolution, unification, natural deduction system, refutation, logic programming, PROLOG, semantic networks, frame system, value inheritance, conceptual dependency, Ontologies, Expert Systems, MYCIN, CLIPS, Expert system shall different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modeling uncertainty such as Dempster-Shafer theory and fuzzy sets/
4. **Natural language processing** component steps of communication, contrast between formal and natural languages in the context of grammar, parsing, and semantics
Readings, speech recognition
5. **Robotics** Definition of Robot, Sensing, Programming, Types of Automation - Hard and Flexible, Classification of Robots, Robot Arms/Types of Joints - Prismatic, Revolute, Ball and Socket Joints, Degree of Freedom, Classification Criterion - Cylindrical, Spherical, Articulated robots, Comparison link Construction, Function and Structure of Robots, Arms Structures, Mobility Probe, Methods of Modelling, Normal Structure. Robot Controllers: Teaching Methods, Control Levels actuators, Close loop and path control, Differential motion, Jacobean and its inverse path recording, Cartesian motion, Joint interpolated control, Robot Teaching Methods Teach-in and Teach through sensors, Programming Methods- Illustrations, Comparison of Teaching and programming methods, Machine learning, Machine Vision.

Books Recommended

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach (2nd ed.), Pearson Education, 2006.
2. Elaine Rich and Edwin Knight, Artificial Intelligence, Tata McGraw Hill, 2002.
3. Nils J Nilson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers, Inc., San Francisco, California, 2000.
4. R. Akerkar, Introduction to Artificial Intelligence, Prentice-Hall of India, 2005
5. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India, 2006.
6. Nils J. Nilson, Principles of Artificial Intelligence, Narosa Publishing House.
7. W.F. Clocksin and C.S. Mellish, Programming in PROLOG, Narosa Publishing House
8. Seroj Kaushik, Logic and Prolog Programming, New Age International Publisher,

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Telecommunication-I

1. Microwave Components Loops and Probes, Bonds and corners, E-Plane Tee, H-Plane Tee, Magic Tee, Directional Coupler, Isolator and Circulator
2. Microwave Strip lines Concepts of MIC's and MMIC's Micro strip lines, Slot lines, Coplanar Strip lines – their Characteristics Impedance losses and Q-Factor
3. Microwave Communication Advantages and disadvantages of Microwave Transmission, Loss in Free Space, Propagation of Microwave, Atmospheric effects on propagation, Fresnel Zone problem, Ground Reflection, Fading Sources, Detectors, Components, Antennas used in MW communication systems
4. Antennas Linear Antenna Arrays, Directional properties, Folded Dipole Antenna, YAGI-UDA antenna, Parabolic Reflection antenna, feed mechanisms, Log-Periodic antenna, Helical Antenna.
5. Radar Systems Elements of Radar Systems, Radar range equation, Performance Parameters, Pulse Radar, CW Radar, MTI Radar, Radar Beacons, Radar Displays, Duplexers, Aircrafts Landing System, Ground Control approach, and Instrument Landing Systems

Books Recommended:

1. Liao S Y, Microwave Devices and Circuits, PHI, N.D.
2. Szefta and Raghuvansi, Microwave Circuits and Passive Devices, Wiley Eastern Pub. N.D.
3. Yeh A, Optical Electronics, Saunders College Pub. London
4. Gupta K C, Garg R, Bahal I H, Micro Striplines and Slotlines, Artech House Pub.
5. Edwards T C, Foundation of Micro Strip Circuit and Design
6. Gupta K C and Singh Amarjeet, Microstrip Integrated Circuit, Wiley Eastern Pvt. Ltd, N.D.
7. Gandhi OP, Microwave Engineering and Application, Pergamon Press.

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Telecommunication-II

1. Signal Analysis Discrete Signal Analysis – In Discrete Time System, Introduction to Z-Transform, Properties of Z-Transform, Inverse Z-Transform, Continuous Signal Analysis – Introduction to periodic and aperiodic signals, Fourier series of periodic functions, Fourier Transform and its properties.
2. Fiber Optic Communication Fiber Optic Communication system, Fiber Optical Characteristics, Light Wave Fundamentals, Integrated optical wave guides, Optic fiber waveguide, Light sources, Light Detectors, Compilers and Converters, Distribution Network, and fiber components, Modulation Noise Detection, System Design. Introduction to non-linear optics
3. Data Acquisition System Introduction, Resolution and Accuracy, Numbers of Channels, Sampling rates, Ratio metric Conversion, Logarithmic compression, Single Channel data acquisition systems, Pre-amplifier and Filtering, Multi-channel data acquisition systems, multiplexing of outputs of sample hold Multiplexing after A/D conversion, Multiplexing Low Level Data, Present Trend in Data acquisition.
4. Signal Conditioning - Excitation Systems and Amplifiers Sample and hold Circuits, Multiplexers – TDM and FDM, MSI, ICS and Multiplexer, Design of High Order Multiplexer using low order multiplexers ICS, A/D conversion, Address decoders, Example of such ICS, Telemetry – AC telemetry, Modulation in telemetry, Pulse and Radio Telemetry, Signal recovery, signal averaging, Signal Correlation, Signal Coding, Data processing, Display and recording Technique in Biomedical systems, Role in telemetry in Biomedical system
5. Digital Communication Introduction of Telecommunication, Power Spectral Density of Digital Modulation, Scalar and Vector communication over discrete memory less Channel, Coherent communication with wave forms, Non-Coherent communication with wave forms, Partially coherent communication with wave forms, Differentially coherent communication with wave form, Double differentially coherent communication with wave form, Communication over band limited channel, Demodulation and Detection of other digital modulation, Coded digital communication, Block coded digital communication, Convolutional coded digital communication

Books recommended:

1. Digital Signal Processing - S Sulkhanan A Swilana - Mc Graw Hill
2. Optical Fiber Communication - Gerd Keiser - Mc Graw Hill
3. Digital Signal Processing - Sanjay Sharma - Katson Books

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Digital Communication

1. Information Theory Introduction, Entropy, Redundancy, Channel Capacity, Hartley's law, Hartley-Shannon Law, Noise in an information carrying channel, Bandwidth, S/N ratio, Trade-off
2. Noisy Communication in Noisy Channels, Error rates in Binary Transmission, Optimum Signal Detection Levels, Information Capacity of PCM systems, Relations among Power, Noise and Bandwidth, Noise Power and Spectral representation of Noise
3. Introduction to Digital Communication Digital Modulation Formats, Coherent Binary Modulation techniques, coherent quadrature-modulation techniques, non-coherent binary modulation techniques, comparison of binary and quaternary modulation techniques, M-ary modulation techniques, Power Spectra, Bandwidth Efficiency, M-ary modulation formats viewed in the light of Channel Capacity Theorem, Effect of Inter symbol interference, Bit Versus Symbol Error Probability, Synchronization, Applications
4. Coding methods and Error control Band rate, Bit rate. Line coding- unipolar, bipolar- NRZ, NRZ, Manchester coding. Source coding- ASCII, EBCDIC and haaslet code. Channel coding, Error, Causes of error and its effects, error detection & correction coding parity, Hamming code
5. Multiplexing and Multiple Access techniques Need of Multiplexing, TDM, FDM definition block diagram and their comparison. Introduction to WDM. Multiple Access techniques- TDMA, FDMA, CDMA, advantages of TDMA over FDMA.

Books recommended:

1. Sanjay Sharma, Communication systems: Analog and Digital, S K Kataria and Sons
2. Wayne Tomasi, Electronic communication system, Pearson Education
3. Louis E. Franzl, Electronics Communication, Tata McGraw Hill
4. Roddy-Coolen, Communication Systems, Prentice Hall of India
5. Amitabha Bhattacharya, Digital Communication, Tata McGraw Hill
6. K. Sam. & Shanmugar, Digital & Analog Communication, Jhonwiley & sons
7. B. Sklar, Digital Communication Fundamentals & Applications, Pearson Education
8. Simarjitaykin, Digital Communication, Jhonwiley & sons
9. J.S. Chitode, Digital Communication Technical, Publication, Pune
10. Froezen, Data Communication Networking, Tata Mc-graw Hill

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Internet Applications

1. **Hyper Text Markup Language (HTML)**
Basic HTML, The document body, Text, Hyperlinks, adding more formatting, using colour, images Tables, Multimedia Objects, Frames, Forms - Toward interactivity, The HTML Document head in detail, XHTML - An Evolutionary markup
2. **Cascading Style Sheets (CSS)**
Introduction, Using Styles: Simple examples, defining your own styles, properties and values in styles, style sheets - worked example, formatting blocks of information, layers
3. **An Introduction to Javascript**
What is dynamic HTML?, Javascript, Javascript - The basics, variables, string manipulation, mathematical functions, statement operators, arrays, functions
4. **Dynamic HTML with Javascript**
Data validation, opening a new window, messages and confirmations, the status bar, linking to a different frame, rollover buttons, moving images, multiple images in a single document, a text-only menu system, floating logos
5. **Introduction to PHP**
PHP, Introducing PHP, Including PHP in a page, data types, program control, arrays, user-defined functions, built-in functions, regular expression, using files

Books recommended:

1. Web programming- Building INTERNET applications- Chris Bates, third edition, Wiley Eastern.
2. Programming with Java - A primer- E Balagurusamy, TMH

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Embedded Systems

1. **Introduction to Embedded Systems** Embedded System overview, Design Challenge, Processor Technology, IC Design Technology, Trade-offs Combinational and Sequential Digital logic, Custom single purpose processor design, RT level custom single purpose processor design, Optimizing custom single purpose Processors
2. **General Purpose Processors: Software** Basic Architecture, Operation, Programmers View, Development Environment, ASIPs, Microprocessor Selection, General purpose processor design
3. **Standard Single Purpose Processors: Peripherals** Timers, Counters and Watchdog Timer, UART, Pulse Width Modulator, Controllers - LCD, Keypad and Stepper Motor, A/D Converters, Real Time Clock
4. **Memory** Write Ability and Storage, Permission, Common Memory Types, Composing Memory, Memory Hierarchy and Cache, Advanced RAM
5. **Interfacing** Communication basics - processor Interfacing, I/O Address- processor Interfacing, Interrupt- processor Interfacing, Direct Memory Address, Arbitration, Multilevel Bus Architecture, Communication principles, Serial Protocol, Parallel Protocol, Wireless Protocol

Books recommended:

- | | |
|--------------------------------|-----------------|
| 1. Embedded System Design | -Vahid&Givargis |
| 2. Embedded Systems | -Rajkumar, TMH |
| 3. An Embedded Software Primer | -Simon, Pearson |

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SPEECH PROCESSING

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1. **Mechanics of Speech production** Mechanism of speech production, Acoustic phonetics - Speech production: Mechanism of speech production, Acoustic phonetics - Digital models for speech signals - Representations of speech waveform: Sampling speech signals, basics of quantization, delta modulation, and Differential PCM - Auditory perception: psycho acoustics. Digital models for speech signals - Representations of speech waveform: Sampling speech signals, basics of quantization, delta modulation, and Differential PCM - Auditory perception: psycho acoustics.
2. **Time Domain Methods for Speech Processing** Time domain parameters of Speech signal, Methods for extracting the parameters, Energy, Average Magnitude, Zero crossing Rate - Silence Discrimination using ZCR and energy - Short Time, Auto Correlation Function - Pitch period estimation using Auto Correlation Function.
3. **Frequency Domain Method for Speech Processing** Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays - Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems: Phase vocoder, Channel Vocoder - Homomorphic speech analysis: Cepstral analysis of Speech, Formant and Pitch Estimation, Homomorphic Vocoders.
4. **Linear Predictive Analysis of Speech** Basic Principles of linear predictive analysis - Auto correlation method - Covariance method - Solution of LPC equations - Cholesky method, Durbin's Recursive algorithm, - Application of LPC parameters - Pitch detection using LPC parameters - Formant analysis - VELP - CELP.
5. **Application of Speech & Audio Signal Processing** Speech signal enhancement, spectral subtraction, Algorithms: Dynamic time warping, Kmeans clustering and Vector quantization, Gaussian mixture modeling, hidden Markov modeling - Automatic Speech Recognition Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence recognition, Language models - Speaker identification and verification - Voice response system - Speech synthesis: basics of articulatory, source-filter, and concatenative synthesis, speech signal separation, basics of music signal processing

Books recommended:

1. Thomas F. Quatieri, Discrete-Time Speech Signal Processing, Prentice Hall / Pearson Education, 2004.
2. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc, Singapore, 2004
3. L.R. Rabiner and R.W. Schaffer - Digital Processing of Speech signals - Prentice Hall
4. L.R. Rabiner and E. H. Juang, Fundamentals of Speech Recognition, Prentice Hall,
5. J.R. Deller, J.H.L. Hansen and J.G. Proakis, Discrete Time Processing of Speech Signals, John Wiley, IEEE Press.

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Computer Network and Web Programming

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1. **Computer network and data communication**/Introduction to Data communication, ISO 7-Layer model, Computer networks, Topologies, Protocol, Introduction to LAN, WAN
2. **PL/SQL**/Introduction to DBMS, PL/SQL Commands
3. **Introduction to C#**Origin & Evolution of C#, Characteristics of C#, Applications of C#, .NET strategy, origin of .NET technology, .NET framework, common languages runtime framework based classes, user and program interface, .NET languages, .NET approach
4. **Overview of C#**Introduction, C# programming, namespaces, adding comments, main returning a value, using aliases for namespace classes, passing string objects to write line method, command line arguments, main with a class, providing interactive input, using mathematical functions, compile time errors, program structures, program coding style
5. **Literals, variables and data types**Introduction, literals, variables, data types, value types, reference types, declaration of variables, initialization of variables, default values, constant values, scope of variables, Decision making with IF statements, simple IF statements, if...else statement, nesting of if... else statements, else if ladder, switch statement, looping- introduction, while statement, do statement, for each statement, jumps in loop

Books recommended:

1. Data & Network Communications - Miller, Michael, Vikas Pub.
2. Microsoft SQL Server 2008 - Cameron and Hitachi Consulting - PHI
3. The complete reference Java - Herbert Schildt, TMH
4. The Java Handbook - Patrick Naughton, TMH
5. An Introduction to Web design + Programming - P S Wang, BSarda S Katiya, Thomson India

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Nanoelectronics

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1. Introduction to nanotechnology Background to nanotechnology, types of nanotechnology and nanomachines, atomic structure, molecules and phases, surface and dimensional space- top down and bottom up. Molecular nanotechnology: Electron microscope, scanning electron microscope, atomic force microscope, scanning tunnelling microscope
2. Nanomaterials Types of nanomaterials-nanopowder, self-assembly nanofibres, nanofibers, nanosheets, nanopillars, nanodots, nanowires, synthesis-high temperature solid state reaction technique-ball milling, sol gel, hydrothermal technique, sintering technique and their types-chemical vapour deposition, pulsed laser deposition, application of nanomaterials, thin films
3. Fundamentals of nanoelectronics Fundamentals of logic devices, requirements, dynamic properties, threshold gates, physical limits to computations, concept of logic devices- classification, two terminal devices, field effect devices, coulomb blockade devices, spintronics, quantum computing, Ultimate computation-power dissipation limit, dissipation in reversible computations, the ultimate computing.
4. Silicon MOSFETs & Quantum transport devices Silicon MOSFETs, Novel materials, fundamentals of MOSFET devices, scaling, SiO₂ based dielectrics, metal-gate junctions, advanced MOSFET concepts, Quantum transport devices based on resonant tunnelling, electron tunnelling, resonant tunnelling diodes, resonant tunnelling devices, single electron devices for logic applications
5. Carbon Nanotubes Carbon nanotubes, types of nanotubes, formation of nanotubes, assemblies, electronic properties, synthesis of carbon nanotubes, carbon nanotube interconnects, carbon nanotube FETs, nanotube for memory applications, molecular electronics, electrodes and contacts, junctions, molecular electronic devices, first test system, simulation and circuit design, future applications: MEMS, Robots, RAM, Mass storage devices

Books recommended:

1. Nanotechnology: Basic Science and Emerging Technologies, Wilson, Kanagara, Smith, Simmons and Ragusa, Chapman and Hall/CRC
2. Nanoelectronics and Information Technology: Advanced Electronic materials and Novel Devices, B Waser, Wiley -VCH
3. Nano: The Essentials-Understanding Nanoscience and Nanotechnology, T Pradeep, TMS

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