CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY

KANPUR

SYLLABUS

(M.Sc. Electronics)

ELECTRONICS AND COMMUNICATION ENGINEERING

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

Vision

To achieve excellence in engineering education, empower students to be technically competent professionals and entrepreneurs with strong ethical values so as to significantly contribute as agents for universal development and societal transformation

Mission

To provide affordable quality education at par with global standards of academia and serve society with harmonious social diversity

To encourage new ideas and inculcate an entrepreneurial attitude amongst the students, and provide a robust research ecosystem

To practice and encourage high standards of professional ethics and accountability among students

M.Sc. Electronics

Program Outcomes (POs)

PO1	**Engineering knowledge:** Acquire strong fundamental knowledge of computer science and engineering along with mathematics.
PO2	**Problem analysis:** Ability to identify, formulate & analyse requirements of a problem to provide sustainable solution which are in coherence with the local/regional/national or global needs and feasibility
PO3	**Design/development of solutions:** Design solution for complex problems, which incorporate components and processes, which are sustainable and reusable.
PO4	**Conduct investigation of complex problems:** Develop skills to synthesize research-based knowledge in the design, interpretation, analysis and synthesis of data for providing solutions to complex problems
PO5	**Modern tool usage:** Possess programming skills in different contemporary programming languages and use different development tools. Be able to select the appropriate tool/programing language/platform and understand the limitations of the same while implementing the solution.
PO6	**The Engineer and Society:** To apply skills for social causes at the local, regional, national and global level and work towards sustainable solutions. Apply reasoning informed by the contextual knowledge to access social, legal and cultural issues.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environment contexts
PO8	**Ethics:** To understand contemporary legal, social & ethical issues in computing.
PO9	**Individual and Teamwork:** Posses Flexibility to adapt to a team environment. To be able to work as an individual or as a member or a team leader in multidisciplinary team organizations.
PO10	**Communication:** To be able to present and communicate precisely and effectively. Be able to comprehend and write effective reports and design documents and presentations professionally and be able to perceive and give clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply to work in the capacity of a member/leader in the team to manage projects
PO12	**Life-long learning:** To have passion for acquiring technical advancements in the field of computer science and engineering and apply new technology for solving local/regional/national or global problems

Program Specific Outcomes (PSOs)

PSO-1	To be able to understand problem, think of best suitable approach to solve the problem, develop and evaluate effective solutions as per the local/ regional/ national/ global requirements and availability of resources/ technologies.
PSO-2	To be able excel in contemporary technologies being adopted by the industry and academia for providing sustainable solutions
PSO-3	To be able to excel in various programming/ project competitions and technological challenges laid by professional bodies

Program Educational Outcomes (PEOs)

PEO-1	**Circuit Design Concepts:** Apply basic and advanced electronics for implementing and evaluating various circuit configurations.
PEO-2	**VLSI Design and Signal Processing:** Demonstrate technical competency in the design and analysis of components in VLSI and Signal Processing domains globally.
PEO-3	**Communication Theory and Practice:** Possess application-level knowledge in theoretical and practical aspects required for the realization of complex communication systems.

New

M.Sc.(ELECTRONICS) MARKS DISTRIBUTION ACCORDING TO NEW ORDINANCE (2017)

SEMESTER - I

S.No	Paper Code	Title of the Paper	Internal Assesment	External Assesment	Max. Marks
1.	ELC-101	PHYSICS OF ELECTRONIC MATERIALS	30 marks	70 marks	100
2.	ELC- 102	SIGNAL ANALYSIS AND MATHEMATICAL METHODS IN ELECTRONICS	30 marks	70 marks	100
3.	ELC-103	C^{++} PROGRAMMING AND DATA STRUCTURE	30 marks	70 marks	100
4.	ELC-104	SEMICONDUCTOR DEVICES	30 marks	70 marks	100
5.	**LAB 1**	**C^{++} PROGRAMMING AND DATA STRUCTURE LAB**	15 marks	35 marks	50
	LAB 2	**SEMICONDUCTOR LAB**	15 marks	35 marks	50

TOTAL=500

SEMESTER - II

S.No.	Paper Code	Title of the Paper	Internal Assessment	External Assessment	Max. Marks
1.	ELC-201	NETWORK ANALYSIS AND SYNTHESIS	30 marks	70 marks	100
2.	ELC-202	ELECTROMAGNETIC,ANTENNA AND MICROWAVE THEORY	30 marks	70 marks	100
3.	ELC-203	ELECTRONIC CIRCUIT	30 marks	70 marks	100
4.	ELC-204	DIGITAL SYSTEM AND DESIGN	30 marks	70 marks	100
5.	**LAB 1**	**DIGITAL LAB**	15 marks	35 marks	50
	LAB 2	**ELECTRONIC CIRCUITS LAB**	15 marks	35 marks	50

TOTAL=500

SEMESTER - III

S.No.	Paper Code	Title of the Paper	Internal Assessment	External Assessment	Max. Marks
1.	ELC-301	CONTROL SYSTEM	30 marks	70 marks	100
2.	ELC-302	IC TECHNOLOGY AND VLSI DESIGN	30 marks	70 marks	100
3.	ELC-303	ANALOG AND DIGITAL COMMUNICATION SYSTEM	30 marks	70 marks	100
4.	ELC-304	ELECTRONIC INSTRUMENTATION AND MEASUREMENTS	30 marks	70 marks	100
5.	**LAB**	**COMMUNICATION LAB**	15 marks	35 marks	50
		SEMINAR /SUMMER TRAINING	15 marks	35 marks	50

TOTAL=500

SEMESTER - IV

S.No.	Paper Code	Title of the Paper	Internal Assessment	External Assessment	Max.Marks
1.	ELC- 401	WIRELESS AND MOBILE COMMUNICATION	30 marks	70 marks	100
2.	ELC-402	MICROPROCESSOR AND MICROCONTROLLER	30 marks	70 marks	100
3.	ELC-403	OPTOELECTRONICS AND OPTICAL COMMUNICATION	30 marks	70 marks	100
4.	ELC-404	ELECTIVE COURSE	15 marks	35 marks	50
5.	LAB	MICROPROCESSOR AND MICROCONTROLLER LAB	15 marks	35 marks	50
		PROJECT			

TOTAL=500

* **LIST OF ELECTIVE COURSES**

ELC-404 (A) POWER ELECTRONICS
ELC-404 (B) DIGITAL SIGNAL PROCESSING
ELC-404 (C) BIOMEDICAL ELECTRONICS
ELC-404 (D) EMBEDDED SYSTEM
ELC-404 (E) FOUNDATION OF NANO ELECTRONICS
ELC-404 (F) PROCESSES IN DEVICE FABRICATION
ELC-404 (G) ARTIFICIAL INTELLEGENCE
ELC-404 (H) INFORMATION THEORY AND CODING TECHNIQUES
ELC-404 (I) INDUSTRIAL ECONOMICS AND MANAGEMENT

PHYSICS OF ELECTRONIC MATERIALS

ELC-101

Course Outcome:

CO1	Selection of materials for modern engineering applications.
CO2	Structure and properties of metals, ceramics and polymers starting with fundamental atomic.
CO3	Identify the fabrication methods of integrated circuits,
CO4	Classify and describe the semiconductor devices for special Applications.
CO5	Applications and properties of dielectric materials & magnetic materials.

UNIT-1

Fundamentals of Materials Science:

Relative stability of Phase, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Elementary idea of point, line and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RT and glow discharge). Smart Materials.

UNIT-2:

Crystal Structures:

Crystal structures, classification of crystals, lattices, reciprocal lattice, Miller indices, Amorphous materials, Electronic structure and related properties, Bloch theorem, phonons, Nearly Free electron theory, Introduction to tight binding and various band structures, Band structure calculation methods, thermal conductivity due to electrons and phonons, perturbation theory.

UNIT-3:

Semiconductors:

Metal-semiconductor and, Direct and Indirect semiconductors, Variation of energy bands with alloy composition, charge carriers in semiconductors, effective mass, Intrinsic and Extrinsic materials, Diffusion and drift, diffusion length, diffusion and recombination. The Fermi level & Fermi dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration Qualitative and Quantitative analysis, Temperature dependency of carrier concentration, conductivity and mobility, effects of temperature and doping on mobility, high field effects, the hall effects, Invariance of the Fermi level at equilibrium.

UNIT-4:

Dielectric and Magnetic Materials:

Dielectric properties, Electronic polarisability, Clausius Mossotti relation, dielectric constant static and frequency dependence, Kramer-Kronig relation, damped oscillation, Piezoelectric properties, polymers and their properties. Magnetic and Electro-optical properties, Magnetism & various contributions to para and dia magnetism, Fero and Ferri magnetism and ferrites, Magnons and dispersion relation, anti-ferromagnetism, domains and domain walls, coercive force, hysterisis, methods for parameters measurements.

UNIT-5:

Superconductivity and Liquid Crystals:

Different Properties of Superconductor, Meissner effect, London equation, BCS theory, Josephson effect, High temperature Superconductors, Types of liquid crystals and their mesomorphous phases, Elementary theory of order, Transition Metal Alloys.

Text Books:

1. A.J.Dekker," Electrical Engineering Materials"Prentice Hall of India , **January 1970**
2. R.K.Rajput,"ElectricalEngg.Materials,"LaxmiPublications.2004
3. C.S.Indulkar&S.Triruvagdan"AnIntroductiontoElectricalEngg.Materials,S.Chand&Co.-2006.

References:

1. Solymar, “Electrical Properties of Materials” Oxford University Press.
2. Ian P.Hones,”Material Science for Electrical and Electronic Engineering,”Oxford University Press.

SIGNAL ANALYSIS AND MATHEMATICAL METHODS IN ELECTRONICS

ELC 102

Course Outcome:

CO1	Understand mathematical description and representation of continuous and discrete time signals and systems and its classification.
CO2	Analyse CT and DT systems in Time domain using convolution
CO3	Represent CT and DT systems in the Frequency domain using Fourier analysis tools like CTFS, CTFT, DTFS and DTFT Plot Fourier transform magnitude and phase functions.
CO4	Conceptualize the effects of sampling a CT signal. The basic concept of probability, random variables & random signals5.Analyze CT and DT systems using
CO5	Laplace transforms and Z Transforms.

UNIT-1

Signal Analysis:

Classification of signals and systems, some ideal signals, energy signal, power signals, energy and power spectral densities. Periodic & non periodic, analog & digital, deterministic & random, unit impulse, unit step. LTI networks, the concept of frequency in continuous & discrete time domain, linear time invariant system definition. Impulse response of LTI system.

UNIT-2

Fourier Series & Transforms:

Fourier Series, Dirchilit conditions, determination of Fourier Coefficients, Statement of Fourier Integral Theorems, Fourier series–sine and cosine series, Fourier Transforms & properties, Fourier Transform of various functions, Fourier Sine & Cosine transforms. Inverse transforms. Convolution Theorem, Parsevals Identity, applications.

Laplace Transforms:

Laplace transforms, Region of Convergence (ROC), Basic properties of Laplace Transforms. Laplace transform of derivatives and integrals, shifting theorem, differentiation and integration of transforms, inverse transforms, convolution property. Laplace transform of unit step function, impulse function and periodic function, Solutions of linear differential equations with constant coefficients using Laplace transform applications

UNIT-3

Z – Transforms:

Definition of Z- transform, Region of Convergence (ROC), properties, initial and final value theorem. Z transform of unit step sequence, unit ramp sequence, polynomial functions, trigonometric functions. Shifting property, convolution property, Inverse transform. Pole-Zero plots from z-transform. Solutions of 1st & 2nd order difference equations with constant coefficients using Ztransforms.

UNIT-4

Probability & Statistics:

Introduction: Probability- Mathematical approach and Statistical Approach. Types of Sampling-Simple Random Sampling Stratified Random Sampling. Random Variables, Probability Density function, Probability Mass Function. Mathematical Expectation- Mean, Expectations and Variance of a Distribution. Binomial, Poisson, Exponential, Normal Distributions, co-relation

UNIT-5

Computational Methods Numerical Differentiation and Integration:

Finite Differences, Derivatives using Forward, Backward and Central Difference Formulae, Newton-Cote's quadrature formula, Trapezoidal rule, Simpson's rules, Weddle's rule.

Numerical methods for Solution of Ordinary Differential Equation-

Picards Method ,Taylor Series Method , Eulers and Modified Eulers methods, Runge and Runge Kutta Methods , Predictor and Corrector Method.

Text book:

1. Millman & Halkias/Integrated Electronics/TMH, Analog and Digital ***Circuit*** and Systems | 2nd Edition July 2017. by ***Jacob Millman*** (Author), Christos ***Halkias***
2. Shail Jain & D.R. Choudhary/Linear IntegratedCircuit/PHI,***4th Ed***. (ISBN 9788122430981)

References:

1. Boylstad & Neshlshky/Electronics Devices &Circuits/PHI, (***11th Edition***), 2017
2. Sedra Smith / Microelectronic /Oxford University Press, (***7th Edition***), 2015

C^{++} PROGRAMMING AND DATA STRUCTURE

ELC103

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Recollect various programming constructs and to develop C programs
CO2	Understand the fundamentals of C programming
CO3	Choose the right data representation formats based on the requirements of the problem
CO4	Implement different Operations on arrays, functions, pointers, structures, unions and files

UNIT-1

Introduction:

Object oriented programming, characteristics of an object-oriented language.

C++ programming language: Tokens, keywords, identifier and constants, basic data types, user defined data types, derived data types, arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, special operators, expressions and evaluation of expressions, scope resolution operator, member dereferencing operators, manipulators, type cast operator, implicit conversions, precedence of operators, new and delete operators. Arrays, pointers and structures.

UNIT-2

Decision making, Branching and Looping:

if, if-else, else-if, switch statement, break, continue and go to statement, for loop, while loop and do loop.

Functions: Function definition, function arguments and passing, returning values from functions, referencing arguments, function overloading, virtual functions, library functions, local, static and global variables.

UNIT-3

Classes and Objects:

Classes and objects, member functions, class constructors and destructors, array of objects, operator overloading. **Class inheritance:** Derived class and base class, multiple inheritance, polymorphism.

UNIT-4

Streams in C++ - Stream Classes – Formatted and Unformatted data – Manipulators – User Defined Manipulators – File Streams – Opening and Closing a File – File Pointers Manipulation–Template Classes and Functions– Exception Handling: Try, Catch, Throw..Exception Handling – Multithreading – Applets – Graphics Programming.

UNIT-5

Data Structures:

Multidimensional arrays definition implementation multidimensional arrays in control loops, pointers to multidimensional arrays. Stacks and queues array implementation: Definition of stacks and queues, Terminology, implementation using arrays, Link Lists, stacks and queues, Implementation of stacks and queues.

Text Books:

1. Programming in C, Schaum Series, McGraww Hill Education, 4th Edition,2018.
2. The ‘C’ Programming, Denis Ritchie, 2nd Edition, Pearson Publication 1988.

References:

1. Mastering C, Venugopal, Second edition, TMH, 2006
2. Let us C, Yashant Kanetkar BPB Publication, 19th edition, 2022.
3. Programming in C, Balaguruswami, TMH Publication, 8th Edition, 2019.

SEMICONDUCTOR DEVICES

ELC 104

Course Outcome:

CO1	Describe the properties of materials and Application of semiconductor electronics
CO2	Apply the knowledge of semiconductors to illustrate the functioning of basic electronic devices.
CO3	Classify and describe the semiconductor devices for special applications
CO4	Understand major properties of semiconductor materials, explain energy band diagrams and connections with the device structures and properties;
CO5	Understand and utilize the basic governing equations to analyse semiconductor devices; design semiconductor devices and calculate device characteristics;
CO6	Quantitatively evaluate limitations in the design of circuits based on specific semiconductor devices;
CO7	Understand and outline major steps of semiconductor device fabrication.

UNIT-1

Junction Theory:

Fabrication of p-n junctions, Different types of junction – grown junction, alloyed junction, diffused junction, Ion implanted junction, Epitaxial junctions. equilibrium conditions, contact potential, current flow at a junction, junction breakdown, capacitance of p-n junctions, charge storage and transient behavior, rectifiers, switching diodes, zener diode, LEDs, Schottky diodes, Varactor diodes.

UNIT-2

Bipolar Transistors:

BJT fabrication, transistor action, minority carrier distributions, and terminal currents, Ebers–moll Model, Switching, Drift in base region, Base narrowing, Avalanche breakdown, injection level - thermal effects, Base resistance and Emitter crowding, h-parameters and analysis of transistor amplifier using h- parameter.

UNIT-3

Field Effect Transistors:

Junction FET - metal semiconductor FET, GaAs MESFET, metal insulator semiconductor FET, High electron mobility transistor, threshold voltage. MOSFET- basic operations, constructions, and characteristics, ideal MOS capacitor, Control of threshold voltage.

UNIT-4

Microwave Solid State Devices:

Principle, structure, construction and working of Gunn diodes, LSA diode, READ diode, IMPATT, TRAPATT and BARRIT diode, Tunnel diodes, Parametric devices.

UNIT-5

Power Electronic Devices:

The p-n-p-n diode, SCR, GTO, IGBT, MCT, DIAC, TRAIC - operations and characteristics,

Textbooks:

1. Boylstad & Neshishkey, “Electronic devices & circuits” , PHI, 10th Edition 2008.
2. Milliman, J. Halkias, “integrated elctronics”,TMH**,**1 July 2017

References:

1. Streetman, B.G. & Banerjee, Sanjay / “Solid State Electronic Devices” / Prentice Hall (India) / 5thEd / Pearson Education 2014 .
2. Bell, David A. / “Electronic Devices & Circuits”/ Prentice-Hall (India), 5thEd. 2004.
3. Millman, J. and Grabel, A. / “Microelectronics”/ McGraw–Hill 2nd edition ,1988.
4. Nair, B. Somanathan /“Electronic Devices & Applications”/ Prentice-Hall(India) 1st edition 2006
5. Nagrath , I.J. / “Electronics, Analog & Digital”/ Prentice-Hall(India) 2nd edition ,2014.
6. Neamen, Donald A. / “Electronic circuit Analysis & design” / Tata McGrawHill, 2003.
7. Salivahanan, S. & Kumar, Suresh N. & Vallavraj / “Electronic Devices & Circuits” / TataMcGraw-Hill 2nd edition 2007.

LAB 1
C++ PROGRAMMING AND DATA STRUCTURE LAB

1. Write a program to calculate the roots of quadratic equation $Ax^2+Bx+C=0$.
2. Write a program to calculate the average of a set of n numbers including zero and negative numbers.
3. Write a program to sort an array element in ascending order and descending order using bubble sort technique.
4. Write a program to plot a sin(X).
5. Write a program to find a row sum and column sum of a given matrix and built a new matrix with the help of row sum and column sum and previousmatrix.
6. Write a program to read and print two-dimensional matrix of order nxm. Find the sum of diagonals.
7. Write a program that calculate and prints out the maximum and minimum of array.
10. Write a program for sorting names in alphabeticalorder.
11. Write a program to plot and exponentialseries.
12. Write a program to print the terms in the exponential series, till the term is equal to 0.00001 also compute the exponential series of x, $e^x=1+x+x^2/2!+x^3/3!+$ .....+0.00001.
13. Write a program for matrix addition and matrixmultiplication.
14. Write a program for the operation of (a) addition (b) subtraction (c) multiplication (d) division. Using switchcommand.
15. Write a program to find the factorial of a given number and Fibonacci series using switch command.
16. Write a program to find the sum of naturalnumbers using function
17. Write a C++ program to create a class to handle telephone directory, include name, phone number (landline, mobile), STD/ISD code, City and Country as data members and write member function to create new directory, display directory, sort according to name, edit, add, delete and search as per name/telephonenumber.
18. Program to demonstrate exception handling mechanism while divide by zero.
19. Program to demonstrate generic programming for sortingusing
    a. **c**lass templates
    b. functiontemplates
20. To write the sum and difference of 2 clock times (hr: min:sec)
    (a) usingmemberfunctions (b) using operatoroverloading
    (c) usingfriendfunction (d) using operator overloading friendfunction

Note: - 20**% experiments other than this list of equal standard relevant to syllabus can also be set.**

LAB-2

SEMICONDUCTORLAB

1. To obtain a static characteristics of a PN junction diode and then obtain the forward resistance of the diode at a given operatingpoint.
2. To obtain V-I characteristics of a zener diode and note down its breakdown potential.
3. To study the I-V characteristics of infrared, blue and red LEDs.
4. To determine the emission intensity of the LED as a function of the diode current using photo-detector.
5. To study and plot the BJT characteristics andevaluate—
    a. Input resistance b. Output resistance c. Current gain.
6. To bias a given transistor in active region in CE configuration.
7. To study the transistor as aswitch.
8. Bias a MOS transistor in saturation region in CS configuration
9. To study and plot the MOSFET characteristics.
10. Bias a JFET in saturation region and operates it as an RC coupled amplifier in CS configuration and measure the voltage gain.
11. Study of I-V characteristics of Gunn Diode.
12. To study the characteristics of JFET in common source configuration & evaluate—
    a. AC drain resistance, 2. Amplification factor and 3.Drain Resistance.
13. Study of DIAC and TRIAC characteristics.
14. Study of R-Triggering and RC triggering of an SCR.
15. Study of RC full wave triggering circuit.

Note: - 20**% experiments other than this list of equal standard relevant to syllabus can also be set.**

NETWORK ANALYSIS AND SYNTHESIS

ELC-201

Course Outcome:

CO1	Understand the concept of graph theory using different analysis methods
CO2	Apply different network functions for the analysis of electrical networks
CO3	Understand the concept of two port networks
CO4	Understand the properties of network functions
CO5	Explain about the fundamental and types of filter

UNIT-1

Network Fundamentals and Graph Theory

Active and passive elements, The dot convention for coupled circuits, Kirchhoff's laws , source transformation, mesh and node analysis of electric circuits, Review of theorems. Concept of a network graph, twigs and links, trees, co-trees, formation of incidence matrix ,cut-set matrix, tie-set matrix and loop currents, analysis of networks ,network equilibrium equation ,duality, network transformation.

UNIT-2

ImpedanceFunctions

Concept of complex frequency, transform impedance and transform circuits, series and parallel combinations of elements R, L and C.

UNIT-3

Network Function

Network function for one port and two port, the calculation of network functions - ladder networks and general networks, pole and zero of network functions, restrictions on pole and zero locations for driving point functions ,restrictions on pole zero locations.

UNIT-4

Two Port Network Analysis

Relationship of two port variable, Z-parameters, Y- parameters, Hybrid parameters, ABCD parameters; T-network, π-netwok, L-network, lattice network, Symmetrical network. Conditions of reciprocity and symmetry; inter-relationship between parameter of two port network, different types of interconnections of two port networks.

UNIT-5

Network Synthesis

Concept, Procedure of Synthesis, Positive real function, Hurwitz polynomial, Reactive Networks, Properties of Expressions of Driving point admittances of L-C Networks, Pole-Zero Interpretations in L-C Networks. L-C Networks Synthesis-Foster's Canonic Form (First and Second Foster form), Significance of Elements in the Foster form. Cauer Canonic form of Reactive Networks-First and Second form of Cauer Networks, Applicability of Foster and Cauer forms, R-L & R-C Network Synthesis by Foster form, Identification of foster form of R-L/R-C network, Identification of Admittance, R-L & R-C Network Synthesis by Cauer form, Identification of Immittance Function in Cauer form, Determination of end elements in Foster and Cauer R-L &R-C Networks.

Text books:

1. M.E.Valkenburg:NetworkAnalysis, Peaerson 3/ED. January 1, 1974 .
2. D.R.Choudhary:NetworkAnalysis, Pearson 1988.

References:

3. Narsingh Deo : "Graphtheory" Prentice Hall, 1974
4. A.Chakrabarti,"Circuit Theory" Dhanpat Rai &Co., 2013
5. W.H.Hayt &JackE-Kemmerly,EngineeringCircuitanalysis"TataMcGraw-Hill ***,2011***

6. Soni, Gupta ,"Circuit Analysis", Dhanpat Rai &Sons ,1979
7. Ram Kalyan, Linear Circuits Oxford UniversityPress 2005.

ELECTROMAGNETIC,ANTENNAANDMICROWAVETHEORY
ELC202

Course Outcomes:

CO1	To differentiate different types of coordinate systems and use them for solving the problems of electromagnetic field theory.
CO2	To describe static electric and magnetic fields, their behaviour in different media, associated laws, boundary conditions and electromagnetic potentials.
CO3	To use integral and point form of Maxwell`s equations for solving the problems of electromagnetic field theory.
CO4	To describe time varying fields, propagation of electromagnetic waves in different media, pyonting theorem, their sources & effects and to apply the theory of electromagnetic waves in practical problems.
CO5	To apply concepts of Wave reflection and refraction, Smith Chart in practical Field.

UNIT-1

Electromagnetic Plane Wave

Electron motion in electromagnetic field, electric and magnetic wave equations, Maxwell's equation, Poynting theorem, uniform plane wave and reflection, uniform plane wave propagation in free space and perfect dielectric,, plane wave propagation in lossy media, duality theorem, uniqueness theorem ,image theory ;equivalence principle; introduction and reciprocity theorem.

UNIT-2

Transmission Lines and Antennas

Basic equation, reflection and transmission coefficient, standing wave and standing wave ratio, line impedance and admittance, Determination of characteristics impedance, Fundamental of Smith Chart, Impedance Matching: Single and Double Stub Matching, microwave Coaxial Connectors. The Radiation mechanism, Current and Voltage distribution, Antennas gain, Antenna resistance, Bandwidth, Beamwidth and Polarisation, effects of Antenna height, Dipole arrays, Folded dipole. Microwave Antennas - Parabolic reflector, Horn and Lens antenna. Special purpose antennas - Yagi, Log periodic and Loopantennas.

UNIT-3

Micro strip Antennas

Advantages and limitations of Microstrip antennas, radiation mechanism, antenna configurations, Rectangular Patch, Quarter wave rectangular patch, Circular Patch, Quality factor, Bandwidth, and frequency, Input Impedance, Coupling, Circular Polarization. Microstrip feeds – coplanar feed, proximity coupled feed, aperture coupled feed, waveguide feed.

UNIT-4

Linear Wire Antennas and Arrays

Infinitesimal Dipole, Small Dipole, Region Separation, Finite Length Dipole, Half-Wavelength Dipole Linear Elements Near or on Infinite Perfect Conductors, Ground Effects ,Two element array, N- element linear array : uniform linear amplitude and spacing, N-element linear array: Directivity, Circulararray.

UNIT-5

Theory of Microwave Propagation, Waveguides and Components, RADAR

Fundamentals of microwave propagation, Rectangular Wave guide – TE and TM modes , power transmission, excitation in rectangular wave guide, circular wave guides – TE,TM and TEM mode, Cavity resonator, Q-factor. Waveguide Tee-E-plane tee, H-plane tee, Hybrid tee, scattering parameters (s-matrix), circulators, isolators, directional couplers. RADAR and its applications.

Text Books:

1. Engineering Electromagnetic- Hayt (sixthedition), 1984.
2. Electromagnetic- Wave and radiating System-Jorden &Balmein,1968
3. Electromagnetic- J.F.D. Kraus; Antenna-J.F.D.Kraus, 2005.
4. Electromagnetic- Kraus &Keith; Antenna, and wave Propagation –K.D.Prasad,***2012***

References:

1. Harington, R. F. / "Time Harmonic EM Fields" / McGrawHills, 1961
2. Collin, R. E. / "Antennas and Radio Wave Propagation"/ TataMcGraw-Hill, 1985.
3. Pramanik,Ashutosh/"Electromagnetism,Theory&Applications"/PrenticeHall India **,2014.**
4. Schaum's Outlines / "Electromagnetics" / Tata McGraw-Hill / 2nd Ed, *1994* .
5. Kraus,Fleisch/"ElectromagneticswithApplications"/TataMcGraw-Hill,2010..
6. Sadiku,MatthewN.O./"ElementsofElectromagnetics"/OxfordUniversityPress,2007.

ELECTRONIC CIRCUIT

ELC 203

Course Outcome:

CO1	To explain the theoretical principles essential for understanding the operation of electronic circuits,
CO2	Measure the characteristics of electronic circuits and present experimental results
CO3	Analyze electrical circuits and calculate the main parameters,
CO4	Develop, design and create simple analogue and digital electronic circuits,
CO5	Choose an engineering approach to solving problems, starting from the acquired knowledge essential for the design of electronic circuits

UNIT-1

Power Supplies

Building blocks of regulated power supplies, Zener as a series and shunt regulators, Transistor as a series and shunt regulators, Regulator design with dicretecomponents,IC 723.

UNIT-2

Transistor Biasing and Stability

Q-point, self bias-compensation techniques, h-model of transistors, Expression for voltage gain, current gain, input and output impedance, trans-resistance & trans-conductance, emitter follower circuits, high frequency model of transistor amplifiers, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier.

UNIT-3

Feedback Amplifiers & Oscillators

Feedback concept, negative & positive feedback, voltage current, series/shunt feedback, Berkhausen criterion,Colpitts,Hartley'sandphaseshiftoscillators,WeinbridgeandCrystaloscillators,amplifier distortion, amplifier classification and characteristics, power and efficiency of amplifiers, direct and transformer coupled amplifiers , Poweramplifiers

UNIT-4

Op-amp and its Applications

OperationalAmplifier:IdealOp-amp,DifferentialAmplifier,Constantcurrentsource(currentmirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, voltage follower/ circuit IC 741,. Applications of Operational Amplifiers: adder, subtractors integrator & differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Trans-conductance multiplier, Precision Rectifier, voltage to current and current to voltageconverter..

UNIT-5

Multi- Vibrators and Wave shaping circuits

Monostable, Bistable and Astable Multivibrators, Monostable and Astable operation using 555 timer, Clipper and clampper circuit, Waveform generators (sine, square and triangular),

Text book:

2. Millman & Halkias/IntegratedElectronics/TMH, Analog and Digital ***Circuit*** and Systems | 2nd Edition July 2017. by ***Jacob Millman*** (Author), Christos ***Halkias***

2. Shail Jain & D.R. Choudhary/Linear IntegratedCircuit/PHI,***4th Ed***. (ISBN 9788122430981)

References:

3. Boylstad & Neshlshky/Electronics Devices &Circuits/PHI, (***11th Edition***), 2017
4. Sedra Smith / Microelectronic /Oxford UniversityPress, (***7th Edition***), 2015

DIGITAL SYSTEM AND DESIGN
ELC 204

Course Outcome:

CO1	To examine the structure of number systems and perform the conversion among different number systems.
CO2	To understand the Digital Logic Family.
CO3	Illustrate reduction of logical expressions using Boolean algebra, k- map and implement the functions using logic gates. Realize combinational circuits for given application.
CO4	Design and analyses synchronous and asynchronous sequential circuits using flip-flops.
CO5	To analyse different types of multivibrators
CO6	To study static and dynamic RAMs, ROM, EPROM, and EEPROM.
CO7	Implement combinational logic circuits using programmable logic devices.

UNIT-1

Basic Logic Circuit

Number systems and Codes, Introduction of basic gates, universal gates, Boolean algebra, Switching characteristics of semiconductor devices, Logic gate characteristics - speed of operation, power dissipation , figure of merit, fan in, fan out, noise margin. Logic families - RTL, DTL, TTL, ECL, Interfacing between logic families, MOS logic, comparison of logic families.

UNIT-2

Combinational Logic Design

Minterm and maxterm, Simplification of boolean algebra using K-map, design of binary adder, substractor , digital comparator, parity generator/checkers, priority encoder, BCD to 7-segments decoder, multiplexer , multiplexer tree, demultiplexer and demultiplexer tree.

UNIT-3

Sequential Circuit Design

Excitation table of flip flops – S-R, J-K , Master-Slave – JK, D and T flip-flops, clocked flip flop design – conversion of one form of flip flop to another type. State equation, state table, state diagram, state input equations, analysis with D flip flops, JK flip flops and T flip flops. State reduction and assignment, design procedure – synthesis using D flip flops, JK flip flops and T flip flops.

UNIT-4

Registers, Counters and A/D , D/A converters

Shift registers, application of shift registers, serial to parallel converter, parallel to serial converter. Counters, modulo-n-counter, synchronous counter –ripple counter (binary, BCD) and up-down counter, asynchronous counters-ripple counter (binary, BCD) and up-down counter. Other counters – counter with unused states, ring counter, Johnson counter. D/A converters- weighted register type, R/2R ladder type, D/A converter specification. A/D converters - Successive approximation type, parallel comparator, dual slop. ADC using voltage to frequency conversion and frequency to timeconversion.

UNIT-5

Semiconductor Memories

Memory organization and operation , write operation, read operation , expanding memory size and word capacity , classification and characterization of memory, sequential memory ROM, dynamic ROM, RAM cell, Content addressable memory (CAM), PLA, CCD, PAL.

Text books:

1. Digital Design, Morris Mano, PHI, 2008.

2. Digital Electronics, Bignill & Donovan, Delmar publishers, 1989

References:

1. Taub and Schilling "Digital Integrated Electronics",TMH, 1977.
2. Bartee , Thomas C. / "Fundamentals of Digital Computers"/ TataMcGraw-Hill, 1979.
3. Gopalan, K. "Gopal" / "Introduction To Digital Microelectronic Circuits" / TataMcGraw-Hill, 2002
4. Millman, Jocob & Taub, Herbert / "Pulse, Digital & Switching Waveforms" / TataMcGraw-Hill 1991Edition: 1st.
5. Malvino, A.P. & Leach, Donald P. / "Digital Principles & Applications" / TataMcGraw-Hill, 7th Ed.,2011
6. Digital Electronics Principles & Application, Tokheim, H. Roger L., Tata McGraw-Hill ,8th Ed., 2014

LAB-1

DIGITALELECTRONICSLAB

1. Design and Study of AND, OR, NOT Logic Gates Using IC.
2. Design and Study of NAND, NOR gates using IC.
3. Design and Study of Ex-OR & Ex-NOR using IC.
4. Design and Study of Half Adder and Full Adders using IC.
5. Design and Study of Half Adder and Full Adder using NAND or NOR gates.
6. Design and Study of 4:1 Multiplexers using common gates.
7. Design and Study of 8:1 Multiplexers 1:4 Demultiplexer using IC.
8. To design a 2^n to n line encoder using basic universal logic gates.
9. To study R-S/D/T flip-flops using NAND ICs and verify truth table.
10. To study the master slave J-K flip-flop and verify truthtable.
11. To study the operation of modulo-n-counter as MOD3 & MOD4 and verify the truthtable.
12. To design Jhonson & Ring counter.
13. To design an up-down synchronous counter with direction control that can count a particular sequence.
14. To design a modulo-n Asynchronous and synchronous counter using JK/T-FlipFlop IC's.
15. To study the operation of a Presetable Divide by N Counter and verify its truth table.
16. To design a universal shift register and demonstrate SISO, SIPO, PISO and PIPO functions.
17. To study the operation of shift register as serial in parallel and parallel in serial mode.
18. To study the operation of shift register as parallel in parallel and serial in serial mode.
19. To study write/read operation of digital data into semiconductor memory using IC 7489. Store and retrieve some set of data.(RAM).
20. Design of A/D and D/A converter usingIC.

Note: - 20% experiments other than this list of equal standard relevant to syllabus can also be set.

LAB-2
ELECTRONIC CIRCUITS LAB

1. To design Rectifier using capacitorfilter
   (a) Half wave Rectifier (b) Full wave Rectifier
2. To study the Clipping circuits as positive and negative logic.
3. To study the Clamping circuits as positive and negativelogic.
4. To study and design an RC coupled amplifier using BJT and FET.
5. To study the Colpit Oscillator, determine its frequency of oscillation and compare the calculated and observedfrequency.
6. To study the Negative Feedback Amplifier by measuring closed loop gain and gain bandwidth product.
7. To study the RC Phase Shift Oscillator by determining its frequency of oscillation and compare calculated and observedfrequency.
8. Construct a Wein Bridge Oscillator and determine its frequency of oscillation and compare calculated and observed frequency.
9. To study the operation of Class B Amplifier.
10. To measure the following parameters of 741 op-ampIC.
    (a) Open-loop gain, (b) Output Off set voltage, (c) CMRR, (d) Slew-rate.
11. Using op-amps design thefollowing:
    (a) Differentiator (b)Integrator (c) Zero Crossing Detector (d) Comparator
12. Using op-amps design thefollowing:
    (a) Buffer (b) Scale changer (c) Adder (d) Subtractor.
13. To Verify that in a current mirror, the output current is equal to inputcurrent.
14. To design and realize Op-Amp based pulse generator.
15. To design and realize a square wave generator using Op-Amp.
16. To design and realize Log and exponential amplifiers using Op-Amps
17. To study the Active Low pass filter and to evaluate:-
    (a) Cutoff frequency (b) Band pass gain (c) Plot the frequency response
18. To study theActive Band pass filter and calculate its
    (a) Bandwidth: - Lower cutoff & upper cut-off frequency (b) Quality factor.
19. To design and realize current to voltage converter and also find its conversion factor.
20. Determine the frequency using IC 555 timer of
    (a) Astable Multivibrator (b) Monostable Multivibrator

Note: -20% experiments other than this list of equal standard relevant to syllabus can also be set.

CONTROL SYSTEM

ELC-301

Course Outcome:

CO1	Categorize different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form.
CO2	Characterize any system in Laplace domain to illustrate different specification of the system using transfer function concept.
CO3	Interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
CO4	Employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions.
CO5	Formulate different types of analysis in frequency domain to explain the nature of stability of the system.
CO6	Identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system.

UNIT-1:

Introduction

Introduction, terminology and Feedback characteristics of control system definitions, closed and open loop systems, Transfer functions, Block diagrams, Reduction Algebra, signal flow graphs.

UNIT-2:

Time domain analysis and Root Locus Techniques:

Standard test signals, Time domain performance of control systems, Transient response of the first order system, the second order system, stability, steady state errors, effect of adding zero to the system, Routh stability criterion. Root locus techniques: The root locus concept, construction of root locus and analysis of control system.

UNIT-3:

Frequency domain analysis and 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.

UNIT-4

Basic actions and industrial control:

Proportional, derivative and integral controllers, combined controllers, Effect of integral and derivative control on system, performance, PID controller.

UNIT -5

State Variable Analysis

Concept of state variables, state model, state model for linear continuous time system, diagonalization, solution of state equations, concept of controllability and observability.

Textbooks:

1. KUO B.CI Automatic controlsystem/Pill. 6th Revised ed. October 1990
2. Ogata K.J Modern Control Engineering /PHI.5th ed.October 2009.

Reference Books:

1. NagrathI.J.&Gopal,M/ControlSystemsEngineering/NewAgeInternational.Seventh ed. September 2021
2. S.N.Sivanandam/ControlSystemsEngineering/VikasPublishingHousePvt.Ltd.Vikas Publication House Pvt Ltd, January 2007.

IC TECHNOLOGY AND VLSI DESIGN
ELC 302

Course Outcome:

CO1	Identify the various design limits material used for fabrication.
CO2	Describe the Performance of technology scaling.
CO3	Understand the complexities involved in the integrated circuits.
CO4	Apply principles to Identify and Analyze the various steps for the fabrication of various components
CO5	Assess the various reliability issues in VLSI technology
CO6	Analysis of the operation of MOS transistor
CO7	Analysis of the physical design process of VLSI design flow
CO8	Analysis of the design rules and layout diagram
CO9	Design of Adders, Multipliers and memories etc.

UNIT-1

Crystal Growth & Wafer Characterization

Electronic Grade Silicon, CZ Crystal Growing, Silicon Shaping, Processing Consideration. Vapor Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators. Growth Mechanism, Oxide Properties, Oxidation Induced Defects. Optical Lithography, Electron Lithography, X-Ray Lithography, Ion Lithography. Feature Size Control and Anisotropic, Etch Mechanisms, Reactive Plasma Etching Techniques and Equipment

UNIT-2

Diffusion and Metallization

Models of Diffusion in Solids, Fick's One Dimensional Diffusion Equations, Atomic Diffusion Mechanisms. Range Theory, Implantation Equipment, Annealing. Metallization Applications, Metallization Choice, Physical Vapour Deposition, Patterning, Bipolar IC Technology

UNIT-3

Introduction to MOS

MOS, CMOS IC Technology, Metal Gate, Poly Silicon Gate, P-Channel, N-Channel Devices, Enhancement Mode and Depletion Mode Devices and theirCharacteristics

UNIT-4

VLSI design Introduction

Issues in Digital Integrated Circuit Design, Quality Metrics of a Digital Design. Manufacturing CMOS Integrated Circuits, Design Rules, IC Layout, Scaling factors, advantages of scaling, limitations to scaling, scaling of wires and interconnections.

UNIT- 5

The CMOS Inverter

The Static CMOS Inverter, Performance of CMOS Inverter, Power, Energy and Energy Delay, Static CMOS Design, Dynamic CMOS Design, Introduction, From custom to semi-custom and structure-array Design Approaches, Custom Circuit Design, Cell based Design Methodology, Array based Implementation Approaches

Text Book:

1. Rabaey,John.M.andChandrakasan,AnanthaandNikolic,Borivoje/"DigitalIntegratedCircuits,A Design perspective" / Pearson Education / 2nd Ed.-2016
2. Wayne,Wolf/"ModernVLSIDesign-SystemsonSilicon"/Addison-Wesley/3rd Ed.2005
3. Sze, S.M./ "VLSI Technology" / Tata McGraw-Hill / 2nd Ed-2011

4. Streetman,B.G.&Banerjee,Sanjay/“SolidStateElectronicDevices”/PrenticeHall(India)/5th Ed. 2005

Reference Books:

1. Kang,Sun-moandLeblebici,Yusuf/“CMOSDigitalIntegratedCircuits,Analysis&Design”/Tata McGraw-Hill/2003
2. Pucknell, Douglas A. and Eshraghian, Kamran/ “Basic VLSI Design”/ Prentice – Hall (India).-2015
3. Razavi,Behzad/“DesignofAnalogCMOSintegratedcircuits”/TataMcGraw-Hill.-2003
4. Weste,N.H.E.&Eshraghian,K./“PrinciplesofCMOSVLSIDesign”/PearsonEducationAsia-1993

ANALOG AND DIGITAL COMMUNICATION SYSTEM
ELC 303

Course outcome:

CO1	Apply the knowledge of statistical theory of communication and explain the conventional digital communication system.
CO2	Amplitude modulation, DBBSC, SSBSC VSBSC,
CO3	Frequency modulation and demodulations, PAM, PWM, PPM and
CO4	Digital modulation techniques such as ASK, FSK, PSK.
CO5	Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise.
CO6	Apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code.
CO7	Describe and analyse the digital communication system with spread spectrum modulation.

UNIT-1

Concept of Communication

Communication system, Study of basic block diagram of communication system, Bandwidth and its requirement, Modulation and its types, Need of modulation, Noise, External and internal source of noise, Calculation of thermal noise and shot noise, Noise figure, Noise temperature, Equivalent noise bandwidth, Random process, Stationary process, Ergodic process, Gaussian process, Poisson process, Power spectral density.

UNIT-2

Amplitude Modulation

Baseband and carrier modulation, Amplitude modulation with full carrier, Mathematical analysis. Power relation in AM wave, Double sideband suppressed (DSB-SC) system, Signal sideband suppressed (SSB-SC) system, Vestigial sideband (VSB) modulation system, Quadrature amplitude modulation (QAM), AM transmitter and receiver, Time division multiplexing (TDM).

UNIT-3

Angle Modulation

Frequency modulation, Analysis of FM waveform and frequency spectrum, Bessel function, Wide-band FM and Narrow band FM, Mathematical analysis of WBFM and NBFM, Phase modulation, Generation and detection of FM, Generation and detection of PM, frequency division multiplexing (FDM).

UNIT-4

Digital Communication System

Element of digital communication system, Sampling process, Sampling theorem, Natural and flat top sampling, Analog pulse modulation: Types of analog pulse modulation, Method of generation and detection of PAM, PWM, PPM, Pulse code modulation, Quantization error, Delta modulation, Adaptive delta modulation, Compandig.

UNIT-5

Digital Modulation Techniques

Digital modulation techniques: ASK, FSK, PSK, BFSK, BPSK, QPSK, Inter symbol interference, Matched filter, Probability of error, Correlationreceiver.

Text books:

1. Communication Systems S. Haykin, John Willy &Sons.4th ed.2006.
2. Communication Systems: A.B. Carlson, TMH.2007.
3. ModemAnalog&DigitalCommunicationSystems:B.P.Lathi,OxfordUniv.Press.4th ed. 2009.

4. Analog Communication Systems: P Chakrabarti, DhanpatRai.2018.

Reference Books:

1. Taub,Herbert&Schilling,DonaldL./"CommunicationSystems"/TataMcGraw-Hill-2017.
2. Carlson, A. Bruce, Crilly, Paul B. & Rutledge, Janet C. / "Communication Systems anIntroduction to Signals & Noise in Electrical Communication"/ TataMcGraw-Hill.-2007.
3. Kennedy,George&Davis,Bernard/"ElectronicCommunicationSystems"/TataMcGraw-Hill/5th Ed.2011.
4. Singh,R.P.&Sapre,S.D./"CommunicationSystems:Analog&Digital"/TataMcGraw-Hill.-2004
5. Prokis J.J / "Digital Communications" / McGraw Hill/5th Ed.-2007
6. Schaum'sOutlines/"Analog&DigitalCommunication"/TataMcGraw-Hill.-2017
7. Kennedy,George&Davis,Bernard/"Electroniccommunicationsystems"/TataMcGraw-Hill-1999

ELECTONICINSTRUMENTATIONANDMEASUREMENTS

ELC304

Course Outcome:

CO1	General concepts of measurement
CO2	Electrical measurement techniques and classical measuring instruments
CO3	Modern measurement techniques and instruments
CO4	Brief concepts of sensors and transducers
CO5	Electronic measurement systems and related components including signal generators, analysers, data acquisition systems, storage and display devices
CO6	Applications of the concepts of electrical and electronic measurement systems in special-purpose measurements including magnetic measurements, fibre optic measurements, RF and microwave measurements

UNIT– 1

Introduction of Measurement

Precision & accuracy, Characteristics of Instruments, Measurement of frequency, phase, time – interval, impedance, power measurement, energy measurement and measurement of distortion, Errors in Measurement.

UNIT-2

Measuring Instruments-

Basic galvanometer ,conversion to voltmeter ,ammeter and ohmmeter, Multimeter Measurement of R,L,C Using Bridge, Voltage, Current, Energy, Frequency/Time power , power factor, working principle and procedure of operation of Digital Voltmeter, Digital Multimeters, Digital Frequency Meter, Q-Meter, Digital Storage Oscilloscope. Spectrum Analyzer, Logic Analyzer, recorders-Galvanometer recorders, Strip recorder, X-Yrecorder.

UNIT– 3

Measurement of Non – Electrical Quantities

Measurement of Displacement, Velocity, Acceleration, Force, Torque, Strain, Speed & Sound, Temperature, Pressure, Flow, Humidity, Thickness.

UNIT-4

Electrical Transducers:

Fundamental Concept & Transducers Classification Resistance, Capacitance, Inductance, Piezoelectric, Thermoelectric, Techogenerator, Optical & Digital Transducers.

UNIT-5

Virtual Instrumentation

Historical Perspective, advantages, block – diagram and architecture of a virtual instrument data – flow techniques, graphical programming in data flow comparison with conventional programming, Development of virtual instrument using GUI.

Textbook:

2. A.K. Sawhney: Electrical & Electronic Measurement & Instrumentation – Dhanpat Rai & Co. (P) Limited.India January 2015
3. M.M.S. Anand: Electronic Instruments and instrumentation Technology.Prentice Hall India Learning Private Limited, 1 January 2004

Reference:

1. Helfrick & Copper: Modern Electronic Instrumentation & Measuring Techniques –Prentice Hall India Learning Private Limited, 1 January 1992
2. W.D. Cooper: Electronic Instrumentation and Measuring Techniques –PHI, 3rd Edition Jan.1985
3. E.O.doebilin: Measurement Systems – TMH, 6th Edition ,July 2017
4. H.S.Kalsi: Electronic Instrumentation-TMH, 3rd Edition.July 2017

COMMUNICATION LAB

1. To study the amplitude modulation anddemodulation.
2. Envelop detector for AMsignals.
3. Generation and Demodulation of DSB-SCsignal.
4. SSB generation.
5. To study andrealize VCO as a FM generator.
6. To study and realize Phase locked loop FM generator.
7. To study and realize frequency discrimination method for FM demodulation.
8. To study and realize PLL as FMdetector.
9. Study of Frequency Division Multiplexing and Demultiplexing
10. Study of Frequency Modulation (FM) and Frequency Shift Keying (FSK)
11. Study of signal sampling and reconstruction techniques and to verify Nyquist criteria and tracing.
12. Study of PAM, PWM and PPM modulation and demodulation techniques.
13. Study of TDM pulse amplitude modulation and demodulation.
14. Study of Pulse code modulation and demodulation techniques.
15. Study of Delta / Adaptive Delta Modulation and Demodulation.
16. Study of Phase Shift Keying Modulation and DemodulationTechnique.
17. Study of Binary Phase Shift Keying(BPSK)
18. Study of ASK and FSK modulation anddemodulation
19. Study of PSK, DPSK and QPSK Modulation and Demodulation
20. Study of Time Division Multiplexing and De-multiplexing

Note: - 20% experiments other than this list of equal standard relevant to syllabus can also be set.

WIRELESS AND MOBILE COMMUNICATION

ELC 401

Course Outcome:

CO1	Cellular concepts like frequency reuse, fading, equalization, GSM, CDMA.
CO2	Apply the concept to calculate link budget using path loss model
CO3	They can analyse different multiple access techniques in mobile communication with
CO4	Equalization and different diversity techniques and can apply the concept of GSM in real time applications.

UNIT - 1

Introduction

History of wireless communication, Evolution of Mobile Communication, Mobile and Wireless devices. A market for mobile communications. A simplified reference model for mobile communications, Large scale path loss: propagation models, reflection, diffraction, scattering, practical link budget design using path loss model.

UNIT- 2

Wireless-transmission

A brief introduction of frequencies for radio transmission, signals propagation, Multiplexing, Modulation, spread spectrum, cellular system, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, Small scale fading & multi path propagation and measurements, impulse response model and parameters of multipath channels, types of fading, theory of multi-path shape factor for fading wirelesschannels.

UNIT- 3

Spread spectrum modulation techniques

Pseudo-noise sequence, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum(FHSS), performance of DS-SS, performance of FH-SS, modulation performance in fading and multipath channels, fundamentals of equalization, equalizer in communication receiver, survey of equalization techniques, linear equalizer, linear equalizer, non-linear equalization, diversity techniques, RAKE receiver. **Medium Access Control:** Introduction to MAC, Telecommunication systems, GSM, DECT, TETRA, UMTS &IMT-2000

UNIT-4

Satellite System

Review of the System, Broadcast System-Review. **Wireless LAN**: IEEE 802-11 Protocol, System Architecture, Protocol Architecture, Physical Layer & MAC Layer, Newer developments, Hiper LAN, Bluetooth Technology, Introduction to wireless networks, 2G, 3G and 4G wireless systems, wireless standards.

UNIT-5

Mobile Network Layer

Mobile IP, Mobile host configuration Network, Mobile ad-hoc networks **Mobile transport Layer:** Traditional TCP, classical TCP improvement TCP over wireless network, performance Enhancing, proxies. **Support for Mobility:** File systems, World Wide Web, wireless application protocol, i-mode, Sync ML, WAP2-0 etc. Architecture of future Network &Applications.

Text Book:

1. Schiller, J. / "Mobile Communication" / Pearson Education / 2nd Ed.-2008
2. T.S. Rappaport, "Wireless Communication-Principles and practice",Pearson-2010

Reference Books:

1. Willium C. Y. Lee, “Mobile communication Design andfundamentals” / 2nd Ed.-2011
2. D. R. Kamilo Fehar, “Wireless digitalcommunication”Prentice Hall, May 1995
3. Haykin S & Moher M., “Modern wireless communication”, Pearson,2005.

MICROPROCESSOR AND MICROCONTROLLER

ELC 402

Course Outcome:

CO1	To define the history of microprocessors,
CO2	Describe the architectures of 8085 and 8086 microprocessors, draw timing diagram, Write programs using 8085 and 8086.
CO3	Distinguish between the different modules of operation of microprocessors.
CO4	Interface peripherals to Microprocessor.
CO5	Interfacing of memory with Microprocessor.
CO6	Architecture of Microcontroller
CO7	Basic Assembly language programming concept.

UNIT 1

Introduction to Microprocessor:

Evolution of Microprocessors, Register structure, ALU, Bus Organization, Timing and Control. Introduction to 8085: Architecture, pin diagram, memory interfacing, memory mapping and organization, timing diagram of different cycles

UNIT-2

Assembly Language Programming

Instruction format and addressing modes, Data transfer instructions, Arithmetical and logical instructions, Program control Instructions (jumps, conditional jumps), stacks and subroutines, interrupts.

UNIT- 3

Basic of Interfacing:

Programmed I/O, Interrupt driven I/O, Parallel I/O (8255-PPI), 8259 Programmable Interrupt Controller, 8237-DMA Controller, 8253/8254 Programmable Timer/Counter,(8279) Keyboard and display interface.

UNIT-4

Fundamentals of 8086 Microprocessor

Internal organization of 8086, Bus interface unit, Execution unit, Register organization, Sequential memory organization, Bus cycle. Signal Description of pins of 8086 and 8088, Clock generation, Address and data bus, demultiplexing, Buffering memory organization, Read and Write cycle Timings, Interrupt structures, Addressing modes and their features.

UNIT-5

8051 Microcontroller

architecture, configuration, I/O port Structure, registers, memory organization, Instruction set, Basic Assembly language programming concept.

Textbooks:

1. Douglas V.Hall / 8086 MicroprocessorsArchitecture / TMH / 3rdEd., July 2017
2. R.Gaonker / 8085Microprocessor /Penram International Publishing / 6thEd., Oct 2013
3. Kenneth J.Ayala / The 8051 Microcontroller / Penram InternationalPublishing.***3rd*** Edition.2007

References:

1. LiuGibson / Microprocessor 2ndEdition 13 January 1986.
2. Ray,A.K.&Burchandi,K.M. /"AdvancedMicroprocessorsandPeripherals: Architecture, Programming and Interfacing" / Tata McGrawHill. 3rdEd., July 2017
3. Brey, Barry B. / "INTEL microprocessors" / Prentice Hall (India) /8thEd. June 2008

OPTTOELECTRONICSANDOPTICALCOMMUNICATION

ELC403

Course outcome:

CO1	Recognize and classify the structures of Optical fibre and types.
CO2	Transmission Characteristics of fibre like attenuation and dispersion. Analyse various coupling losses.
CO3	Manufacturing techniques of fibre/cable.
CO4	Principle and operation of the optical sources and detectors such as LASER, LED& APD.
CO5	Optical Amplifier: The basic concepts of optical networks, Describe about the SONET/SDH, WDM.
CO6	Familiar with Design considerations of fibre optic systems, OTDR. Non communicational applications of optical fibre
CO7	To perform characteristics of optical fibre, sources and detectors, design as well as conduct experiments in software and hardware, analyse the results to provide valid conclusions.

UNIT 1:

Introduction:

Historical developments, Optical fiber communication system, Principle of optical communication, Advantages of optical fiber communication, Total internal reflection, Acceptance angle, Numerical aperture, Skew rays, Cylindrical fiber.

Structure and types of optical cable: Structure of optical fibers, Single and multimode fibers, Step index and graded index optical fiber.

UNIT 2:

Transmission Characteristics of Optical Fibers:

Mid-infrared and Far-infrared transmission, Inter-modal and Intra-modal dispersion, Overall fiber dispersion, Polarization.

Losses in optical fibers: Attenuation, Material absorption losses, Linear scattering losses, Non-linear scattering losses and Fiber bends loss and Joint loss.

Preparation methods of optical fibers: Liquid phase (melting) and Vapour phase deposition techniques.

UNIT 3:

Optical Fiber Connection:

Joints, Fiber alignment, Splices, Connectors, Couplers.

Optical sources: Absorption and emission of radiation, Einstein's relation, Population inversion, Optical emission from semiconductors, Semiconductor LASER, LED power and efficiency characteristics. Optical transmitter and receiver.

UNIT 4:

Optical Detectors:

Optical detection principles, Absorption and emission, Quantum efficiency, Responsivity, Long wavelength cutoff, p-n photodiode, p-i-n photo diode, photo transistors.

Optical fiber measurements: Fiber attenuation measurements, Dispersion measurements, Refractive index profile measurements, Cut-off wavelength measurements, Numerical aperture measurements.

UNIT –5

Digital Transmission Systems

Point to point links, system considerations, link power budget, rise time budget, modulation formats for analog communication system, introduction to WDM concepts, Introduction to advanced multiplexing strategies.

Textbooks:

1. G.Keiser: Optical Fiber Communication –**McGraw Hill Education, Fifth Ed. July 2017**

2. Jenkins & White: Fundamentals of Optics –MGH,4th ed. 2017
3. J.M. Senior: Optical Fiber Communication –PHI-3rd ed. 2010
4. Gagliardi & Karp: Optical Communication –Wiley-2nd ed. 1995

Reference Books:

1. Bhattacharya, Pallab / "Semiconductor Optoelectronics Devices" / PearsonEducation.-2017
2. Singh,Jasprit/"OptoelectronicsanIntroductiontoMaterialsandDevices"/ McGraw-Hill-1996
3. Khare,R.P./"FiberOptics&Optoelectronics"/OxfordUniversityPress-2004
4. Gupta,S.C./"TextBookofOpticalFiberCommunication&ItsApplications"/Prentice–Hall (India).-2013

POWER ELECTRONICS

ELC 404 (A)

Course Outcome:

CO1	Relate basic semiconductor physics to properties of power devices, and combine circuit mathematics and characteristics of linear and non-linear devices.
CO2	Describe basic operation and compare performance of various power semiconductor devices, passive components and switching circuits
CO3	Design and Analyse power converter circuits and learn to select suitable power electronic devices by assessing the requirements of application fields.
CO4	Formulate and analyse a power electronic design at the system level and assess the performance.
CO5	Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.
CO6	Recognize the role power electronics play in the improvement of energy usage efficiency and the applications of power electronics in emerging areas.

UNIT 1

Power semiconductor Devices:

Power semiconductor devices their symbols and static characteristics. Characteristics and specifications of switches, types of power electronic circuits. Operation and steady state characteristics of MOSFET and IGBT. Thyristor – Operation & V- I characteristics, two transistor model, methods of turn-on Operation of GTO, MCT and TRIAC, Protection of devices. Series and parallel operation of thyristors, Commutation techniques of thyristor

UNIT 2

DC-DC Converters:

Principles of step-down chopper, step down chopper with R-L load, Principle of step-up chopper, and operation with RL load, classification of choppers.

UNIT 3

Phase Controlled Converters

Single phase half wave controlled, rectifier with resistive and inductive loads, effect of freewheeling diode. Single phase fully controlled and half controlled bridge converters. Performance Parameters, Three phase half wave converters, Three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters.

UNIT 4

AC Voltage Controllers

types of AC voltage controllers, integral cycle control, single phase voltage controllers, with R and RL loads, single-phase transformer tap changers, single-phase sinusoidal voltage controllers, working of three-phase controllers with star & delta loads.

Cycloconverters: Principle of cycloconverter operation, single-phase to single-phase circuit, step-up and step-down cycloconverter, three-phase half wave cycloconverter, output voltage equation of a cycloconverter, load commutated cycloconverter.

UNIT 5

Inverters

Single phase series resonant inverter, Single phase bridge inverters, Three phase bridge inverters
Voltage control of inverters, Harmonics reduction techniques, Single phase and three phase current source inverters.

Text Books:

1. M.H.Rashid,"PowerElectronics:Circuits,Devices&Applications",PrenticeHallof India Ltd. 3rdEdition,2004.
2. M.D. Singh and K.B.Khanchandani, "Power Electronics" Tata MC Graw Hill,2005

Reference Books:

1. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd.,2004
2. A. Chakrabarti,rai & Co. "Fundamentals of Power Electronics & Drives" DhanpatRai.-2010
3. K.Hari Babu, "Power Electronics" SwitchPublications-2004

DIGITAL SIGNAL PROCESSING

ELC 404 (B)

Course Outcomes:

CO1	Interpret, represent and process discrete/digital signals and systems.
CO2	Thorough understanding of frequency domain analysis of discrete time signals.
CO3	Ability to design & analyse DSP systems like FIR and IIR Filter etc.
CO4	Practical implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors.
CO5	Understanding of spectral analysis of the signals

UNIT -1

Introduction

Limitations of analog signal processing, Advantage digital signal processing, discrete time characterization of signals & systems some elementary discrete time sequences and systems, concepts of stability, causality, linearity time invariance and memory, linear time invariant systems, and their properties, linear constant coefficient differenceequations.

Frequency domain representation of discrete time signal and systems complex exponentials as Eigen function of LTI systems, Fourier transform of sequences.

UNIT -2

Processing of Continuous Time Signals

Discrete time processing of continuous time signals and vice – versa; decimation & interpolation, changing the sampling rate by integer and non integer factors using discrete time processing.

Discrete Fourier transform: DFT and its properties ; linear, periodic and circular convolution , linear filtering methods based on DFT, filtering of long data sequences; fast Fourier transform algorithm using using decimation in time and decimation in frequency techniques ; linear filtering approaches to computation of DFT.

UNIT -3

Transform Analysis of LTI Systems

Frequency response of LTI systems, system function for system characterized by linear constant coefficient difference equations. Relationship between magnitude and phase, all pass systems, minimum phase systems. **Structure for discrete time systems** Signal flow graph representation, transposed forms, lattice structures.

UNIT -4

Design of Digital Filters

Linear phase FIR filters; FIR differentiator and Hilbert transforms, FIR filter design by impulse invariance, bilinear transformation; Matched Z – transformation; frequency transformation in the analog and digital domain.

UNIT -5

Finite Precision Effects

Fixed point and floating point representations, effect of coefficient quantization, effect of round off noise in digital filters, limit cycles.

Digital signal processors Architecture and various features of TMS/ADSP, series of digital signal processors; Instruction set and few applications of TMS 320CXX.

Textbooks:

1. Oppenhiem,A.V&SachsferR.W,"DiscreteTimeSignalProcessing"PrenticeHall,1989.
2. Proakis, J.G&Manolakis,D.G,"DigitalSignalProcessing"PrenticeHall1992.

Reference Books:

1. Rabiner,L.R. andGoldB./“TheoryandapplicationsofDSP”/PrenticeHall(India)
2. Oppenheim,AlanV.&Willsky,AlanS./“Signalsand Systems”/PrenticeHall(India)/2nd Ed.1996
3. Johnson, J.R./“IntroductiontoDigitalSignalProcessing”/PrenticeHall(India)-1992
4. DeFatta,D.J.,Lucas,J.G.&Hodgkiss,W.S/“DigitalSignalProcessing”/JohnWiley&Sons.-July 2009
5. Sen M. Kuo & Woon-Seng S. Gan, “Digital Signal Processors-architectures, implementation and applications” / Pearson Education / Ist Ed./2004

BIO – MEDICAL ELECTRONICS
ELC 404 (C)

Course Outcome:

CO1	Having understanding of different bioelectric potential and electrodes
CO2	Understanding cardiovascular system and its measurements
CO3	Understanding respiratory system and its measurement.
CO4	Having knowledge of diagnostic techniques, biotelemetry, Patient care and monitoring system.

UNIT – 1

Introduction:

The age of Biomedical Engineering, Development of Biomedical Instrumentation, Man-Instrumentation System, Components, Physiological system of the body, Problems encountered in measuring a livingsystem.

Transducers & Electrodes: The transducers & transduction principles, Active transducers, Passive transducers, Transducers for BiomedicalApplications.

Source of Bioelectric potentials: Resting and Action potentials, propagation of active potential. The Bioelectric potential – ECG, EEG, EMG and Envoked responses.

Electrodes: Electrode theory, Biopotential Electrodes – Microelectrodes, Body Surface Electrodes, Needle Electrodes, Biochemical Transducers, Reference Electrodes, pH Electrodes, Blood GasElectrodes.

UNIT – 2

Cardiovascular Measurements:

Electrocardiography – ECG amplifiers, Electrodes and leads, ECG – Recorders – Three channel, Vector Cardiographs, ECG system for stress testing, Continuous ECG recording (Holter recording), Blood pressure measurement, Blood flow measurement, Heart sound measurements.

Patient Care and Monitoring: Elements of intensive care monitoring, Patient Monitoring displays, Diagnosis, Calibration & Reparability of patient monitoring equipment, Pacemakers & Defibrillators.

UNIT – 3

Measurements of Respiratory System:

Physiology of respiratory system measurement of breathing mechanics –Spirometer, Respiratory therapy equipments: Inhalators ventilators & Respirators, Humidifiers, Nebulizers & Aspirators.

UNIT – 4

Diagnostic Techniques:

Ultrasonic Diagnosis Eco - Cardiography, Eco– Encephalography, Opthalmic scans, X-Ray & Radio-isotope instrumentation, CAT scan, Emission Computer Tomography, MRI.

UNIT – 5

Bio-Telemetry:

The components of a Biotelemetry system, Implantable units, Telemetry for ECG measurement during exercise for Emergency patient monitoring.Other Prosthetic devices like Hearing Aid and Myoelectric Arm, Special aspects- Safety of Medical Electronic Equipments, Shock hazards from electrical equipment and prevention againstthem.

Text Books:

1. Cormwell/"BiomedicalInstrumentationandMeasurements"/PrenticeHall(India).1980

Reference Books:

1. Khandpur R.S./ “Biomedical Instrumentation”/ TataMcGraw-Hill.2003
2. Tompkins/“BiomedicalDSP:CLanguageExamplesandLaboratoryExperimentsfortheIBM PC”/ Prentice Hall(India).2015

EMBEDDED SYSTEM

ELC 404-D

Course Outcome:

CO1	Be familiar with the composition, design, and implementation of embedded systems
CO2	Be familiar with reading and understanding processor and component datasheets
CO3	Be familiar with the basics of interfacing hardware and software
CO4	Be exposed to history of embedded interfaces

UNIT 1

Hardware Considerations:

Introduction: Overview, design metrics, processor technology, design technology. Custom single-purpose processors- introduction, RT-level combinational & sequential components, custom single purpose processor design, Optimizing program, FSMD, data path & FSM.

General purpose processors and ASIP's: Basic architecture and operation of general purpose processors, programmer's view, development environment - ASIP's – microcontrollers, DSP and less general ASIPenvironments.

UNIT 2

Standard Processor Peripherals:

Timers, counters and watchdog timers, applications, UART, PWM application, LCD controller, keypad controllers, stepper motor control, ADC and DAC. Memory: Different types of ROM & RAM, cache systemdesign

UNIT 3

Interfacing:

introduction to interfacing, communication basics, basic protocol concepts, interrupts and DMA, arbitration, multilevel bus architectures, communication - serial parallel and wireless protocols, I^2C, CAN, USB, FireWire, parallel and wirelessprotocols.

UNIT 4

Software Considerations:

Basics of real time concepts, bus transfer mechanism, software concepts, system concepts, real time definitions, events and determinism, synchronous and asynchronous events, time loading, real time design issues, examples of real time systems. The software life cycle: phases of the software life cycle, interrupts: basics - shared data problem, interrupt latency.

Survey of software architecture: round robin, round robin with interrupts, function queues, scheduling, RTOS architecture, selection architecture.

UNIT 5

Introduction to RTOS :

Tasks, states, data – semaphores and shared data. More operating system services – message queues, mail boxes and pipes, timer function, events, memory management, interrupt

Basic design using RTOS: Principles, an example, encapsulating semaphoresand queues, hard real time scheduling considerations, saving memory, space andpower.

Embedded software development tools: Host and target machines, linkers/locators for embedded software.

Text Books:

1. "Embedded system Design" by Frank Vahidand Tony Givargis, John Wiley, 2010
2. "An Embedded Software Primer" by David E.Simon,Pearson Education, 2012

Reference Book:

3. "Real Time System Design and Analysis"by Phillip A Laplante ,PHI Pub., 2017

FOUNDATION OF NANO ELECTRONICS

ELC-404 (E)

Course Outcome:

CO1	Understand Nano-CMOS scaling and, advantages and implications of scaling down Nano electronic devices.
CO2	Describe the solid-state physics and quantum mechanics that govern the operation and electrical characteristics of Nano electronic devices.
CO3	Explain different fabrication and characterization techniques for nanoscale electronic devices.
CO4	Study 3D ICs and progress in interconnect technology.
CO5	Understand the importance and significance of key reliability issues in Nano electronic devices and materials.
CO6	Become familiar with recent research progress related to new devices and materials, and its application in Nano electronics and nanotechnology field.

UNIT 1

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).

UNIT 2

Infinite array of potential wells, Barrier penetration, applications to tunnel diode, Josephson effect, Perturbation theory and its applications, Scattering. Binomial and related distributions, Phasespace,

UNIT 3

Statistical ensembles, applications of classical statistical mechanics, Quantum statistics, Brownian motion, Random walk problem. Concept of Chemical potential, partition function and its applications in computing thermodynamic quantities.

UNIT 4

Quantum electronic devices, electrons in mesoscopic structures, short channel MOSFET, split-gate transistor, electron wave transistor, electron spin transistor, quantum cellular automata, Bioelectronics, molecular processor, DNA analyzer as biochip, Molecular electronics, Fullerenes, nanotubes, switches based on Fullerenes and nanotubes,

UNIT 5

Nanoelectronics with tunneling devices, resonant tunneling diode(RTD), three terminal RTDS, RTD based memory, basic logic gates and dynamic logic gates,Principle of single electron transistor, Coulombblockade.

RECOMMENDED BOOKS:

1. "Nanotechnology: Science, Innovation and Opportunity"by Lynn E. Foster,Prentice Hall.2005
2. "Handbook of Nanotechnology: Volume 1&2" by B.Bhushan , Springer -Verlag. Seconded.208
3. "Nanoelectronics and Nanosystems" by K.Goser, P. Glosekotterand J. Dienstuhl,Springer, 2010
4. "Introduction to Nanotechnology" by Charles P Poole Jr., and Frank J.Ownes,, John Wiley Sons., 2017

5. “Nanotechnology-A gentle introduction to the Next Big Idea” by Mark Ratner and Danial Ratner, Perason, 2009
6. "Encyclopedia of Nanoscience & Nanotechnology" by H.S.Nalwa, American ScientificPub., 2015

PROCESSES IN DEVICE FABRICATION

ELC 404 (F)

Course Outcome:

CO1	Introduction and overview of semiconductor device fabrication
CO2	Fabrication operations: Oxidation, doping, and lithography
CO3	Fabrication processes: etching and growth. Process evaluation
CO4	Process yield, clean room design, and IC logic and packaging

UNIT-1

Crystal Growth and Wafer Preparation –Electronic Grade silicon, Czocharski Single Crystal growth technique, Zone refining, Silicon Shaping – from ingot to finished wafer, Defects in the crystal.

UNIT-2

Epitaxial Growth, VPE, LPE and MBE techniques, Mechanism, Equipment, Methods of Evaluation, Epitaxial defects, Buried layers Oxidation

UNIT-3

Oxidation, Deal Grove model of thermal oxidation, dry, wet, rapid thermal, and pyrogenic oxidation, chlorine enhanced oxidation, anodic and plasma oxidation, dependence on process and substrate parameters, oxide properties – masking, oxide charges, oxide stress, quality of oxide, oxidation induced stacking faults, oxidation of Polysilicon.

UNIT-4

Lithography, Types, Optical lithography – resists, contact, proximity and projection printing, mask making, Equipment, limitations, Electron Beam Lithography – Equipment, resists, pattern writing, mask generation, limitations, X-ray lithography - Equipment, X-ray sources resists, masks generation,limitations.

UNIT-5

Characterization and analytical techniques: Thickness measurement, I-V measurement, C-V measurements, Resistance measurement – two probe and four probe, spreading resistance, Dielectric property measurements, XRD, XPS, FTIR, SEM, Ellipsometer, UV-VIS spectrometer, Ramanspectroscopy.

RECOMMENDED BOOKS

1. “VLSI Fabrication Principles” by S.K. Gandhi, John Willey & SonsPub., 2005
2. “VLSI Technology” by S.M.Sze, McGrawHillPub., 2008
3. “Semiconductor & Integrated Fabrication Techniques” by P.E. Gise and R. Blanchard, Restonn Pub., 2015
4. “Large Scale Integration” by M.J. Hower and D.V.Morgan, JohnWileyPub., 2018

ARTIFICIAL INTELLIGENCE

ELC 404-(G)

Course Outcome:

CO1	Design user interfaces to improve human–AI interaction and real-time decision-making.
CO2	Evaluate the advantages, disadvantages, challenges, and ramifications of human–AI augmentation.
CO3	Design and develop symbiotic human–AI systems that balance the information processing power of computational systems with human intelligence and decision making.
CO4	Explain the benefits, limitations, and trade-offs of designing engaging and ethical conversational user interactions, including those supported by chatbots, smart speakers, and other AI-driven, voice-based technologies.
CO5	Design and evaluate conversational interfaces for different users and contexts of use.

Unit – 1

Introduction to Artificial Intelligence. Natural and artificial intelligence. Role of representation of knowledge, Description matching and goal reduction, exploiting natural constraints in problem solving, Exploiting alternative paths, Best paths.

Unit – 2

Reasoning , Logic and Theorem proving : Deductive and inductive reasoning . heuristic methods , proof by resolutions and constraint propagation, problem solving paradiagrams.

Unit – 3

Knowledge replacement: First order predicate calculus, Skolemlsation, Resolution principle, Unification nementic networks, frame , system value inheritance, introduction to prolog, Introduction to expert systems, application of expert system and various shells.

Unit – 4

Application of artificial intelligence methods in various disciplines: database management, computer aided.

Unit - 5

Design principles of pattern recognition system, Statistical pattern recognition, Parameter estimation methods- Principle Component Analysis (PCA) and Linear discriminant analysis (LDA),Classification Techniques, Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM)

Text Books and References:

1. S.J. Russell and P. Norvig , Artificial intelligence : A Modern Approach , Pearson; 3rd edition 2010
2. Elaine Rich and Kaven Knight – Artificial Intellegence McGraw Hill Education; 3rd edition, 2017
3. Introduction to Artificial Intelligence, Mariusz Flasiński, Springer, 1st ed. 2016
4. Introduction to Artificial Intelligence, Patterson, Pearson, 2015

INFORMATION THEORY AND CODING

ELC 404 (H)

Course Outcome:

CO1	Expected Course Outcomes Upon completion of this course, the students will be able to:
CO2	Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source
CO3	Represent the information using Shannon Encoding, Shannon-Fano, Prefix and Huffman Encoding.
CO4	Model the continuous and discrete communication channels using input, output and
CO5	joint probabilities
CO6	Apply linear block codes for error detection and correction
CO7	Apply convolution codes for performance analysis & cyclic codes for error detection and correction.

UNIT 1

Source Coding:

Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measures for Continuous Random Variables, Source Coding Theorem, Huffman Coding, The Lempel- Ziv Algorithm, Rate Distortion Function, Optimum Quantizer Design.

UNIT 2

Channel Capacity and Coding:

Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem. The Shannon Limit, Random Selection of Codes.

UNIT 3

Linear Block Codes for Error Correction:

Introduction to Error Correcting Codes, Basic Definitions, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes
Hamming Codes, Optimal Linear Codes, Cyclic Codes, Introduction to Cyclic Codes, Polynomials.
The Division Algorithm for Polynomials, A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Fire Code, Golay Codes, Cyclic Redundancy Check (CRC) Codes
Introduction to BCH Codes, Primitive Elements, Minimal Polynomials, Generator Polynomials in Terms of Minimal Polynomials, Some Examples of BCH Codes, Decoding of BCH Codes
Reed-Solomon Codes, Implementation of Reed-Solomon Encoders and Decoders, Nested Codes.

UNIT 4

Convolutional Codes:

Introduction to Convolutional Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolutional Codes (Analytical Representation), Notions for Convolutional Codes, The Generating Function, Matrix Description of Convolutional Codes, Veterbi Decoding of Convolutional Codes, Distance Bounds for Convolutional Codes, Performance Bounds, Known Good Convolutional Codes, Turbo Codes, Turbo Decoding 792.14 C, Concluding Remarks 788.15 Po

UNIT 5

Trellis Codes Modulation:

Introduction to TCM, The concept of Coded Modulation, Mapping by Set Partitioning, Ungerboeck's TCM Design Rules, TCM Decoder, Performance Evaluation for AWGN Channel, Computation of dfree, TCM for Fading Channel.

Text Books:

1. Bose, Ranjan / “Information Theory, Coding & Cryptography” / Tata McGraw Hill /2008

Reference Books:

1. Van Lint**,** J.H./ “Introduction to Coding Theory” /Springer-Verlag Berlin and Heidelberg1998
2. Proakis, John G. / “Digital Communications” / McGrawHill-2014
3. Sathyanarayana,P.S./“ProbabilityInformationandCodingTheory”/DynaramPublications, Bangalore-2001
4. Gallager / “Information Theory and ReliableCommunication”1991
5. Shulin & Costello/ “Error Correcting Codes” / Prentice Hall(India).-2004
6. Taub&Schilling/“PrinciplesofCommunicationSystems”/TataMcGrawHill-2nd Ed. 1996

INDUSTRIAL ECONOMICS AND MANAGEMENT

ELC-404 (I)

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the concepts related to business and demonstrate the roles, skills and functions of management
CO2	Understand how the industrial company can be organized and managed
CO3	Understand the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities
CO4	Express leadership and entrepreneurial attributes through various case studies

UNIT -1

Definition and scope of engineering economics, Concept of supply and demand, Price elasticity and cross elasticity of demand, Production, Engineering costs and cost estimation, Concept of time value of money, Cash flow analysis

UNIT-2

Perfect competition, Monopoly, Monopolistic competition

UNIT-3

National Income, GDP, Inflation, Deflation and treatment

UNIT-4

Introduction to Industrial management, Brief history of industries in India, Brief definition of management, organization and administration. Characteristics of management, Principle of management, Function of management like, planning, organization, direction, co-ordination etc.

UNIT-5

Level of management, skills of management, inter-relation between skills and levels of management, scientific management, Introduction to Schools of Management thoughts, introduction to organization, study of basic type of organization for ex. Line and staff organization, project organization, metrics organization, Informal organization, Introduction to industrial Psychology, Motivation theory and study of Max low, Need, Hierarchy Theory, Planned Location, Planned Layout. Study of different forms of layout like line layout, process layout, product layout, combinational layout, sixth position layoutetc.

Texts and Reference Books:

1. Economics by Paul. A.Samuelson, 2015.
2. Managerial Economics by Christopher R.Thomas, S.CharlesMaurice,SumitSarkar, 2012.
3. Financial Management by J. V.Vaishampayan, 2017
4. Microeconomics by A.Koutsoyannis, 2009
5. Mahajan: Industrial and Process Management, 1 January 2015.

MICROPROCESSOR LAB

1. Write programme for Addition/Subtraction of 8 and 16t numbers using 8085.
2. Write programme for Multiplication/Division of 8 and 16 numbers using 8085.
3. Write programme to compute the factorial of an integer using 8085.
4. Write programme for Addition and Subtraction of two packed BCD's numbers using 8085.
5. Write programme to find the largest signed number in a given series of data using 8085.
6. Write programmeto find sum of a given series of numbers using 8085.
7. Write programme to find the largest and smallest number from a given un ordered array of 8- bit numbers using 8085.
8. Write programme to perform BCD addition using 8085.
9. Write programme for BCD to Binary and Binary to BCD conversion using 8085.
10. Write programme to convert BCD into its equivalent binary number using 8085.
11. Write programme convert Binary number into its equivalent unpacked BCD number using 8085.
12. Write programme to arrange the data array in ascending and descending order using 8085.
13. Write a programme to control the operation of a steeper motor using 8085 and 8251 PPI.
14. Program 8253 in mode 3 to generate square wave.
15. Program 8255 in mode 0 i.e. simple I/O mode. Program Port A in I/P mode, Port B in input mode. Read data from Port A & B, add it & display the result in Port C.
16. Interface 8251 with 8085 M.P.U. and program it in asynchronous transmitter mode, use 8251 Group A.
17. Interface 8251 with 8085 M.P.U. and program it in asynchronous receiver mode, use 8251 Group A.
18. Study of master 8259 in stand-alone mode. Generate and interrupt request-using 8259 and display the respective interrupt in address field.
19. Write programme to add first ten natural numbers using 8051.
20. Write programme for Multiplication of two numbers using 8051.
21. Write programme to toggle the bits of an I/O port using 8051.
22. Write programme to convert Hexadecimal to Decimal number using 8051.
23. Write an 8051 ALP to generate 10 KHz square wave on any pin of port0.
24. Write programme to obtained 1 sec delay using 8051.
25. Write an 8051 ALP to generate 10 KHz square wave on any pin of port 0 using interrupts.

Note: - 20% experiments other than this list of equal standard relevant to syllabus can also be set.