SCHOOL OF PHYSICAL SCIENCES,
SOLAPUR UNIVERSITY, SOLAPUR
M.Sc – Physics (Applied Electronics)
Choice Based Credit System
w.e.f June 2016-17

Semester	Code	Title of the Paper	Semester exam			L	T	P	Credits
First		**Hard core**	**Theory**	**IA**	**Total**				
AE	**HCT1.1**	Mathematical Techniques	70	30	100	4		-	4
	HCT1.2	Condensed Matter Physics	70	30	100	4		-	4
	HCT1.3	Analog & Digital Electronics	70	30	100	4		-	4
		Soft Core (Any one)							
	SCT1.1	Classical Mechanics	70	30	100	4		-	4
	SCT1.2	Fundamentals of Nanoelectronics	70	30	100	4		-	
		Tutorial			25		1		1
		Practical							
	HCT 1.1	Practical HCP 1.1	35	15	50	-	-	2	6
	HCP1.2	Practical HCP 1.2	35	15	50	-	-	2	
	HCP1.3	Practical HCP 1.3	35	15	50	-	-	2	
		Soft core (Any one)							
	SCP1.1	Practical SCP1.1	35	15	50	-	-	2	2
	SCP1.2	Practical SCP1.2	35	15	50	-	-	2	
		Total for first semester	**420**	**180**	**625**				**25**
Second		**Hard core**							
AE	**HCT2.1**	Quantum Mechanics	70	30	100	4		-	4
	HCT2.2	Electrodynamics	70	30	100	4		-	4
		Soft core (Any one)							
	SCT2.1	Microprocessors & Microcontrollers	70	30	100	4		-	4
	SCT2.2	Statistical Mechanics	70	30	100	4		-	
		Open elective (Any one)							
	OET2.1	Elements of Electronics	70	30	100	4		-	4
	OET2.2	Electronic Instrumentation	70	30	100	4		-	
		Tutorial			25		1		1
		Practical							
	HCP 2.1	Practical HCP 2.1	35	15	50	-	-	2	4
	HCP2.2	Practical HCP 2.2	35	15	50	-	-	2	
		Soft core (Any one)							
	SCP2.1	Practical SCP2.1	35	15	50	-	-	2	2
	SCP2.2	Practical SCP2.2	35	15	50	-	-	2	
		Open elective (Any one)							

	OEP2.1	Practical OEP2.1	35	15	50	-	-	2	2
	OEP2.2	Practical OEP2.2	35	15	50	-	-	2	
		Total for second semester	**420**	**180**	**625**				**25**
Third		**Hard core**							
AE	**HCT3.1**	Semiconductor Devices	70	30	100	4		-	4
	HCT3.2	Atomic, Molecular & Nuclear Physics	70	30	100	4		-	4
		Soft core (Any one)							
	SCT3.1	Communication System	70	30	100	4		-	4
	SCT3.2	Biomedical Instrumentation	70	30	100	4		-	
		Tutorial			25		1		1
		Open elective (Any one)							
	OET3.1	Energy Harvesting Devices	70	30	100	4		-	4
	OET3.2	Introduction to MATLAB & LabVIEW	70	30	100	4		-	
		Practical							
	HCP 3.1	Practical HCP 3.1	35	15	50	-	-	2	2
	HCP3.2	Practical HCP 3.2	35	15	50	-	-	2	2
	SCP 3.1	Practical SCP 3.1	35	15	50	-	-	2	2
		Open elective (Any one)							
	OEP3.1	Practical OEP3.1	35	15	50	-	-	2	2
	OEP3.2	Practical OEP3.2	35	15	50	-	-	2	
		Total for third semester	**420**	**180**	**625**				**25**
Four		**Hard core**							
AE	**HCT4.1**	Microelectronics	70	30	100	4		-	4
	HCT4.2	Microwave Devices & Circuits	70	30	100	4		-	4
	HCT 4.3	Microprocessors & Interfacing	70	30	100	4		-	4
		Soft core (Any one)						-	4
	SCT4.1	Instrumentation	70	30	100	4		-	
	SCT4.2	Fiber Optic Communications	70	30	100	4		-	
		Tutorial			25		1	-	1
	MP4.3	Major Project	140	60	200	-	-	-	8
		Total for four semester	**420**	**180**	**625**				**25**
	Total								**100**

L = Lecture T = Tutorials P = Practical IA= Internal Assessment

4 Credits of Theory = 4 Hours of teaching per week

2 Credit of Practical = 4 hours per week

HCT = Hard core theory

SCT = Soft core theory

HCP = Hard core practical

SCP = Soft core practical

OET = Open elective theory

OEP = Open elective practical

MP = Major project

M.SC-I, SEME. I, PHYSICS (APPLIED ELECTRONICS)

HCT - 1.1: MATHEMATICAL TECHNIQUES

Choice Based Credit System (CBCS)

(w. e. f. June 2016-2017)

Unit I: Calculus of Residues (15)

COMPLEX VARIABLE AND REPRESENTATIONS: Algebraic Operations, Argand Diagram: Vector Representation, Complex Conjugate, Euler's Formula, De Moiver's Theorem, The n^{th} Root or Power of a complex number.

ANALYTICAL FUNCTIONS OF A COMPLEX VARIABLE : The Derivative of f(Z) and Analyticity, Harmonic Functions, Contour Integrals, Cauchy's Integral Theorem, Cauchy's Integral Formula,

Zeros, Isolated Singular points, Evaluation of Residues, Cauchy's Residue theorem.

Unit II : Operator and Matrix Analysis (15)

Vector Space and its dimensionality, Vector Spaces and Matrices, Linear independence; Bases; Dimensionality, linear dependence, Inner product Hilbert space, linear operators.

Matrix operations, properties of matrices, Inverse, Orthogonal and unitary matrices; Independent elements of a matrix Diaglonization; Complete orthogonal sets of functions, special square matrices, Eigen values and eigenvectors; Eigen value problem.

Unit III: Ordinary Differential Equations (14)

First-Order homogeneous and non homogeneous equations with variable coefficients. The superposition principle, Second-order homogeneous equations with constant coefficient. Second-order non homogeneous equations with constant coefficients.

Unit IV: Fourier Series, Integral Transforms and Laplace transform (16)

Fourier Series: Fourier's theorem; Cosine, Sine and complex Fourier series, Applications to saw tooth and square waves and full wave rectifier. FS of arbitrary period; Half wave expansions; Partial sums Fourier integral and transforms; cosine since complex forms, Parsevals relation, Application to Gaussian distribution, box and exponential functions; FT of delta function.

Laplace transforms: Laplace transforms of common functions, First and second shifting theorems; inverse LT by partial fractions; LT of derivative and integral of a function.

Reference Books:

1. Introduction to Mathematical Physics by C. Harpcr, Prcnticc - Hall of India Ltd. N.Delhi 1993,(Chapters 2,4,6,9)

2. Mathematical Physics by A.G. Ghatak, I.C.Goyal and S.J.Chua, McMillan India Ltd. New Delhi 1995 (Chapters 4,7,9,10)

3. Matrices and Tensors for Physicists,by A W Joshi
4. Advanced Engineering Mathematics, by E Keryszig
5. Mathematical Method for Physicits and Engineers, by K F Reily, M P Hobson and S J Bence

6. Mathematics for Physicists by Mary L B
7. Mathematical Methods for Physics, by G Arfken

M.SC-I, SEME. I, PHYSICS (APPLIED ELECTRONICS)

HCT - 1.2: CONDENSED MATTER PHYSICS

Choice Based Credit System (CBCS)

(w. e. f. June 2016-2017)

Unit I: Crystal Structure (15)

Basic Structures; symmetry properties, packing fractions, directions and position-orientation of planes in crystal, concept of reciprocal lattice, concept of brillouin zones, closed packed structure, and structures of some binary/ternary compounds. Elementary concepts of polycrystalline, nanocrystalline and amorphous materials. Elementary concepts of defects in solids. X-ray scattering from solids including Laue conditions and line intensities.

Unit II : Energy bands and Semiconductors (15)

Energy bands: Electron in periodic potential, Bloch function, solution of wave equation of electron in periodic potential, reduced, periodic and extended zone schemes. Construction of Fermi surfaces in brillouin zones for two - dimensional lattices, Introduction to methods for calculations of energy bands and their features. **Semiconductors:** Direct and indirect band gap semiconductors effective mass, intrinsic carrier concentration, impurity conductivity thermal ionization Revision on p-n junction and rectification, metal- semiconductor contacts, schotky barrier.

Unit III : Dielectric properties of Solids (15)

electronic, ionic, orientational, polarzabilities, static dielectric constant for gases, internal field in solids, dielectric constant of solids, dielectric relaxation in alternating fields, dielectric losses, complex dielectric constant.

Unit IV: Superconductivity (15)

Basic concepts, Meissner effect, heat capacity, energy gap, London equation, coherence length Josephson effect (flux quantization), type I and II superconductors, BCS theory, Introduction to high Tc Superconductors.

Reference Books:

1) Introduction to Solid State Physics 4 th Ed. C.Kittel,

2) Solid State Physics by A.J.Dekker

3) Solid State Physics by N.W.Ashoroff&N.D.Mermin

4) Solid State Physics S.O.Pillai

5) Solid state Physics by R.L.Singhal

M.SC-I, SEME. I, PHYSICS (APPLIED ELECTRONICS)

HCT - 1.3: ANALOG & DIGITAL ELECTRONICS

Choice Based Credit System (CBCS)

(w. e. f. June 2016-2017)

Unit I: Operational Amplifiers (15)

Differential amplifier Circuit Configurations, Dual Input Balanced Output Differential amplifier , DC analysis, AC analysis, Inverting and Non Inverting Inputs, Constant Current Bias Circuit.

Block diagram of a typical Op-Amp, Open loop configuration, Inverting and Non-inverting amplifiers, Op-amp with negative feedback, Voltage Series Feed back, Effect of feed back on closed loop gain, Input resistance, Output resistance, Bandwidth and Output offset voltage, Voltage follower.

Practical Op-amp, Input Offset Voltage, Input bias current- input offset current, total output offset voltage, CMRR frequency response.

Unit II: Applications of Op amps (15)

DC and AC amplifier, Summing, Scaling and Averaging Amplifiers, Instrumentation amplifier, Integrator and Differentiator.

Oscillator: Principles , Oscillator types, Frequency stability, Response , Phase Shift oscillator ,Wein Bridge Oscillator, LC Tunable Oscillator , Multivibrators, Monostable and Astable, Comparators, Square Wave and Triangle wave generators.

Voltage regulations: Fixed regulators, Adjustable voltage regulators, Switching regulators.

Unit III: Combinational & Sequential Logic Circuits (15)

Combinational logic:

The transistor as a switch, OR AND NOT gates- NOR And NAND gates Boolean algebra- Demorgans theorems- exclusive OR gate, Decoder/ Demultiplexer Date selector/ multiplexer - Encoder.

Sequential Logic:

Flip- Flops: RS Flip- Flop, JK Flip- Flop, JK master slave Flip-Flops Flip-Flop, D Flip- Flop, Shift registers Synchronous and Asynchronous counters.

Unit IV: Microprocessors (15)

Architecture of 8085, Signals and timing diagram of 8085, Demultiplexing Address and Data bus, Instruction Set, Addressing modes, Assembly Language Programming of 8085 (Sum of an array, Minimum and Maximum of an array, Multiplication & Division of 4 & 8 bit numbers) .

Reference Books:

1) OP Amp amplifiers by RamakantGaikwad
2) Integrated Circuits by K.R.Botkar
3) Modern Digital Electronics by R.P.Jain
4) Digital Principle and Application by Malvino&Leeach
5) Digital Fundamentals by Floyd
6)8085 Microprocessor by Ramesh Gaonkar

M.SC-I, SEME. I, PHYSICS (APPLIED ELECTRONICS)
SCT - 1.1: CLASSICAL MECHANICS
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I : Mechanics of Particles and Rigid Bodies (15)

Mechanics of Particle and system of Particles using vector algebra and vector calculus, Conversion laws, work-energy theorem, open systems (with variable mass), Gyroscopic forces; dissipative systems, Jacobi integral, gauge invariance, integrals of motion; symmetries of space and time with conservation laws; invariance under Galilean transformations.

Unit II:Lagrangian Formulation and Motion Under Central Force (15)

Constrainsts, Generalised co-ordinates, D Alemaberts Principle, Lagranges equations of motion, Central Force, definition and characteristics, Reduction of Two-bod problem into equivalent One-body problem, General analysis of orbits, Keplers laws and equations, Artificial satellites, Rutherford Scattering.

Unit III: Variational Principle (15)

Introduction to Calculus of variation, Variational technique for many independent variables, Eulers Lagrange differential equation, Hamilton's principle, Deduction f Lagrange's equation of motion from Hamilton's principle.

Hamilton, Generalized momentum, Constant of motion, Hamilton's canonicl equations of motion, Deduction of canonical equations from Variations principle.

Applications of Hamilton's equations of motion, Principle of least action, Proof of principles of least action, Problems.

Unit IV: Canonical Transformations and Hamilton's - Jacobi Theory (15)

Canonical Transformations, Condition for Transformation to be Canonical, Illustration of Canonical Transformation, Poisson's Brackets, Properties of Poisson's Brackets, Hamilton's Canonical equations in terms of Poisson's Brackets.

Hamilton's - Jacobi Theory, Solution of harmonic oscillator problems by HJ Method, Problems.

Texts and Reference Books:

1. Classical Mechanics, By Gupta, Kumar and Sharma (Pragati Prakashan2000).
2. Introduction to Classical Mechanics, by R.G. Takwale and P S Puranik(Tata McGraw Hill 1999).
3. Classical Mechanics, by H Goldstein (Addison Wesley 1980).
4. Classical Mechanics, by N C Rana and P S Joag(Tata McGraw Hill 1991).
5. Mechanics, by A Sommerfeld (Academic Press 1952)

M.SC-I, SEME. I, PHYSICS (APPLIED ELECTRONICS)
SCT - 1.1: Fundamentals of Nanoelectronics
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit – 1 **(15)**

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 **(15)**

Infinite array of potential wells, Barrier penetration, applications to tunnel diode, Josephson effect, Perturbation theory and its applications, Scattering. Binomial and related distributions, Phase space, Statistical ensembles, applications of classical statistical mechanics, Quantum statistics, Brownian motion, Random walk problem. Concept of Chemical potential, partition function and its applications in computing thermodynamic quantities.

Unit – 3

(15) 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 – 4 **(15)**

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, Coulomb blockade.

Text/ Reference Books:

1. Nanoelectronics and Nanosystems: K.Goser, P. Glosekotter, J. Dienstuhl, Springer (2005).
2. Quantum Mechanics: Schiff L.I. , “”
3. Fundamentals of Statistical Mechanics and Thermal Physics: Reif

M.SC-I, SEME. II, PHYSICS (APPLIED ELECTRONICS)
HCT - 2.1: QUANTUM MECHANICS
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I : Introductory Quantum Mechanics (16)

Waves and quanta: Wave and particle nature of radiation, Wave equation, Interpretation and properties of wave function; Heisenberg uncertainty principle. Operators, postulates of quantum mechanics, some important theorems, Eigen functions of the position operator and Dirac delta function. (AKC, pp 1-32)

Unit II: Wave Mechanics of simple systems (16)

One dimensional Box, Normalization and orthogonality, Discussion of the factors influencing colour. One dimensional harmonic oscillator, Normalization and Characteristics of eigen functions of harmonic oscillator, Hydrogen - like atoms, Total wave function of hydrogen- like atom, Prob. Density of 1s atomic orbital, shape of atomic orbital, physical interpretation of hydrogenic orbital, space quantization, electronic spin, Vibration and vibrational spectra of diatomic molecules. [AKC,pp:33-91]

Unit III : Many electron atoms (12)

Wave function of many electron systems, Helium atom, Many electron atoms, Hartree and HartreeFock self consistent field methods. [AKC, pp: 120-130)

Unit IV: Molecular Orbitals (16)

The Born- Oppenheimer approximation, Molecular orbital theory, Hydrogen molecule ion, Hydrogen Molecule - Molecular Orbital -Valance Band methods. [AKC, pp: 151-180]

Text Books:

1. Introductory Quantum Chemisty (3rd Ed^{n}), A. K. Chandra (Tata McGraw Hill).
2. Quantum Chemistry (4th Edition) - Ira N. Levine (Prentice Hall) of India Pvt. Ltd. New Delhi. 1995.
3. A textbook of Quantum Mechanics - P M Mathews, K Venkatesan. (Tata McGraw Hill).

M.SC-I, SEME. II, PHYSICS (APPLIED ELECTRONICS)
HCT - 2.2:ELECTRODYNAMICS
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I: Multipole expansions and time varying fields (15)

Multipole expansions for a localized charge distribution in free space, linear quadrapole potential and field, static electric and magnetic fields in material media, boundary conditions, Time dependent fields, Faraday's law for stationary and moving media, Maxwell's displacement current, differential and integral forms of Maxwell's equations, Maxwell's equations for moving medium.

Unit II: Energy, force, momentum relations and electromagnetic wave equations (15)

Energy relations in quasi-stationary current systems, Magnetic interaction between two current loops, Energy stored in electric and magnetic fields, Poynting's theorem, General expression for electromagnetic energy, Electromagnetic wave equations, Electromagnetic plane waves in stationary medium, Reflection and refraction of electromagnetic waves at plane boundaries (Oblique incidence), Electromagnetic waves in conducting medium, Skin effect and skin depth.

Unit III: Inhomogeneous wave equations (15)

Inhomogeneous wave equations, Lorentz's and Coulomb's gauges, Gauge transformations, Wave equations in terms of electromagnetic potentials, D'Alembertian operator, Hertz potential and its use in computation of radiation fields.

Unit IV: Radiation emission (15)

Radiation from an oscillating electric dipole, radiation from a half wave antenna, radiation from a group of moving charges, radiation damping, Thomson cross-section.

Text Book:

1. Introduction to Electrodynamics, (3rd Edition) by David J. Griffith Publication: Prentice-Hall of India, New Delhi.

Reference Books:

2. Introduction to Electrodynamics, by A.Z.Capri and P.V.PanatNarosa Publishing House.
3. Classical electricity & Magnetism, by panofsky and Phillips, Addison Wesley.
4. Foundations of Electromagnetic theory, by Reitz & Milford, World student series Edition.
5. Classical Electrodynamics, by J.D.Jackson, 3rd Edition John Wiley.
6. Electromagnetic theory and Electrodynamics, by Satya Prakash, KedarNath and Co.Meerut.
7. Electromagnetics by B.B.Laud, Willey Eastern.
8. Electrodynamics by Kumar Gupta and Singh.

M.SC-I, SEME. II, PHYSICS (APPLIED ELECTRONICS)
SCT - 2.1: MICROPROCESSORS & MIICROCONTROLLERS
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I : Microprocessors Intel 8086 (15)

Pin configuration, Architecture, EU and BIU, Flag registers, Concept of Segmentation of Memory, Buffered system bus, minimum mode and maximum mode configurations, clock generator 8284, Interrupts of 8086.

Unit II : Instruction set & programming of 8086 (15)

Instruction format, Addressing modes, Physical & Effective memory address , Data transfer, Arithmetic, Logical instructions, Control & branch instructions, Assembly language programming of 8086.

Unit III : Microcontrollers (8051) (15)

Pin configuration, Architecture of 8051, Program status word, Internal registers of 8051, Memory organization, Programming model of 8051, SFRS, Input/ Output ports, Timers/ Counters, Interrupts and Serial communication.

Unit IV :Instruction Set & programming of 8051 (15)

Instruction set, Arithmetic instructions, Logical byte operations, program control instructions, Stack operations, Data pointer & lookup table instructions, Addressing modes, Assembly language programming, Introduction to IDE (Integrated development environment-Keil/ Pinnacle), Port programming, LED Interfacing, Wave generation using 8051.

Reference Books/Text Books:

1. Microprocessors and Digital Systems: Hall .D. V.
2. Microprocessors and Digital Systems 8086/8088: Hall. D V.
3. Microprocessor systems 8086/8088 architecture, programming and design: Luo& Gibson
4. Programming and customizing the 8051 microcontroller: Predko, TMH.
5. 8051 Microcontroller : Ayla
6. Microprocessor Interface Techniques: ZakaLasen (BPB).

M.SC-I, SEME. II, PHYSICS (APPLIED ELECTRONICS)
SCT - 2.2:STATISTICAL MECHANICS
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I: Foundations of statistical Mechanics and Classical Statistical Mechanics (15)

Thermodynamics, Laws of thermodynamics, Contact between statistics and thermodynamics, the classical ideal gas, entropy of mixing and Gibbs and paradox.

Classical statistical mechanics: Phase space, statistical ensembles, Liouville's theorem, Micro canonical ensemble-condition for equilibrium, canonical ensemble-partition function, energy fluctuations, Grand canonical ensemble-partition function, density and number fluctuations.

Unit II: Quantum Statistical Mechanics (15)

Phase space and quantum states, density matrix, Liouvilles theorem, ensembles, various statistics in quantum mechanics-Maxwell- Boltzmann, Fermi-Dirac and Bose-Einstein statistics, Ideal Bose gas, Fermi gas, Bose- Einstein condensation.

Unit III: Phase transitions and critical phenomena (15)

Phase transition, condition for phase equilibrium, first order phase transition, Clausius- Clayperon equation, second order phase transition, Critical indices, Properties of matter near the critical point. The law of corresponding states.

Unit IV: Fluctuations (15)

Thermodynamic fluctuations, spatial correlations in a fluid, Einstein - Smoluchowski theory of Brownian motion, Langevin theory of Brownian motion, The fluctuation-deposition theorem, The Fokker-Plank equation.

Reference Books:

1) Introduction to Statistical Mechanics by B.B.Laud
2) Statistical Mechanics by S.K.Sinha
3) Statistical Mechanics by I.D. Landau &F.M.Lifshitz

M.SC-I, SEME. II, PHYSICS (APPLIED ELECTRONICS)
OET 2.1 ELEMENTS OF ELECTRONICS
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

UNIT 1: Semiconductor Diodes and Applications (15)

Semiconductor Diodes :Introduction, Ideal Diode ,Semiconductor Materials ,Energy Levels ,Extrinsic Materials—n- and p-Type ,Semiconductor Diode ,Resistance Levels ,Diode Equivalent Circuits ,Diode Specification Sheets ,Transition and Diffusion Capacitance ,Reverse Recovery Time ,Semiconductor Diode Notation ,Zener Diodes ,Light-Emitting Diodes (LEDs) .

Diode Applications: Load-Line Analysis ,Diode Approximations ,Series Diode Configurations with DC Inputs ,Parallel and Series-Parallel Configurations , AND/OR Gates , Sinusoidal Inputs; Half-Wave Rectification , Full-Wave Rectification , Clippers , Clampers , Zener Diodes , Voltage-Multiplier Circuits.

UNIT 2: Bipolar Junction Transistors and DC Biasing (15)

Bipolar Junction Transistors: Introduction, Transistor Construction, Transistor Operation, Common-Base Configuration, Transistor Amplifying Action, Common-Emitter Configuration, Common-Collector Configuration.

DC Biasing—BJTS: Operating Point, Fixed-Bias Circuit , Emitter-Stabilized Bias Circuit , Voltage-Divider Bias , DC Bias with Voltage Feedback ,Miscellaneous Bias Configurations ,Design Operations , Transistor Switching Networks ,Troubleshooting Techniques ,*PNP* Transistors , Bias Stabilization

UNIT 3: Field-Effect Transistors an Biasing (15)

Field-Effect Transistors Introduction, Construction and Characteristics of JFETs, Transfer Characteristics, Specification Sheets (JFETs), Instrumentation, Important Relationships, Depletion-Type MOSFET, Enhancement-Type MOSFET, MOSFET Handling, VMOS, CMOS.

Biasing: Fixed-Bias Configuration, Self-Bias Configuration, Voltage-Divider Biasing, Depletion-Type MOSFETs, Enhancement-Type MOSFETs, Combination Networks, Design, Troubleshooting, *P*-Channel FET's, and Universal JFET Bias Curve.

UNIT 4: Operational Amplifier and Applications (15)

Introduction, Differential and Common-Mode Operation, Differential amplifier circuit, Op-Amp Basics, Practical Op-Amp Circuits, Op-Amp Specifications—DC Offset Parameters, Op-Amp Specifications—Frequency Parameters. Constant-Gain Multiplier, Voltage Summing, Voltage Buffer, Controller Sources, Instrumentation Circuits, Active Filters: low pass, high pass, band pass, all pass, notch filter.

Feedback and Oscillator Circuits: Feedback Concepts, Feedback Connection Types, Practical Feedback Circuits, Feedback Amplifier—Phase and Frequency Considerations, Oscillator Operation, Phase-Shift Oscillator, Wien Bridge Oscillator, Tuned Oscillator Circuit, Crystal Oscillator, Unijunction Oscillator.

References:

1. Electronics Devices and Circuits Theory by Robert L. Boylestad, Louis Nashelsky, Pearson
2. Electronic Devices and Circuit by J.B.Gupta, SK KATARIA & SONS
3. Electronic Devices and Circuits by by Anil K. Maini , Varsha Agrawal , Wiley

M.SC-I, SEME. II, PHYSICS (APPLIED ELECTRONICS)
OET 2.2 ELECTRONIC INSTRUMENTATION
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit 1: Transducers (Basic concepts and schematic of interface circuits) (15)

Transducers classification Resistance, Capacitance, Inductance, Piezoelectric, Thermoelectric, Hall effect, Tachogenerator, Measurements of displacement, Velocity, Acceleration, Force, Torque, Strain.

Unit 2: Instrumentation Electronics: (15)

Instrumentation Amplifiers, basic characteristics, D.C. Amplifiers, Isolation amplifiers, feedback transducers system, feedback fundamentals, Inverse transducers.

Unit 3: Signal processing circuits: (15)

Phase sensitive detection, Absolute value circuit, peak detector, sample and hold circuits, RMS converter, Logarithm (Amplifier, Frequency to Voltage and Voltage to Frequency Converter, V to I and I to V converter.

Unit 4: Measurements Instruments: (15)

Measurements of R,L, C bridge and potentiometer, Voltage, Current, Energy, Power, Frequency, Phase, Digital Voltmeter, Digital multimeters, Digital Frequency meter, Q meter, Proximity detector.

Reference Books:

1. Transducer Theory and Application: Jhon A Alloca, Allen Stuart

(Reston Publishing Company Inc.)

2. Transducer and Display Devices: B. S. Sonde.

3. Integrated Circuits: K. R. Botkar.

M.SC-II, SEME. III, PHYSICS (APPLIED ELECTRONICS)
HCT -3.1:SEMICONDUCTOR DEVICES
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I : MIS Structure and MOS FETs (15)

Schottky diode, MIS structures, basic equations in flat band conditions, MIS capacitances, current flow mechanisms in MS junction and MIS junction, depletion and enhancement type MOS FETS, capacitances in MOS FETs, quantitative analysis of I - V characteristics, thresholds in MOSFETS, charge trapping and flat band voltage, study of CMOS devices.

Unit II: Power Devices (15)

Power diodes, ratings, reverses recovery characteristics, fast recovery diodes, Power transistors,Switching characteristics, construction of SCR, two transistors analogy, I - V characteristics, gate trigger characteristics, turn on and turn - off times, losses, reverse recovery characteristics, SCR ratings, dv/dt and di/dt characteristics, thyrister types, construction and characteristics of DIACs and TRIACs, static induction thyristors, , light activatedthyristors, Gate turn off thyristors (GTO), MOS controlled thyristors, programmable Unijunction transistors, Silicon Unidirectional switch (SUS) , IGBT

Unit III: Charge Coupled and Transferred Electron (15)

Charge storage, surface potential under depletion, construction of basic two and three phase of CCD, mechanism of charge transfer, Oxide Charges, charge trapping and transfer efficiency, dark current, buried channel CCD, application of CCD, Transferred Electron Effect, NDR (Negative differential resistivity of voltage and current controlled devices), formation of gunn domains, uniform and accumulation layer, operation modes, transistors and quenched diodes, layers and modes of

operation, LSA mode of operation, frequency responses and overall device performance of Gunn devices.

Unit IV: Optoelectronic and Advanced Solid State Devices (15)

Light emitting diodes, Performance of LEDs, emission spectra, visible and IR LEDs, semiconductor LASER: p-n junction lasers, heterojunction lasers, materials for semiconductor LASER, threshold current density, effect of temp. Quantum well hetero structures,

Detectors:photoconductors, photocurrent gain and detectivity, photodiodetypes : p-n junction, p-i-n, avalanche characteristics, quantum efficiency, response speed, noise and optical absorption coefficient, efficiency, Solar cells – current voltage characteristics

Reference Book/Text Book:

1. D.A. Roustan: Bipolar Semiconductor Devices.
2. Mauro Zambuto: Semiconductor Devices.
3. D. Nagchoudhari: Semiconductor Devices.
4. Karl Hess: Advanced theory of semiconductors devices.
5. S. M. Sze: Physics of Semiconductor Devices 2nd edition..
6. A Dir - Bar - Lev: Semiconductor and Electronic Devices.
7. M. H. Rashid: Power Electronics.
8. P. C. Sen: Power electronics
9. B. G. Streetman and S. Banergee : Solid state Electronic Devices

M.SC-II, SEME. III, PHYSICS (APPLIED ELECTRONICS)
HCT - 3.2: ATOMIC, MOLECULAR AND NUCLEAR PHYSICS
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I: Atomic structure and Atomic Spectra (15)

Quantum states of an electron, Quantum numbers, spectroscopic terms and selection rules, Pauli's Exclusion principle, Electron spin, Vector atom model, Spin-orbit coupling (LS and JJ coupling), fine structure, Hund's rule etc. Features of one electron and two electron spectra, hyperfine structure, Lande splitting factor (g), Zeeman effect (Normal and Anomalous).

Unit II: Molecular Spectra (15)

Molecular energy states and associated spectra, Types of molecular spectra. Pure rotational; spectra, Diatomic molecule as a rigid rotator, Diatomic molecule as a non-rigid rotator, its Energy levels, Spectra, Rotation spectra of polyatomic molecules, Linear, Spherical top, Symmetric top, Asymmetric molecules, Vibrating diatomic molecule as a Harmonic and Anharmonic oscillator, Vibration-Rotation Spectra, molecule as vibrating rotator, Born-Oppenheimer approximation, Electronic states of diatomic molecules, Franck-Condon principle.

Unit III: Nuclear Forces and Nuclear Models (16)

Nuclear Forces:

Introduction, Nature of nuclear force, Deuteron (Properties, non-excited and excited states), elements of deuteron problem, Neutron-Proton (n-p) scattering at low energies, Theory of n-p scattering, proton-proton (p-p) scattering at low energies; its theory, Low energy n-n scattering, Charge Independence and charge symmetry of nuclear forces. Similarities between n-n and p-p forces, Non-central forces, its

properties, Ground state of deuteron, Magnetic moment, Electric Quadrupole moment, Saturation of Nuclear forces, High energy n-p and p-p scattering.

Nuclear Models:
Constitution of the nucleus; neutron-proton hypothesis, Nature of nuclear force, stable nuclides, Liquid drop model: Semi-empirical mass formula, applications of semi-empirical mass formula, Limitations of liquid drop model, Nuclear shell model: Shell model and it's evidence, Limitations of shell theory, Fermi gas model, Extreme Single Particle model, Individual Particle model, Superconductivity model.

Unit IV: Nuclear Reactions (14)
Types of Nuclear Reactions, Conservation laws, Nuclear reaction kinematics, Nuclear Transmutations, Charged particle reaction spectroscopy, Neutron spectroscopy, Nuclear reactions-Q values and kinematics of nuclear cross-sections, Analysis of cross section classical and partial analysis, its energy and angular dependence, Thick Target yield, Requirements for a reaction, Reaction mechanism, General features of cross-section, Inverse reaction, Compound Nucleus – introduction, its reactions and disintegration, Different stages of a Nuclear Reactions, Statistical Theory of Nuclear Reactions, Direct reactions, stripping reactions and shell model, Giant Resonance, Heavy ion reactions, Nuclear shock waves.

References:

1. Introduction to atomic spectra, H. E.White, Mc-Graw hill, International Edition.1962.
2. Molecular structure and spectroscopy 2nd Edi., G. Aruldhas, PHI learning Pvt. Ltd. NewDelhi.
3. Fundamentals of Molecular Spectroscopy, Colin Banwell, McGraw-Hill Publishing Company.
4. Introduction to Atomic and nuclear Physics, Harvey E. White, Van Nostrand Reinhold Company, 1964.
5. Nuclear Physics, D.C. Tayal, Himmalaya Publishing House, 5th Edi. 2008.
6. Introductory nuclear Physics, Kenneth S. Krane, John Wiley and Sons, 1988.
7. Nuclear Physics, Irving Kaplan, Addison-wesley publishing company, Inc,1962.
8. Concepts of Nuclear Physics, Bernard L Cohen, Tata McGraw-Hill publishing company limited, 1971.
9. Nuclear Physics, S. N. Ghoshal, S. Chand and company limited, 1994.

M.SC-II, SEME. III, PHYSICS (APPLIED ELECTRONICS)
SCT - 3.1: COMMUNICATION SYSTEMS
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit 1: A.M. Transmitters and (15)

Block diagram of High and Low level modulated A.M. Transmitters. The exciter, Class A, Class B, Class C modulated power amplifier circuits of sidebands and sideband transmission, Balanced modulators.

Block diagram of A.M. receiver and A.M. Detector, (circuits to be discussed), Class B audio amplifier.

Unit 2: F.M. Transmitters and Receivers (15)

F.M. radio frequency band, Block diagram of F.M. transmitter, block diagram of VCO, frequency doubler, tripler.

Block diagram of F.M. receiver, F.M. detector (Slope and dual slope detector), PLL as FM detector. (Circuits to be discussed)

Unit 3: Digital Modulation and Techniques (15)

Pulse: Modulation systems: Sampling theorem, low pass and band pass signals (PAM, PWM, PPM, Amplitude shift keying, Frequency shift keying, Phase shift keying, Differential phase shift keying. Quantization of signals,

Delta modulation (Basic introduction).Modulation and Demodulation Circuits, TDM, FDM, Cross talk in TDM , Pulse time modulation , Generation of PTM , Demodulation of PTM , Transponder, TDMA, PDMA, CDMA

Unit 4: Multiplexing & Multiple Access Techniques (15)

Unipolar, Bipolar, RZ, NRZ, Transmission modes, Simplex, Half duplex, full duplex, Asynchronous transmission.

Text Books:

1) Communication System, Analog and Digital R.P. Singh and S.D. Sapre (THM)

2) Electronic Telecommunication System (4th Edition) George Kennedy and Bernard Devise (MGH)

References

1. Digital and analog communication system – Sam Shanmugam, Wiley Student Edition, 2008 reprint.
2. Data communication – William Schweber, McGraw-Hill, 1988
3. Digital communication – Simon Haykin, Wiley, 1988.
4. Digital communication fundamentals and applications - Sklar, 2nd edition, Prentice Hall, 2001.
5. Electronics communication systems – Fundamentals to advanced: wayneTomasi, Pearson Education, 5th edition, 2009.
6. Wireless communications and networking – Vijay K Garg, Elseiver, 2007.

M.SC-II, SEME. IV, PHYSICS (APPLIED ELECTRONICS)
SCT - 3.2: Biomedical Instrumentation
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

UNIT 1 **(15)**

MEDICAL INSTRUMENTATION BASICS: Generalized Systems, Constraints. Classification of Biomedical Instruments, Bio-statistics, Regulation of Medical Devices. Overview of Fiber Optic Sensors, Radiation Sensors, Smart Sensors, Electro Chemical Sensors.

BIOELECTRIC SIGNALS AND ELECTRODES: Electrode-Electrolyte Interface, Polarizable and Nonpolarizable Electrodes, Electrode Model, Recording Electrodes, Internal Electrodes, Micro Electrodes.

UNIT 2 **(15)**

MEASUREMENT SYSTEMS: Patient Monitoring Systems, Measurement of Blood Pressure, Heart Rate, Pulse Rate, Temperature, Heart Sounds, Blood Flow and Volume, Respiratory Systems, Measurements, Cardiac Output Measurement, Blood pH, pO2 Measurement, Oximeters, Audiometers, Spectrophotometers.

UNIT 3 **(15)**

MEDICAL IMAGING SYSTEMS: Information content of an Image, Radiography, Computed Radiography, Computed Tomography, Magnetic

Resonance Imaging, Nuclear Medicine, Single Photon Emission Computed Tomography, Positron Emission Tomography, Ultrasonagraphy.

UNIT 4 **(15)**

THERAPEUTIC AND PROSTHETIC DEVICES: Cardiac Pacemakers, Defibrillators, Hemodialysis, Lithotripsy, Ventilators, Incubators, Drug Delivery devices, Artificial Heart Valves, Heart Lung Machine, Applications of Laser. **ELECTRICAL SAFETY**: Physiological Effects of Electricity, Important susceptibility parameters, Distribution of Electric Power. Macroshock Hazards, Microshock Hazards, Electrical safety codes and Standards, Basic Approaches to Protection against shock, Equipment Design, Electrical Safety Analyzers, Testing.

References:

1. Medical Instrumentation application and Design - John G.Webster, Editor, John Wiley & Sons, Inc Noida. 3rd Edition, 2008
2. Handbook of Biomedical Instrumentation - R.S.Khandpur, Tata McGraw Hill, New Delhi, 2nd Edition, 2008
3. Introduction to Biomedical Equipment Technology- Joseph J. Carr and John M. Brown, Pearson Education, 4th Edition, 2008

M.Sc-II, SEME. IV, PHYSICS (APPLIED ELECTRONICS)

OET - 3.1: ENERGY HARVESTING DEVICES
Choice Based Credit System (CBCS)

(w. e. f. June 2016-2017)

Unit -1: Solar Cells **(15)**

Photovoltaic effect, Solar cell characterization, Types of Solar cells, Solid state solar cells Silicon solar cell, CdTe based solar cells, CdS/Cu_2S solar cells, $CuInSe_2$ based solar cells, Metal-semiconductor solar cells, photoelectrochemical and photo electrolysis cells, Solar cells based on thin film heterojunctions, Ultra thin absorber solar cells, Nanostructured solar cells, Dye sensitised solar cells: basic concepts, working and materials. Organic Solar cells: basic concepts, working and materials.

Unit -2: Super Capacitors **(15)**

Comparison of battery and super capacitors, Super capacitor characterization, Types of super capacitors, double layer and pseudo capacitance, hybrid super capacitors, Recent status of carbon, RuO_2 and polyaniline based super capacitors, different methods for preparation of cathodic and anodic electrode materials, Fabrication of super capacitors with examples, Applications of supercapacitors

Unit -3: Fuel Cells **(15)**

Comparison between fuel cells and batteries, fuel cell characterizations, Types of fuel cells: Metal oxide, proton exchange membrane, Phosphoric acid, Solid oxide fuel cells, working of fuel cells, Materials for fuel cells, applications of fuel cells

Unit -4: Piezoelectrics **(15)**

Piezoelectric Energy Harvesting: Energy harvesting basis, case study
Piezoelectric Materials: Piezoelectric polycrystalline ceramics,Piezoelectric Single Crystal Materials, Piezoelectric and Electrostrictive Polymers, Piezoelectric Thin Films.
Piezoelectric transducers, Mechanical energy harvester using Laser Micromachining, Mechanical energy harvester using PlezoelectricFibers, Piezoelectric Microcantilevers, Energy harvesting circuits, Multimadal energy harvesting, Mangetoelectric composites,
Introduction to Piezoelectric bulk Power generators, Piezoelectric Micro Power Generators, Conversion efficiency, Power storage circuits

Reference Books

1. Semiconductor Sensors, S M Sze, A Wiley- Interscience Publication, John Wiley and Sons, NY1994
2. Electrochemical Supercapacitors, B E Conway, Kluwer Academic/ Plenum publishers, NY 1999.
3. C. N. R. Rao and Claudy Rayan Serrao, J. Mater. Chem., 2007, 17, 4931–4938
4. Solar Cells by Martin Green.
5. Photoelectrochemical Solar Cells by S. Chandra, Gordon &Breach Science Publisher, UK
6. Energy Harvesting Technologies, ShashankPriya, Daniel J. Inman Springer

M.SC-II, SEME. III, PHYSICS (APPLIED ELECTRONICS)
OET 3.2 INTRODUCTION TO MATLAB AND LAB VIEW
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit 1: Introduction to MATLAB, Vector and Matrices **(15)**

Introduction to MATLAB:

MATLAB environment, help feature, types of files, Data types, constants, variables, operators, assignments statement.

Unit 2 :Vector and Matrices: **(15)**

Vectors and Scalars, defining data use matrix, matrix subscripts, multi – dimensional matrices and arrays, matrix manipulation, matrix and array operation. Function with array inputs, structure arrays, cell arrays.

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Unit3: **Introduction to VI.** **[(15)**

Introduction to VI:

Graphical System Design (GSD) model. Embedded system design flow, Virtual Instrumentation. Lab View: Introduction, Software environment, front panel, block diagram, palettes (tools & control, function), loops, structures, arrays, clusters, plotting data.

Unit 4: Modular Programming: **(15)**

Modular programming in Lab VIEW, creating an icon, displaying sub Vis and express Vis as icons or expandable nodes, creating sub Vis (operating, editing and placing sub VIs) creating

stand alone applications. String and File I / O: Creating and configuring string controls and indicators, basics of file input / output.

TEXT / REFERENCE BOOKS:

1. Virtual Instrumentation using LabVIEW, Jovitha Jerome, PHI, ISBN 978 – 81- 203-40305, 2010.
2. Gary Johnson (1979) – Labview Graphical Programming, Second edition, McGraw Hill.

3. MATLAB and its applications in Engineering by Raj Kumar Bansal, Ashok kumar Goel, Manoj kumar Sharma – Pearson Education

M.SC-II, SEME. IV, PHYSICS (APPLIED ELECTRONICS)
HCT - 4.1: MICROELECTRONICS
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I: Single crystalline Silicon and crystal structure (15)

(111) and (100) planes, Characteristics of substrates: physical (dimensional), electrical, dielectric, mechanical, Wafer cleaning process and wet chemical etching techniques, Environment for VLSI technology: clean room and safety requirements.

Epitaxial Process: Epitaxial Growth: VPE, LPE and MBE techniques, Mechanism, Chemistry and growth kinetics, evaluation of grown layer.

Unit II: Oxidationand Impurity Incorporation (15)

Oxide growth: dry, wet, rapid thermal oxidation; Deal Grove model of thermal oxidation, plasma oxidation,orientation dependence of oxidation rate, electronic properties of oxide layer, masking characteristics, oxide characteristics.

Impurity Incorporation:Interstitial and substitutional diffusions, diffusivity, laws governing diffusion, constant source and instantaneous source diffusion, Solid Source, liquid source and gas source Boron and Phosphorus diffusion systems, Ion implantation, annealing; Characterization of impurity profiles, buried layers

Unit III: Lithographic and Deposition Techniques (15)

Lithography: Types, Optical lithography –contact, proximity and projection printing, masks, resists: positive and negative, photo - resist pattering, characteristics of a good photo - resist, Mask generation using co-ordinaton graph and electron beam lithography.

Deposition Techniques for polysilicon and metals

Chemical Vapour deposition techniques: CVD technique for deposition of polysilicon, silicon dioxide and silicon nitride films; Metallisation techniques: Resistive evaporation and sputtering techniques. (D.C. and magnetron), Failure mechanisms in metal interconnects; multilevel metallisation schemes.

Unit IV: Device fabrication, Assembling and Packaging (15)

Masking Sequence and Process flow for pnp and npn devices , p-MOS and n-MOS, Die separation, bonding and attachments, encapsulation, package sealing, flat package, PGA (Printed Grid Array), BGA (Ball Grid Array)

Reference Books:

1. S.M.Sze (Ed), "VLSI Technology", 2nd Edition, McGraw Hill, 1988.
2. Streetman," VLSI Technology". Prentice Hall, 1990
3. C.Y. Chang and S.M. Sze (Ed), "VLSI Technology", McGraw Hill Companies Inc., 1996.
4. S.K.Gandhi, "VLSI fabrication Principles", John Wiley Inc., New York, 1983.
5. Sorab K. Gandhi, "The Theory and Practice of Microelectronics", John Wiley & Sons
6. A.S Grove, "Physics and Technology of semiconductor devices", John Wiley & Sons,
7. Integrated Ckts: Design principles and Fabrication: Warner.

Topics for Tutorials/Seminars: The problem/ exercise / short questions answers/ block diagrams given in the reference books will from the Tutorial Course.

M.SC-II, SEME. IV, PHYSICS (APPLIED ELECTRONICS)
HCT - 4.2 : Microwave Devices & Circuits
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I: F.M. Fields and Waves (10)

Microwave spectrum**,** Microwave applications, Electronic and Magnetic fields, Fields in conductors and Insulators, Maxwell's equations and boundary conditions, wave propagation in perfect Insulators, Wave polarization.

UnitII: Microwave Tubes (15)

Sources: Basic principles of two cavity Klystrons (Velocity modulation), Reflex Klystrons, TWT, Gunn effect, principle of operation.

Unit III: Microwave Transmission Lines (15)

Basic concepts of the open two-wire line, the coaxial line, strip type transmission lines, Rectangular and circular wave-guides, Theory of rectangular wave-guide transmission.

Unit IV: Coaxial and Stripline and Waveguide Components (20)

Coaxial and Stripline components: Terminations, matched loads, short and open circuits, standard mismatches, connectors and transitions, Dielectric bead supports, standard coaxial connectors, TEM to TEM transitions, Attenuators and phase shifters, coaxial and strip linge attenuators, coaxial and strip line shifters.

Waveguide components: Terminations, Matched loads, Standard mismatches, adjustable short circuits, Attenuators and phase shifters, Waveguide attenuators, waveguide phase shifters.

Reference Books:

1. Microwave Engineering: Peter Rizzi(PHI)
2. Microwave Devices and Circuits : S Y Liao (PHI)
3. Foundation for Microwave Engineering: R E Collin (MGH).
4. Microwave Integrated Circuits: K C Gupta and Amarjit Singh.

Topic for tutorials:
The problems /exercise/short questions answers/ circuit diagrams given in the Text and Reference Books will for Tutorial Course.

M.SC-II, SEME. IV, PHYSICS (APPLIED ELECTRONICS)
HCT - 4.3: MICROPROCESSORS AND INTERFACING
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I: Basic Concept of Interfacing (15)

Input/output data transfer techniques: Input ports, Output ports, I/O Interfacing- I/O mapped I/O and memory mapped I/O.

Basic concept of memory interfacing with 8085: Address map, Address decoding, Examples of ROM (27XX) and RAM (62XX) interfacing with 8085 microprocessor.

Unit II: Interrupts and Programmable Interrupt Controller Interface (6) Introduction, Polling and Interrupts, Classification of Interrupts, Interrupts in 8085, Hardware interrupts in 8085, Masking / Unmasking of Interrupts, Interrupts Acknowledgement , 8259A Interrupt Controllers, Features of 8259, Block diagram of 8259A, Programming the 8259 A , 8259A Interfacing with 8085.

Unit III: Programmable I/O Devices (15)

Programmable Peripherals Interface 8255

Introduction, Features of 8255 A, Signal of 8255, Block Diagram, Data Bus Buffer, Control Logic, Group A and Group B Controls, Operating Modes, Control Word Formats, 8255A Interfacing with 8085.

Programmable Interval Timer 8253

Necessity and Introduction, Features, Block Diagram, Operation Description, Mode Definition, Interfacing of 8253 with 8085.

Keyboard and Display Interface 8279

Introduction, Keyboard Interfacing, Display Interfacing, IC 8279, Features, Signals,Block Diagram, Operating Modes, 8279 Commands. Interfacing with 8085.

Unit IV: A/D and D/A Converters and Interfacing (15)

Introduction, Digital to Analog Converter, DAC Characteristics, Basic Conversion Techniques, Binary Weighted Resistor D/A Converter, R/2R, Ladder D/A Converter, IC 1408 DAC, Interfacing DAC with 8085.

Analog to Digital Converter, ADC Characteristics, Basic Conversion Techniques, Successive Approximation ADC, Flash ADC, IC 0809 ADC, Interfacing with 8085.

Reference Book:

1) 8085A /8080 Microprocessors: Architecture, Programming and Applications, - Ramesh Gaonkar
2) Microprocessor Interfacing Techniques - ZakaLasen - BPB Publisher.
3) 8 bit & 16 bit Microprocessors - B. Ram, S. Chand Publisher.
4) 8085 / 8080 A Microprocessor: Architecture, Programming & Interfacing by Raffic Zeeman.
5) 8085/8086 Architecture, Programming & Interfacing by Mazidi.

M.SC-II, SEME. III, PHYSICS (APPLIED ELECTRONICS)
SCT - 4.1: INSTRUMENTATION
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit I: Transducers

(15) Transducers classification Resistance, Capacitance, Inductance, Piezoelectric, Thermoelectric, Hall effect, Tachogenerator, Optical and Digital transducers, Measurements of displacement, Velocity, Acceleration, position, Force, pressure, flow, level, Torque, Strain, Speed and Sound, flow humidity, PH, position, Piezoelectric devices, micromechanical devices and smart sensors.

Unit II: Instrumentation Electronics (15)

Instrumentation Amplifiers, basic characteristics, D.C. Amplifiers, Isolation amplifiers, feedback transducers system, feedback fundamentals, Inverse transducers, temperature balance system,

Phase sensitive detection, Absolute value circuit, peak detector, sample and hold circuits, RMS converter, Logarithm (Amplifier, Frequency to Voltage and Voltage to Frequency Converter,

Unit III: Measuring Instruments (15)

True RMS measurement and DMM, R, L, C, Q measurement technique, active passive component testing, Automatic Test Equipment. Function generator, Sine,

square, triangular, ramp wave generator, pulse generator, sine wave synthesis, arbitrary waveform generator. Oscilloscope: Dual Trace Oscilloscope, sweep modes, active, passive probes, delay line, Digital Storage Oscilloscope and its features like roll, refresh, sampling rate, application of the same in instrumentation and measurement, sampling oscilloscope. Wave analyzer, Distortion analyzer, spectrum analyzers.

Unit IV: Signal Processing Circuits (15)

ADC and DAC techniques, types, and their specifications, V to F converter, Sample and hold, analog multiplexer, data loggers. Digital Instrumentation: Universal counter and its mode – totalizing frequency, period, time. interval, ratio, measurement errors, application of counters for, frequency meter, capacitance, meter and timers, automation digital instruments. Virtual Instrumentation and its applications,

Reference Books:

1. Transducer Theory and Application: John A Alloca, Allen Stuart (Reston Publishing Company Inc.)
2. Transducer and Display Devices: B. S. Sonde.
3. Integrated Electronics: K. R. Botkar.
4. W. D. Cooper & A. D. Helfrick, 'Electronic Instrumentation And Measurement Techniques', PH I, 4th e/d, 1987
5. Kalsi H. S., 'Electronic Instrumentation', TMH, 2nd e/d, 2004

M.SC-II, SEME. IV, PHYSICS (APPLIED ELECTRONICS)
SCT - 4.2:Fiber Optic Communication
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Unit – 1 (15)

Introductionand Transmission characteristics of optical fibers: The general optical communication system, Advantages and disadvantages, Ray theory of transmission, Mode theory, Types of optical Fibers

Transmission characteristics of optical fibers: Attenuation, Material absorption, losses in fibers, Linear and Nonlinear scattering losses, fiber bend loss, Mid-infrared and Far-Infrared transmission. Dispersion: Intermodal and Intramodal dispersion, Dispersion modified Single mode fibers.

Unit – 2 (15)

Optical fibers and cables, Joints and Couplers: Preparation of optical fibers, Liquid phase and vapour phase deposition techniques, Fluoride glass fibers. Cables: Fiber strength, durability and stability of fiber transmission characteristics, cable design

Optical Fiber Joints and Couplers: Fibers alignment and joint loss. Fiber splices, connectors, Fiber couplers.

Unit – 3 (15)

Optical sources and Optical detectors: Optical sources: LASERS basic concept, optical emission from semiconductors. Semiconductor Injection Laser, Injection laser structures and characteristics, Laser fiber coupling, Non-semiconductor Lasers, Laser Modulation.LED) LED power and efficiency, LED structures, characteristic and Modulation techniques.

Optical detectors: Introduction, device, types, optical detection principals, absorption, quantum efficiency Responsivity, Long wavelength Cutoff. Semiconductor photo diodes with and without internal gain. Mid-infrared and photoconductive detectors, PN, PIN, Avalanche Photo diodes, Phototransistors.

Unit – 4

Optical fiber Measurements, Receiver performance considerations and Applications (15)

Optical fiber Measurements: Attenuation, Dispersion, Refractive index profile, cut-off wavelength, Numerical aperture, fiber diameter and field measurements. Receiver performance considerations: Noise, Receiver noise, Receiver structures, FET preamplifiers, High performance amplifiers. Applications: Public Network, Military, Civil, Consumer, Industrial and Computer applications.

Reference:

1. Optical fiber communications – principles and practice. John. M. Senior
2. Optical communications By David Gover
3. Optical communications By KEISER

M.SC-, PHYSICS (APPLIED ELECTRONICS)
Choice Based Credit System (CBCS)
(w. e. f. June 2016-2017)

Practical List

HCP 1.1/1.2/1.3

1. Study of Filters.
2. Voltage Regulator.
3. Transistor Biasing.
4. C. E. Amplifier Design.
5. Op.Amp. Inverting and Non- inverting amplifiers
6. D.T. L. Gates.
7. C.E. with CC Amplifier.
8. AstableMultivibrator (IC 555)
9. Determination of Bandgap of Ge diode.
10. Temperature Transducer (Thermister).
11. Wein Bridge oscillator.
12. Negative Feedback Amplifiers.
13. DC Amplifiers.
14. FET Characteristics and Designing of Amplifier.

15. Op. Amp (Adder, Substractor, Integrator and Differentiator).
16. Crystal Structure (FCC- Type)
17. Verification of Demorgan's Theorem.
18. Op. Amp. Phase Shift Oscillator.
19. Temp. Variation of break down voltage of Zener Diode.
20. AstableMultivibrator (using 741 Op amps)
21. Op amp Phase Lead Circuit.
22. Op amp Phase Lag Circuit
23. Microprocessors (μp) - I (Logsun 8085 Kit)
24. Divide by 2, divide by 5 and divide by 10 counters using IC – 7490.

SCP 1.1/1.2

1. Characteristics of UJT .
2. Op. Amp. Parameters.
3. P - N Junction Capacitance.
4. LVDT.
5. Op. Amp. I to V and V to I converters.
6. Multiplication & Division using Microprocessor 8085.
7. Addition, Substractor, Multiplication using 89C51 microcontroller.
8. Logical operation using 89C51 microcontroller.
9. Microcontroller – III
10. Microcontroller – IV

HCP 2.1/2.2

1. Twin T Networks.
2. Butter worth low pass filter using IC- 741
3. Variable Duty cycle MV using Op. amp.(IC- 741)
4. Constant current source (Floating load).Using Opamp.
5. Constant current source (Grounded load). Using Opamp
6. Wein bridge oscillator
7. Op-Amp Op. Amp. Parameter (Slew rate, power band width, CMMR) .
8. Voltage regulator using IC 723.
9. Constant Voltage Source with Fold back Current Limit.
10. Constant Voltage Source (Precision Voltage Regulator) with
11. Constant Current Limit.
12. Study of Wein Bridge oscillator.

SCP 2.1/2.2

1. Microprocessor - VI (Ascending & Descending).
2. Microprocessor - VII (Decimal Addition & Odd & Even Parity).
3. Microcontroller - I Addition and subtraction of 8 bit and 16 bit numbers with and without carry.

4. Microcontroller – II Study of LED interfacing to 8051 microcontroller.
5. Microcontroller – III Study of ADC Interfacing to 8051 microcontroller.
6. Microcontroller – IV Study of DAC Interfacing to 8051 microcontroller.
7. Microcontroller – V -Determination of minimum & maximumnumbers.
8. Microcontroller – VI- LCD interfacing with µc -8051.
9. Microcontroller – VII-Seven segment interfacing with µc -8051.

OEP 2.1/2.2

1) Transister Parameters.
2) Op-Amp inverting and non-inverting amplifiers.
3) Monostablemultivibratorvsing IC555.
4) FET charaterishes.
5) Op-Amp Adder.
6) Op-Amp subtractor.
7) First order High pass filter.
8) First order Low pass filter.
9) Determination of optical gap.
10) Determination of optical absorption by materials & hence determination of type of transition.
11) Study of p.n. junction photo voltaic.
12) Characterization of a PV cell in dark & in light & hence determination of junction ideality factor.

HCT 3.1/3.2

1. Digital Multiplexer Demultiplexer.
2. Assembly Language Programming on 8086 µp –I & II
3. Microcontroller – I Port Programming -I
4. Microcontroller – II Port Programming -II
5. Study of Speed, Thermocouple &Thermister.
6. RF Tuned Amplifier.
7. Up / Down Counter
8. Shift Register.
9. Study characteristic of the reflex klystron tube.
10. VSWR measurement.
11. Microcontroller –III-DC motor interface with µc-8051.
12. Microcontroller – IV-Servo motor interface with µc-8051.
13. Microcontroller – V-Study the serial communication of µc-8051..
14. Microcontroller – VI- Stepper motor interface with µc-8051.
15. Microcontroller – VII- Relay interface with µc-8051.
16. Microcontroller – VII- ADC interface with µc-8051.

17. Op-Amp application (Design of differentiator and integrator for sine wave at 1 KHz)
18. Study of Attenuator (Fixed and Variable type).
19. Study of Magic Tee.
20. Study of Directional coupler characteristics.

SCT 3.1/3.2

1. Active Filter (High Pass)
2. Astable and MonostableMultivibrator using IC-741.
3. Study of digital to analog conversion (DAC) using Op.Amp (IC-741).
4. Study of Amplitude modulation and demodulation.
5. Study of Frequency modulation and demodulation.
6. Wave - form generator (Square and Triangular).
7. Inverting & Non-inverting Adder for two inputs.
8. Op-Amp integrator & Differentiator.
9. Op-Amp instrumentation amplifier with IC 324.
10. VCO as a triangular wave generator.

OEP 3.1/3.2

1. Voltage Source.
2. Amplitude shift keying (ASK) modulation & demodulation.
3. Frequency shift keying (FSK) modulation & demodulation.
4. Phase Shift Keying (PSK) Modulation and Demodulation.
5. De-Morgan's theorem
6. DTL gates

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