LINGAYA'S VIDYAPEETH
choose to know
(u/s 3 of UGC Act 1956)

School of Basic Science & Humanities

SCHEME OF STUDIES AND SYLLABUS

MASTER OF SCIENCE-PHYSICS
(2020-21 Batch Onwards)

Lingaya's Vidyapeeth, Faridabad

Deemed to be university (u/s of UGC act 1956)

(Approved By UGS, MHRD, AICTE, BCI, PCI & ACI)

SYLLABUS SCHEME

MASTER OF SCIENCE- PHYSICS

S.No.	Subject Code	Subject	L	T	P	Credit	Type of Course: CC, AECC, SEC, DSE, GE	Course focus on Employability/ Entrepreneurship/ Skill Development
2020-Semester-I								
1.	MPH-110	Mathematical Physics	3	1	0	4	Core-I	Skill Development
2.	MPH-111	Classical Mechanics	3	1	0	4	Core-II	Skill Development
3.	MPH-112	Quantum Mechanics-I	3	1	0	4	Core-III	Skill Development
4.	MPH-113	Electro-Optic Effects in Materials (EOEM)	5	1	0	6	Core-IV	Skill Development
5.	MPH-114	Electronics	2	0	0	2	Core-V	Skill Development
6.	MPH-161	General Physics Laboratory	0	0	4	2	Core-I Lab	Skill Development
7.	MCS-163	Electro-Optic Effects in Materials (EOEM) Lab	0	0	4	2	Core-II Lab	Skill Development
8.	MPH-164	Electronics Lab	0	0	4	2	Core-III Lab	Skill Development

S.No.	Subject Code	Subject	L	T	P	Credit	Type of Course: CC, AECC, SEC, DSE, GE	Course focus on Employability/ Entrepreneurship/ Skill Development
2021-Semester-II								
1.	MPH-115	Quantum Mechanics-II	3	1	0	4	Core-I	Skill Development
2.	MPH-116	Theory of Radiation & Statistical Mechanics	3	1	0	4	Core-II	Skill Development
3.	MPH-117	Numerical Methods and Computational Physics	3	1	0	4	Core-III	Skill Development
4.	MPH-118	Electromagnetic theory and Electromagnetism	5	1	0	6	Core-IV	Skill Development
5.	MPH-119	Atomic and Molecular Physics	2	0	0	2	Core-V	Skill Development
6.	MPH-165	Advanced Physics Laboratory	0	0	4	2	Core-I Lab	Skill Development
7.	MPH-167	Numerical Methods and Computational Physics Lab	0	0	4	2	Core-II Lab	Skill Development

S.No.	Subject Code	Subject	L	T	P	Credit	Type of Course: CC, AECC, SEC, DSE, GE	Course focus on Employability/ Entrepreneurship/ Skill Development
2021-Semester-III								
1.	MPH-210	Solid State Physics	3	1	0	4	Core-I	Skill Development
2.	MPH-211	Nuclear and Particle Physics	3	1	0	4	Core-II	Skill Development
3.	MPH-212	Fiber Optics & Laser	3	1	0	4	Core-III	Skill Development
4.	MPH-213	Electronics - I	3	1	0	4	Core-IV	Skill Development
5.	MPH-214	Electronics - II	3	1	0	4	Core-V	Skill Development
6.	MPH-263	Electronics – I Lab	0	0	4	2	Core-I Lab	Skill Development
7.	MPH-264	General Physics Laboratory-II	0	0	4	2	Core-II Lab	Skill Development

S.No.	Subject Code	Subject	L	T	P	Credit	Type of Course: CC, AECC, SEC, DSE, GE	Course focus on Employability/ Entrepreneurship/ Skill Development
2022-Semester-IV								
1.	MPH-221	Measurement Techniques	3	1	0	4	Core-I	Skill Development
2.	MPH-222	Nano Science and Technology Departmental Elective paper-II	3	1	0	4	Core-II	Skill Development
3.	MPH-223	Electronic Communication System (Specialization Elective paper-III)	3	1	0	4	Core-III	Skill Development
4.	MPH-224	Electronic Devices (Specialization Elective paper-IV)	3	1	0	4	Core-IV	Skill Development
5.	MPH-271	Measurement Techniques Lab	0	0	4	2	Core-I Lab	Skill Development
6.	MPH-273	Electronic Communication System Lab	0	0	4	2	Core-II Lab	Skill Development
7.	MPH-274	Project/ Dissertation	0	0	24	12	Core-III Lab	Skill Development

SEMESTER-I

LINGAYA'S VIDYAPEETH
NACHUALI, JASANA ROAD, FARIDABAD
MASTER OF SCIENCE

SEMESTER-I

MPH-110: MATHEMATICAL PHYSICS

L-3, T-1, P-0 **Credits–4** **Max Marks: 100**

Objective- The emphasis of course is on applications in solving problems of interest to physicists. The students are to be examined entirely based on problems, seen and unseen.

Course Outcome:

CO1: Use complex analysis in solving physical problems.

CO2: Solve ordinary and partial differential equations of second order that are common in the physical sciences.

CO3: Use the orthogonal polynomials and other special functions.

CO4: Use Fourier series and integral transformation.

UNIT 1.COMPLEX VARIABLES: 10 LECTURES
Introduction, Cauchy-Riemann conditions, Cauchy's Integral formula, Laurent expansion, singularities, calculus of residues, evaluation of definite integrals, Dispersion relation.

UNIT 2.DELTA AND GAMMA FUNCTIONS: 10 LECTURES
Dirac delta function, Delta sequences for one dimensional function, properties of delta function, Gamma function, factorial notation and applications, Beta function.

UNIT 3.DIFFERENTIAL EQUATIONS: 11 LECTURES
Partial differential equations of theoretical physics, boundary value, problems, Neumann & Dirichlet Boundary conditions, separation of variables, singular points, series solutions, second solution.

UNIT 4: SPECIAL FUNCTIONS: 12 LECTURES
Bessel functions of first and second kind, Generating function, integral representation and recurrence relations for Bessel's functions of first kind, orthogonality. Legendre functions : generating function, recurrence relations and special properties, orthogonality, various definitions of Legendre polynominals. Associated Legendre functions: recurrence relations, parity and orthogonality, Hermite functions, Laguerre functions.

UNIT 5: ELEMENTARY STATISTICS: 10 LECTURES
Introduction to probability theory, random variables, Binomial, Poisson and Normal distribution.

REFERENCE BOOKS:

- Mathematical Methods for Physicists: G. Arfken and H.J. Weber (Academic Press, San Diego) 7th edition, 2012.
- Mathematical Physics: P.K. Chattopadhyay (Wiley Eastern, New Delhi), 2004.
- Mathematical Physics: A.K. Ghatak, I.C. Goyal and S.J. Chua (MacMillan, India, Delhi),1986.

- Mathematical Methods in the Physical Sciences – M.L. Boas (Wiley, New York) 3rd edition, 2007.
- Special Functions: E.D. Rainville (MacMillan, New York), 1960.
- Mathematical Methods for Physics and Engineering:K.F.Riley, M.P.Hobson and S.J. Bence (CambridgeUniversity Press, Cambridge) 3rd ed., 2006.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	1	3	2	3	1
CO2	2	3	1	-	1	2	1	-
CO3	3	3	-	2	1	2	-	-
CO4	2	3	-	-	2	1	-	-

MPH-111 CLASSICAL MECHANICS

L-3, T-1, P-0 **Credits–4** **Max Marks: 100**

Objective: The aim of course will increase the understanding of the following fundamental concepts in the dynamics of system of particles, motion of rigid body, Lagrangian and Hamiltonian formulation of mechanics.

Course outcomes:

CO1: Define and understand basic mechanical concepts related to discrete and continuous mechanical systems.

CO2: Describe and understand the vibrations of discrete and continuous mechanical systems.

CO3: Describe and understand planar and spatial motion of a rigid body.

CO4: Describe and understand the motion of a mechanical system using Lagrange-Hamilton formalism.

UNIT 1. LAGRANGIAN FORMULATION: 12 LECTURES

Mechanics of a system of particles; constraints of motion, generalized coordinates, D'Alembert's Principle and Lagrange's velocity - dependent forces and the dissipation function, Applications of Lagrangian formulation.

UNIT 2.HAMILTON'S PRINCIPLES: 10 LECTURES

Calculus of variations, Hamilton's principle, Lagrange's equation from Hamilton's principle, extension to nonholonomic systems, advantages of variational principal formulation, symmetry properties of space and time andconservation theorems.

UNIT 3.HAMILTON'S EQUATIONS: 09 LECTURES

Legendre Transformation, Hamilton's equations of motion, Cyclic-ordinates, Hamilton's equations from variational principle, Principle of least action.

UNIT 4. CANONICAL TRANSFORMATION AND HAMILTON-JACOBI THEORY: 10 LECTURES

Canonical transformation and its examples, Poisson's brackets, Equations of motion, Angular momentum, Poisson's Bracket relations, infinitesimal canonical transformation, Conservation Theorems. Hamilton Jacobi equations for principal and characteristic functions, Action-angle variables for systems with one-degree of freedom.

UNIT 5.RIGID BODY MOTIONAND SMALL OSCILLATIONS: 11 LECTURES

Independent co-ordinates of rigid body, orthogonal transformations, Eulerian Angles and Euler's theorem, infinitesimal rotation, Rate of change of a vector, Coriolis force, angular momentum and kinetic energy of a rigid body, the inertia tensor, principal axis transformation, Euler equations of motion, Torque free motion of rigid body, motion of a symmetrical top. Eigenvalue equation, Free vibrations, Normal Coordinates, Vibrations of a triatomic molecule.

REFERENCE BOOKS:

- Classical Mechanics: H. Goldstein, C.Poole and J.Safko (Pearson Education Asia, New Delhi), 3rd ed 2002.
- Classical Mechanics of Particles and Rigid Bodies: K.C. Gupta (Wiley Eastern, New Delhi), 1988. Q

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	-	-	2	2	1	1
CO2	1	3	1	1	1	2	1	3
CO3	1	3	-	-	1	2	-	1
CO4	2	3	1	1	2	1	-	-

MPH-112 QUANTUM MECHANICS – I

L-3, T-1, P-0 Credits–4 Max Marks: 100

Objective: Connect the historical development of quantum mechanics with previous knowledge and learn the basic properties of quantum world.

Course outcomes:

CO1: Pinpoint the historical aspects of development of quantum mechanics

CO2: Understand and explain the differences between classical and quantum mechanics

CO3: Understand the idea of wave function, uncertainty relations, Schrodinger equation for simple potentials

CO4: Identify and relate the eigenvalue problems for energy, momentum, angular momentum and central potentials explain the idea of spin.

UNIT 1 : MATHEMATICAL TOOLS OF QUANTUM MECHANICS: 10 LECTURES

Brief introduction to origins of quantum Physics. Wave packets. Dirac notation. Operators, their eigenvalues and eigen functions, orthonormality, completeness and closure. Generalized Uncertainty Principle. Unitary transformations, change of basis. Matrix Representation of operators. Continuous basis, position and momentum representation and their connection. Parity operator.

UNIT 2: FUNDAMENTAL CONCEPTS OF QUANTUMMECHANICS: 12 LECTURES

Basic postulates of quantum mechanics. Measurement. Time evolution of system's state. Properties of one-dimensional motion, free particle, potential step, potential well and barrier , tunneling effect, infinite square well potential, simple harmonic oscillator by wave equation and operator method, charged particle in a uniform magnetic field.

UNIT 3: SPHERICALLY SYMMETRIC POTENTIAL: 10 LECTURES

Separation of variables in spherical & Polar coordinates, orbital angular momentum, parity, spherical harmonics, free particle in spherical polar coordinates, square well potential, hydrogen atom.radial solution and principal quantum number, orbital and magnetic quantum number. Electron probability density, radiative transition**.**

UNIT 4: ANGULAR MOMENTUM: 08 LECTURES

Orbital, Spin and total angular momentum operators. Pauli spin matrices, their Commutation relations. Eigen values and eigenfunctionsL^2 of Lz.

UNIT 5: IDENTICAL PARTICLES: 08 LECTURES

Many particle systems, systems of identical particles, exchange degeneracy, symmetrization postulate, construction of symmetric and anti-symmetric wave functions from un-symmetrized functions. The Pauli Exclusion Principle.

REFERENCE BOOKS:

- Franz Schwabl : Quantum Mechanics
- J. J. Sakurai : Modern Quantum Mechanics
- N. Zettili : Quantum Mechanics
- P. A. M. Dirac :Priciples of Quantum Mechanics

➢ Bohm : Quantum Mechanic

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1	2	2	1	1
CO2	2	3	1	-	1	2	1	-
CO3	1	3	-	-	1	2	-	1
CO4	2	3	-	2	2	1	2	-

MPH-113 ELECTRO-OPTIC EFFECTS IN MATERIALS (EOEM)

L-3, T-1, P-0 Credits–4 Max Marks: 100

Objective: The emphasis of course is on Fundamentals and properties of Electro-optic, propagation of light in anisotropic optical media and electro-optical effects in liquid crystals.

Course outcomes:

CO1: Understanding of Fundamentals and properties of Electro-optic.

CO2: Understanding of light in anisotropic optical media.

CO3: Understanding of electro-optical effects in liquid crystals.

CO4: Understanding of liquid crystal devices.

UNIT 1. PRINCIPLES OF ELECTRO-OPTICS LECTURE 8

Introduction, Fundamentals of Electro-optic effects, Pockels and Kerr effect. Electro-optic sensors and switches, spatial light modulators, phase retarders. Electro-optical materials: Inorganic crystals, organic crystals, liquid crystals, semiconductors, dye-doped polymers, dichroism in materials, field induced-anisotropy in materials.

UNIT 2. PROPAGATION OF LIGHT IN ANISOTROPIC OPTICAL MEDIA LECTURE 7

Electromagnetic Waves, Polarization, Monochromatic plane waves and their polarization states: Linear polarization states, Circular polarization states, Elliptical polarization states. Propagation of Light in Uniform Anisotropic Optical Media, Birefringence, ordinary and extraordinary waves, Eigenmodes, Orthogonality of eigenmodes, Energy flux, Special cases, Polarizers

UNIT 3 - LIQUID CRYSTALS – THE FOURTH PHASE OF MATTER LECTURE 11

Introduction, classification of liquid crystals, various mesophases of liquid crystals, polymer liquid crystals, chirality in liquid crystals, ferroelectric and antiferroelectric liquid crystals, discotic liquid crystals, lyotropic liquid crystals, applications.

UNIT 4 – ELECTRO-OPTICAL EFFECTS IN LIQUID CRYSTALS LECTURE 12

Order parameter, Anisotropy in liquid crystals, electrical anisotropy, optical anisotropy, deformations, electro-optic alignment, optical waveguiding, field-induced switching, Freedericksz transition, response time, confinement of liquid crystals for electro-optic effects, factors governing electro-optics.

UNIT 5 - LIQUID CRYSTAL DEVICES LECTURE 12

Display matrices, LCD, TN displays, STN displays, fast-switching devices, phase modulators, Guest-host displays, Liquid crystal-polymer dispersions, flexible displays, non-display devices.

REFERENCE BOOKS:

- G. R. Elion and H. A. Elion, Electro-Optics Handbook, Marcel Dekker, New York,
- P. Kaminow, An Introduction to Electrooptic Devices, Academic Press, New York,
- The Physics of Liquid Crystals: P.G. de Gennes and J Prost. Oxford University press.
- Liquid Crystals- Applications and Uses: B Bhadur (Vol.1,2,3)

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1	2	2	1	1
CO2	2	3	1	-	1	1	2	-
CO3	1	3	3	-	1	2	-	-
CO4	2	3	-	3	2	1	-	1

MPH-114 ELECTRONICS

L-3, T-1, P-0 **Credits–4** **Max Marks: 100**

Objective: To introduce students to entire circuit designs, and to provide in-depth theoretical base of Digital Electronics. The Electronics course covers semiconductor physics, physical principles of devices and their basic applications, basic circuit analysis, first-order nonlinear circuits, Analysis of Passive and Active filters, OPAMP based analog circuits and introduction to various communication techniques.

Course outcomes:

CO1: Understanding of Fundamentals and properties of semiconductor devices.

CO2: Logic circuits, digital systems and microprocessor and their peripheral devices.

CO3: Operating and designing digital systems

CO4: How to solve problems in design and/ or implementation of digital.

UNIT I : SEMICONDUCTOR DEVICES-I **10 LECTURES**

Semiconducting Materials, conduction in semiconductors, Charge densities in a semiconductor, PN junction, space charge and electric field distribution at junctions, forward and reverse biased conditions, Space charge capacitance, varactor diode, Zener and avalanche breakdowns, Zener diodes, Schottky barrier, tunnel diode, photodiode, LED, p-n-p-n devices and their characteristics.

UNIT II : SEMICONDUCTOR DEVICES II: **12 LECTURES**

Transistors: Bipolar junction Transistor (BJT), Analysis of CE amplifier using h-parameters, The T-network equivalent circuit, constants of CB and CE amplifier using emitter, base, collector resistance, Biasing technique to BJT, stabilization factor, temperature stabilization, operating point, fixed bias, emitter feedback bias, voltage feedback bias. Field-Effect Transistors (FET) and MOSFET: Structure, Working, Derivations of the equations for I-V characteristics under different conditions.

UNIT – III POWER AMPLIFIER AND OSCILLATORS **11 LECTURES**

Operating conditions for power amplifier, power relations, The ideal transformer, voltage limitations of the transformer, non-linear distortion, Idea of inter-modulation distortion, The class A power amplifier, The push-pull amplifier, Feedback requirements ofoscillations, Basic oscillator analysis, Hartley and Colpitt oscillators, Piezo- electric,frequency control , RC oscillators.

UNIT – IV BASICS OF DIFFERENTIAL AND OPERATIONAL AMPLIFIERS **10 LECTURES**

Differential amplifier, Differential amplifier circuit configuration, Dual input balanced output differential amplifier, Voltage gain, differential input resistance, inverting and non-inverting inputs, common mode rejection ratio, Operational amplifier, input offset voltage,input offset currents, input bias currents, differential input resistance, input capacitance, offset voltage supply, rejection ratio, Ideal OP Amp, equivalent circuit of an OP Amp, ideal voltage transfer curve, inverting, dual and non-inverting amplifier, measurement of OPAmp parameters, frequency response

UNIT V COMMUNICATION SYSTEMS (BROAD ASPECTS): **10 LECTURES**

Digital transmission, ASK, FSK, PSK, Differential PSK, modulators and detectors, Broadband Communication Systems-Optical Fibre comm., Submarine cables, Satellite and cellular mobile systems, Integrated Services Digital Network

REFERENCE BOOKS:

- Electronics Fundamentals and Application: J.D. Ryder
- Solid State Electronic Devices: B.G.Streetman
- Electronic Principals: Malvino
- Principals of Microwave: Atwarter
- Electromagnetic Wave and Radiating System: Jorden and Ballmon
- Electronic Devices and Circuits: Millman and Halkias

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	1	2	2	1	1
CO2	2	3	1	1	1	3	1	-
CO3	1	3	1	2	1	2	-	-
CO4	2	3	-	3	2	1	-	-

MPH-161 GENERAL PHYSICS LABORATORY

L-0, T-0, P-4 **Credits–2** **Max Marks: 100**

Objective: The aim and objective of the course General Physics Laboratory is to expose the students to experimental techniques in electronics, so that they can verify some of the things read in theory here or in earlier classes and develop confidence to handle sophisticated equipment.

Course outcomes:

CO1: Understanding of Fundamentals of semiconductor devices, energy, Magnetic Susceptibility .

CO2: Understanding of Hall effect in semiconductors

CO3: Understanding of Hysteresis loop curve of Magnetic Materials

CO4: Master the techniques to calculate various mechanical parameters.

List of Experiments:

1. G.M. Tube Characteristics & Absorption Coefficient

2. Study of high energy interaction in nuclear emulsion

3. Study of Hall effect in semiconductors:
 (**a**) Determination of Hall voltage and Hall coefficient, and
 (**b**) Determination of the mobility of chargee carriers and the carrier concentration.

4. Study of Magnetic Susceptibility of $MnCl_2$

5. To determine dissociation Energy of Iodine Molecule

6. To study of Hysteresis loop curve of Magnetic Materials

7. To study conductivity of a Semiconductor using Four Probe method

8. Determination of the energy gap of a semiconductor by four probe method.

9. To determine the response of silicon solar cells and the effect of prolonged irradiation and to calculate theefficiency and fill factors of a variety of solar cells.

10. To determine: a). the velocity of ultrasonic waves in a liquid and,
 b). the compressibility of the liquid.

11. Dielectric constant of ice.

12. Elastic properties of a solid using piezoelectric oscillator.

13. Measurement of e/m by Thomson effect.

14. Michelson interferometer.

Note: Each student is required to perform at least 07 of the above experiments.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1	2	2	1	1
CO2	2	3	1	-	1	1	2	-
CO3	1	3	3	-	1	2	-	-
CO4	2	3	-	3	2	1	-	1

MPH-163 Electro-Optic Effects In Materials (EOEM) Lab

L-0, T-0, P-4 Credits–2 Max Marks: 100

Objective: The aim and objective are to expose the students to experimental techniques of Electro-optic, propagation of light in anisotropic optical media and electro-optical effects in liquid crystals.

Course outcomes:

CO1: Understanding of phase transition temperatures for LC materials.

CO2: Understanding of Response Time characteristics of a PDLC cell.

CO3: Understanding of effects of various frequency-shapes on the EO properties.

CO4: Master the techniques to Structural and morphological changes in liquid crystal.

1. To examine the phase transition temperatures for LC materials.
2. To study the electro-optical behavior of a Liquid Crystal cell.
3. To study the Response Time characteristics of a PDLC cell.
4. To study the angular dependence of VT characteristics in a PDLC cell.
5. To examine the polarized effects of light through a Liquid Crystal device.
6. To study effects of various frequency-shapes on the EO properties and response time of liquid crystaldevice.
7. Structural and morphological changes in liquid crystal director configuration under effect of an appliedelectric field.

Note: Each student is required to perform at least 7 of the above experiments.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	-	1	2	2	1	1
CO2	1	3	1	-	1	2	1	1
CO3	1	3	-	3	1	2	2	-
CO4	2	3	-	1	2	1	-	-

MPH-164 ELECTRONICS LAB

L-0, T-0, P-4 **Credits–2** **Max Marks: 100**

Objective: The aim and objective of the course electronics lab is to expose the students of M.Sc. (H.S.) class to experimental techniques in electronics, so that they can verify some of the things read in theory here or in earlier classes and develop confidence to handle sophisticated equipment

Course outcomes:

CO1: Understanding of types of amplifiers.

CO2: Understanding of characteristics of PN junction diode.

CO3: Experimental knowledge of Schottky diode, tunnel diode.

CO4: Experimental knowledge of different Operational Amplifier IC-741

LIST OF EXPERIMENTS:

1. Design & Study of Common Emitter Amplifier characteristics curve of PN junction diode
2. To draw the characteristics curve of PN junction diode.
3. To draw the characteristics curve of Zener diode.
4. To draw the characteristics curve of Schottky diode
5. To draw the characteristics curve of Tunnel diode
6. To draw the characteristics curve of Photo diode
7. Study of Operational Amplifier IC-741:
    a. summer,
    b. Subtractor
    c. Inverter
    d. Non-inverter
    e. differentiat
    orf integrator

Note: Each student is required to perform at least 7 of the above experiments.

REFERENCE BOOKS:

- Electronics Fundamentals and Application: J.D. Ryder
- Solid State Electronic Devices: B.G.Streetman
- Electronic Principals: Malvino
- Principals of Microwave: Atwarter

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	1	2	2	1	1
CO2	2	3	1	1	1	3	1	-
CO3	1	3	1	2	1	2	-	-
CO4	2	3	-	3	2	1	-	-

SEMESTER-II

MPH-115 QUANTUM MECHANICS – II

L-3, T-1, P-0 **Credits–4** **Max Marks: 100**

Objective: This course will introduce Dirac's bra-ket formulation of quantum mechanics and make students familiar with various approximation methods applied to atomic, nuclear and solid-state physics, and to scattering.

Course outcomes:

CO1: Develop a knowledge and understanding of the concept that quantum states live in a vector space.
CO2: Develop a knowledge and understanding of perturbation theory, level splitting, and radiative transitions.
CO3: Knowledge and understanding of the role of angular momentum in atomic and nuclear physics.

CO4: Knowledge and understanding of the scattering matrix and partial wave analysis.

UNIT 1. LINEAR VECTOR SPACE AND MATRIX MECHANICS: 12 LECTURES
Vector spaces, Schwarz inequality, Orthonormal basis, Schmidt ortho-normalisation method, Operators, Projection operator, Hermitian and Unitary operators, change of basis, Eigenvalue and Eigenvectors of operators, Dirac's bra and ket notation, commutators, Simultaneous eigenvectors, Postulates of quantum mechanics, uncertainty relation. Harmonic oscillator in matrix mechanics, Time development of states and operators, Heisenberg and Schrodinger representations, Exchange operator and identical particles. Density Matrix and Mixed Ensemble.

UNIT 2. SYMMETRY IN QUANTUM MECHANICS 10 LECTURES
Symmetry operations and unitary transformations, conservation principles, space and time translations, rotation, space inversion and time reversal, symmetry, and degeneracy.
Rotation operators, angular momentum algebra, eigenvalues of J^2 and Jz, spinors and Pauli matrices, addition of angular momenta. Representation of general angular momentum operator, Addition of angular momenta, C.G. coefficients.

UNIT 3. TIME-INDEPENDENT & TIME-DEPENDENT PROBLEMSAPPROXIMATION METHODS 10 LECTURES
Non-degenerate perturbation theory, degenerate case, Stark effect, Zeeman effect and other examples, variational methods, WKB method, tunnelling.
Schrödinger and Heisenberg picture, time-dependent perturbation theory, transition probability calculations, golden rule, adiabatic approximation, sudden approximation, beta decay as an example.

UNIT 4. STATIONARY STATE APPROXIMATE METHODS: 08 LECTURES
Variational method with applications to the ground states of harmonic oscillator and other sample systems.

UNIT 5. SCATTERING THEORY 10 LECTURES
Differential cross-section, scattering of a wave packet, integral equation for the scattering amplitude, Born approximation, method of partial waves, low energy scattering and bound states, resonance scattering.

REFERENCE BOOKS:

- C. Cohen-Tannoudji, B. Diu and F. Laloe, Quantum Mechanics (Volume II).
- A. Messiah, Quantum Mechanics (Volume II).
- S. Flügge, Practical Quantum Mechanics.
- J.J. Sakurai, Modern Quantum Mechanics.

➢ K. Gottfried, Quantum Mechanics.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1	2	2	1	1
CO2	2	3	1	-	1	1	2	-
CO3	1	3	3	-	1	2	-	-
CO4	2	3	-	3	2	1	-	1

MPH-116 THEORY OF RADIATION & STATISTICAL MECHANICS

L-3, T-1, P-0 Credits–4 Max Marks: 100

Objective: This course introduces the microscopic formulation of thermal physics, generally known as statistical mechanics. The course explores the general principles, from which emerge an understanding of the microscopic significance of entropy and temperature.

Course outcomes:

CO1: Understanding the concepts of microstate and macro state of a model system

CO2: Knowledge the concepts and roles of entropy and free energy from the viewpoint of statistical mechanics.

CO3: Discuss the concept and role of indistinguishability in the theory of gases; know the results expected from classical considerations and when these should be recovered.

CO4: Understanding of the Fermi-Dirac and Bose-Einstein distributions; state where they are applicable; understand how they differ and show when they reduce to the Boltzmann distribution

UNIT 1:THEORY OF RADIATION 10 LECTURES

Classical Theory of Radiation: Properties of Thermal Radiation. Blackbody Radiation. Pure Temperature Dependence, Kirchhoff's Law, Stefan-Boltzmann Law and Wien's Displacement law. Saha's Ionization Formula.

UNIT 2 QUANTUM THEORY OF RADIATION: 12 LECTURES

Stefan-Boltzmann Law: Thermodynamic Proof. Radiation Pressure, Spectral Distribution of Black Body Radiation. Wien's Distribution Law and Displacement Law, Rayleigh-Jean's Law, Ultraviolet Catastrophe, Planck's Quantum Postulates. Planck's Law of Blackbody Radiation : Experimental Verification. Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law and (4) Wien's Displacement Law from Planck's Law.

UNIT 3. REVIEW OF THERMODYNAMICS 10 LECTURES

Extensive and intensive variables, laws of thermodynamics, Legendre transformations and thermodynamic potentials, Maxwell relations, applications of thermodynamics to (a) ideal gas, (b) magnetic material, and (c) dielectric material.

UNIT 4. FORMALISM OF EQUILIBRIUM STATISTICAL MECHANICS 11 LECTURES

Concept of phase space, Liouville's theorem, basic postulates of statistical mechanics, ensembles: microcanonical, canonical, grand canonical, and isobaric, connection to thermodynamics, fluctuations, applications of various ensembles, partition function, equation of state for a non-ideal gas, Van der Waals' equation of state, Meyer cluster expansion, virial coefficients

UNIT 5. QUANTUM STATISTICS 12 LECTURES

Transition from classical statistical mechanics to quantum statistical mechanics, Indistinguishability and quantum statistics, identical particles and symmetry requirements, Bose Einstein statistics, Fermi Dirac statistics, Maxwell Boltzmann statistics. Bose Einstein Condensation, Thermal properties of B.E. gas, liquid Helium, Energy and pressure of F-D gas, Electrons in metals, Thermionic Emission. Fermi-Dirac and Bose-Einstein statistics.

Applications of the formalism to:

(a) Ideal Bose gas, Debye theory of specific heat, properties of black-body radiation, Bose-Einstein condensation, experiments on atomic BEC, BEC in a harmonic potential.
(b) Ideal Fermi gas, properties of simple metals, Pauli Paramagnetism, electronic specific heat,

white dwarf stars.

REFERENCE BOOKS:

- F. Reif, Fundamentals of Statistical and Thermal Physics.
- K. Huang, Statistical Mechanics.
- R.K. Pathria, Statistical Mechanics.
- D.A. McQuarrie, Statistical Mechanics.
- S.K. Ma, Statistical Mechanics.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	-	2	2	2	1	1
CO2	1	3	1	-	1	2	1	-
CO3	1	3	3	2	1	2	2	-
CO4	2	3	-	-	2	1	-	2

MPH-117 NUMERICAL METHODS AND COMPUTATIONAL PHYSICS

L-3, T-1, P-0 **Credits–4** **Max Marks: 100**

Objective: This hands-on course introduces computational methods in solving problems in physics. It teaches programming tactics, numerical methods, and their implementation, together with methods of linear algebra.

Course outcomes:

CO1: Identify modern programming methods and describe the extent and limitations of computational methods in physics

CO2: Independently program computers using leading-edge tools,

CO3: Formulate and computationally solve a selection of problems in physics

CO4: Use the tools, methodologies, language, and conventions of physics to test and communicate ideas and explanations.

UNIT I: DIFFERENTIATION AND INTEGRATION (12 LECTURES)
Differentiation: Taylor series method, Numerical differentiation using Newton's forward difference formula, Backward difference formula, Stirling's formula, Cubic splines method.
Integration: Trapezoidal rule, Simpson's 1/3 rule, Gaussian Quadrature, Legendre–Gauss Quadrature, Numerical double integration, Numerical integration of singular integrals.

UNIT II: SOLUTION OF DIFFERENTIAL EQUATIONS (12 LECTURES)
Numerical solution of ordinary differential equations: Taylor's series method, Euler's method, Forth-order Runge Kutta method, Cubic splines method; Second order differential equations: Initial and boundary value problems, Numeric solution of Radial Schrodinger equation for Hydrogen atom using Forth-order Runge-Kutta method(when eigen value is given), Numerical Solutions of Partial Differential Equations Using Finite Difference Method.

UNIT III: RANDOM NUMBERS AND CHAOS (12 LECTURES)
Random numbers: Random number generators, Mid-square methods, Multiplicative congruential method, mixed multiplicative congruential methods, modeling radioactive decay. Hit and miss Monte-Carlo methods, Monte-Carlo calculation of , Monte-Carlo evaluation of integration, Evaluation of multidimensional integrals; Chaotic dynamics: Some definitions, The simple pendulum, Potential energy of a dynamical system. Portraits in phase space: Undamped motion, Damped motion, Driven and damped oscillator.

UNIT IV: SELECTED PHYSICS PROBLEMS (12 LECTURES)
Algorithms to simulate interference and diffraction of light, Algorithms of charging an discharging of a capacitor, current in LR and LCR circuits, Computer models of LR and LCR circuits driven by sine and square functions.

UNIT 5: FOURIER TRANSFORMATIONS: (10 LECTURES)
Fourier sine & cosine series, Analysis of a time series and search for periodicity. FFT (Fast Fourier transformation) and power spectrum and any other topics used in physics research.

REFERENCE BOOKS

- J. D. Lambert , Numerical Methods for Ordinary Differential Systems.
- Kendall Atkinson, Weimin Han, Theoretical Numerical Analysis.
- Mark Newman, Computational Physics.
- Cristian C. Bordeianu, Manuel J. Paez, and Rubin H. Landau, Computational Physics: Problem Solving with Python.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	-	2	2	2	1	1
CO2	1	3	1	-	1	2	1	-
CO3	1	3	3	2	1	2	2	-
CO4	2	3	-	-	2	1	-	2

MPH-118 ELECTROMAGNETIC THEORY & ELECTRODYNAMICS

L-3, T-1, P-0 Credits–4 Max Marks: 100

Objective: In this course, the students will primarily learn how to solve the Maxwell's equations for various boundary conditions. Some emphasis will be on learning to use spherical harmonics and the Greens function methods for solving the Maxwell's equations.

Course outcomes:

CO1: Apply vector calculus to static electric-magnetic fields in different engineering situations.

CO2: Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse science problems.

CO3: Examine the phenomena of wave propagation in different media and its interfaces and in applications of wave engineering.

CO4: Analyze the nature of electromagnetic wave propagation in guided medium

UNIT I: ELECTROSTATICS 12 LECTURES

Electric Field, Gauss Law, Differential form of Gauss Law, Electromagnetic scalar and vector potentials, Maxwell's equations in terms of scalar and vector potentials, Non-uniqueness of Electromagnetic potentials and concept of Gauge. Lorentz gauge and coulomb gauge. Boundary value problem, Poisson and Laplace equations, Solution of Laplace equation in rectangular coordinates, Green's Theorem, Dirichlet and Neumann boundary conditions, Formal solution of boundary value problem with Green's function, Electrostatic potential energy and energy density.

UNIT 2.MAGNETOSTATICS 10 LECTURES

Biot-Savart law, differential equation for static magnetic field, vector potential, magnetic field from localized current distributions, examples of magnetostatic problems, Faraday's law of induction, magnetic energy of steady current distributions.

UNIT 3. MAXWELL'S EQUATIONS 09 LECTURES

Displacement current, Maxwell's equations, vector and scalar potentials, gauge symmetry, Coulomb and Lorentz gauges, electromagnetic energy and momentum, conservation laws, inhomogeneous wave equation and Green's function solution.

UNIT 4. ELECTROMAGNETIC WAVES 11 LECTURES

Plane waves in a dielectric medium, reflection and refraction at dielectric interfaces, frequency dispersion in dielectrics and metals, dielectric constant and anomalous dispersion, wave propagation in one dimension, group velocity, metallic wave guides, boundary conditions at metallic surfaces, propagation modes in wave guides, resonant modes in cavities.

UNIT 5. RADIATION & COVARIANT FORMULATION OF ELECTRODYNAMICS 12 LECTURES

Field of a localized oscillating source, fields and radiation in dipole and quadrupole approximations, antenna, radiation by moving charges, Lienard- Wiechert potentials, total power radiated by an accelerated charge, Lorentz formula.

Four-vectors relevant to electrodynamics, electromagnetic field tensor and Maxwell's equations, transformation of fields, fields of uniformly moving particles.

Concepts of Plasma Physics: Formation of plasma, Debye theory of screening, plasma oscillations, motion of charges in electromagnetic fields, magneto-plasma, plasma confinement, hydro magnetic waves.

REFERENCE BOOKS:

- J.D. Jackson, Classical Electrodynamics.
- D.J. Griffiths, Introduction to Electrodynamics.
- J.R. Reitz, F.J. Milford and R.W. Christy, Foundations of Electromagnetic Theory.
- W.K.H. Panofsky and M. Phillips, Classical Electricity and Magnetism.
- F.F. Chen, Introduction to Plasma Physics and Controlled Fusion.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	-	1	2	2	1	1
CO2	1	3	1	-	1	2	1	1
CO3	1	3	-	3	1	2	2	-
CO4	2	3	-	1	2	1	-	-

MPH-119 ATOMIC & MOLECULAR PHYSICS

L-3, T-1, P-0 **Credits–4** **Max Marks: 100**

Objective: This course deals principally with atomic structure and the interaction between atoms and fields. It covers electronic transitions, atomic spectra, excited states, hydrogenic and multi-electron atoms.

Course outcomes:

CO1: Derive the energy shifts due to these corrections using first order perturbation theory.

CO2: Explain the observed dependence of atomic spectral lines on externally applied electric and magnetic fields.

CO3: State and justify the selection rules for various optical spectroscopies in terms of the symmetries of molecular vibrations.

CO4: Explain how light interacting with atom and effect of magnetic field on the spectrum.

UNIT-1: ATOMIC PHYSICS **12 LECTURES**

Fine structure of hydrogen atoms-mass correction, Spin orbit term, Darwin term, Intensity of fine structure lines, ground state of two electron atoms-perturbation theory and variation method. Many electron atoms- LS and jj coupling schemes, Lande interval rule. Terms for equivalent & non-equivalent electron atom. Space Quantization: stern Gerlach experiment, normal & anomalous Zeeman effect, Stark effect, Paschen-Back effect; Intensities of spectral line: General selection rule, Hyperfine Structure, Isotope Shifts and Nuclear Size Effects**.**

UNIT-II: MOLECULAR STRUCTURE **08 LECTURES**

Born-Oppenheimer separation for diatomic molecules, rotation, vibration and electronic structure of diatomic molecules. Description of Molecular Orbital and Electronic Configuration of Diatomic Molecules: H2, H2+. Co- relation diagram for heteronuclear molecules.

UNIT-III: MOLECULAR SPECTRA **09 LECTURES**

Rotation, Vibration-rotation, and electronic spectra of diatomic molecules. The Franck Condon Principle. Raman Spectroscopy: Introduction, pure rotational Raman Spectra, vibrational Raman spectra, nuclear spin and intensity alternation in Raman spectra, Isotope effect and Raman spectrometer. Dissociation and pre dissociation, Dissociation energy, Rotational fine structure of electronic bands.

UNIT-IV: RESONANCE SPECTROSCOPY **10 LECTURES**

NMR: Basic principles- classical and quantum description-Bloch Equation-spin-spin an spin-lattice relaxation times-chemical shift and coupling constant- experimental methods single and double coil methods; ESR: Basic principles, ESR Spectrometer-nuclear interaction and hyperfine structure-relaxation g factor.

UNIT-V: ROTATION AND VIBRATION OF MOLECULES: **11 LECTURES**

Solution of nuclear equation; Molecular rotation: Non-rigid rotator, Centrifugal distortion, Symmetric top molecules, Molecular vibrations: Harmonic oscillator and the anharmonic oscillator approximation, Morse potential.

Spectra of Molecules: Transition matrix elements, Vibration-rotation spectra: Pure vibrational transitions, Pure rotational transitions, Vibration-rotation transitions.

REFERENCE BOOKS:

- I.N. Levine, Quantum Chemistry.
- R. McWeeny, Coulson's Valence.
- L.D. Landau and E.M. Lifshitz, Quantum Mechanics.

- M. Karplus and R.N. Porter, Atoms and Molecules: An Introduction for Students of Physical Chemistry.
- P.W. Atkins and R.S. Friedman, Molecular Quantum Mechanics.
- M. Tinkham, Group Theory and Quantum Mechanics.
- L. Fetter and J. D. Walecka, Quantum Theory of Many-Particle Systems.
- W.A. Harrison, Applied Quantum Mechanics.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	-	2	2	1	1
CO2	2	3	1	-	1	2	1	-
CO3	2	1	3	3	1	2	-	-
CO4	2	3	-	-	2	1	-	2

MPH-165 ADVANCE PHYSICS LABORATORY

L-0, T-0 P-4 Credits–2 Max Marks: 100

Objective: The aim and objective of the course General Physics Laboratory is to expose the students of M.Sc. (H.S.) class to experimental techniques in electronics, so that they can verify some of the things read in theory here or in earlier classes and develop confidence to handle sophisticated equipment.

Course outcomes:

CO1: Experimental experience on UJT, FET and MOSFET.

CO2: Understanding of Oscillator, amplifier, and Op-amp.

CO3: Experimental knowledge of Modulation & Demodulation

CO4 : Experimental knowledge of Michelson Interferometer Hall voltage & Hall coefficient of a semiconductor material

1. UJT - characteristics and it's applications as relaxation oscillator
2. SCR - characteristics and its applications as switching device
3. Study of Optoelectronic Devices
4. Study of Phase Shift Oscillator
5. Study of Negative & Positive Feedback Amplifier
6. FET - I/V characteristics, biasing and its application as an amplifier
7. MOSFET - I/V characteristics, biasing and its application as an amplifier
8. Study of Pulse Amplitude Modulation (PAM) & Demodulation
9. A/D and D/A converter
10. Design & study of regulated and stabilized power supply.
11. Design & study of triangular wave generator.
12. Study of IC - 555 as a stable, mono-stable and bi-stable multivibrator
13. Active filters using op-amp
14. To determine the wavelength of a laser light
15. To determine the ridberg constant of hydrogen atom.
16. To determine the wavelength of used light by Michelson Interferometer
17. To determine the temperature coefficient of resistance of a platinum by using Callender & Grifith.
18. To draw the B-H curve of a ferromagnetic material.
19. To determine the Hall voltage & Hall coefficient of a semiconductor material
20. To determine the dielectric constant of a dielectric material.
21. To find the thickness of a wire by Interference method.
22. To determine the Boltzmann constant.
23. Mini Project
24. Electron-spin resonance
25. Faraday rotation/Kerr effect.
26. Interfacial tension and Phase separation kinetics.
27. Reaction kinetics by spectrophotometer and conductivity.
28. Study of color centers by spectrophotometer.
29. Alpha, Beta and Gamma ray spectrometer.
30. Mossbauer spectrometer.
31. Sizing nano-structures (UV-VIS spectroscopy).

32. Magneto-resistance and its field dependence.
33. X-ray diffraction.
34. Compton scattering.
35. Adiabatic compressibility.
36. Solid-liquid phase diagram for a mixture.

Note: Each student is required to perform at least 12 of the above experiments.

REFERANCE BOOK:

- Advanced Physics Laboratory Book inc CD-ROM by Peter Warren.
- Advanced Physics Lab Experiments, Vol-2 by Jeethendra Kumar P K, Prabhakar Sharma
- Advanced Physics Laboratory Manual by J.W. Hammer

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1	2	2	1	1
CO2	2	3	1	-	1	1	2	-
CO3	1	3	3	-	1	2	-	-
CO4	2	3	-	3	2	1	-	1

MPH-167 NUMERICAL METHODS AND COMPUTATIONAL PHYSICS LAB

L-0, T-0 P-4 Credits–2 Max Marks: 100

Objective: The aim of this course is to give knowledge of computational methods in solving problems. It teaches programming tactics, numerical methods, and their implementation, together with methods of linear algebra.

Course outcomes:

CO1: Understanding of superposition of waves.

CO2: Knowledge of standard deviation, mean, variance, moments.

CO3: Understanding of matrix - its eigen values and eigenvectors

CO4: Experimental knowledge of Monte Carlo techniques.

List of Numerical Problems using "Classes":

1. Data handling: find standard deviation, mean, variance, moments etc. of at least 25 entries.
2. Choose a set of 10 values and find the least squared fitted curve.
3. Generation of waves on superposition like stationary waves and beats.
4. Fourier analysis of square waves.
5. To find the roots of quadratic equations.
6. Wave packet and uncertainty principle.
7. Find y for a given x by fitting a set of 9 values with the help of cubic spline fitting technique.
8. Find first order derivative at given x for a set of 10 values with the help of Lagrange interpolation.
9. To generate random numbers between (i) 1 and 0, (ii) 1 and 100.
10. Perform numerical integration on 1-D function using Simpson and Weddle rules.
11. To find determinant of a matrix - its eigen values and eigenvectors.
12. Use Monte Carlo techniques to simulate phenomenon of nuclear radioactivity.

REFERENCE BOOKS:

- Numerical Mathematical Analysis, J.B. Scarborough (Oxford & IBH Book Co.) 6th ed., 1979.
- A first course in Computational Physics: P.L. DeVries (Wiley) 2nd edition, 2011.
- Computer Applications in Physics: S. Chandra (Narosa) 2nd edition, 2005.
- Computational Physics: R.C. Verma, P.K. Ahluwalia and K.C. Sharma (New Age) 2000.
- Object Oriented Programming with C++: Balagurusamy, (Tata McGrawHill) 4th edition 2008.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1	2	2	1	1
CO2	2	3	1	-	1	1	2	-
CO3	1	3	3	-	1	2	-	-
CO4	2	3	-	3	2	1	-	1

SEMESTER-III

MPH-210 SOLID STATE PHYSICS

L-3, T-1, P-0 | **Credits–4** | **Max Marks: 100**

Objective: The aim of this course is to give an extended knowledge of the principles and techniques of solid-state physics.

Course outcomes:

CO1: Explain the properties related to states of matter/solids.

CO2: Explain the band theory of solids.

CO3: Understand about the specific heat of solids.

CO4: To know the about the superconducting behavior of the solids.

UNIT1. LATTICE DYNAMICS AND THERMAL PROPERTIES: 12 LECTURES

Crystalline and amorphous solids. The crystal lattice. Basis vectors. Unit cell. Symmetry operations. Point, Three-dimensional crystal systems. Miller indices. Directions and planes in crystals. Inter-planar spacings. Simple crystal structures: FCC, BCC, Nacl, CsCl, Diamond and ZnS structure, HCP structure. Binding in solids; Stress components, stiffness constant, elastic constants, elastic waves in crystals Rigorous treatment of lattice vibrations, normal modes; Density of states, thermo dynamic properties of crystal, anharmonic effects, thermal expansion.

UNIT2. ENERGY BAND THEORY: 10 LECTURES

The Bloch theorem. Bloch functions. Review of the Kroning-penney model. Brillouin zones. Number of states in the band. Band gap in the nearly free electron model. The tight binding model. The Fermi-surface. Electron dynamics nonelectric field. The effective mass. Concept of hole.(elementary treatment)

UNIT3. TRANSPORT THEORY: 10 LECTURES

Quantized free electron theory. Fermi energy, wave vector, velocity and temperature, density of states. Electronic specific heats. Electronic transport from classical kinetic theory; Introduction to Boltzmann transport equation; electrical and thermal conductivity of metals; thermo electric effects; Hall effect and magnetoresistance.

UNIT4. DIELECTRIC PROPERTIES OF MATERIALS: 12 LECTURES

Diamagnetism, Langevin equation. Quantum theory of Paramagnetism. Curie law. Hund's rules. Paramagnetism in rare earth and iron group ions. Elementary idea of crystal field effects. Ferromagnetism. Curie-Weiss law. Heisenberg exchange interaction. Mean field theory. Anti-ferro-magnetism. Neel point. Other kinds of magnetic order. Nuclear magnetic resonance.

UNIT5. SUPERCONDUCTIVITY 08 LECTURES

Survey of important experimental results. Critical temperature. Meissnereffect. Type 1 and type II superconductors. Thermodynamics of superconducting transition. London equation. London penetration depth. Energy gap. Basic ideas of BCS theory. High-Tc superconductors.

REFERENCE BOOKS:

- Introduction to Solid State Physics: C.Kittel (Wiley, NewYork),8thed.2005.
- Quantum Theory of Solids: C. Kittel (Wiley, New York)1987.
- Principles of the Theory of Solids: J. Ziman (Cambridge University Press)1972.
- Solid State Physics: H. Ibachand, H.Luth (Springer Berlin)3rd.ed.2002.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	-	2	2	2	1	1
CO2	1	3	1	-	1	2	1	-
CO3	1	3	3	2	1	2	2	-
CO4	2	3	-	-	2	1	-	2

MPH-211 NUCLEAR & PARTICLE PHYSICS

L-3, T-1, P-0 **Credits–4** **Max Marks: 100**

Objective: The aim and objective of the course on Nuclear and Particle Physics is to familiarize the students to the basic aspects of nuclear and particle physics like static properties of nuclei, radioactive decays, nuclear forces etc**.**

Course outcomes:

CO1: Explain various nuclear properties.

CO2: Understand various nuclear forces in a nucleus.

CO3: To know about the shell model of nucleus.

CO4: To know about the radioactive behavior of the solids.

UNIT-1:NUCLEAR SIZE AND SHAPE 08 LECTURES

General properties of nuclei: size, shape and charge distribution, spin and parity. muonic atoms and electron scattering, charge form factor, Magnetic dipole moment, electric quadruple moment and nuclear shape, Binding energy, semi-empirical mass formula.

UNIT-II:TWO-NUCLEON PROBLEM AND NUCLEAR FORCES 09 LECTURES

Deuteron problem, Deuteron ground state, excited states, two-nucleons catering, n-p scattering, partial wave analysis, phase-shift, scattering length, p-p scattering (qualitative discussion),

Nature of the nuclear force, Charge symmetry and charge independence of nuclear forces. Exchange nature of nuclear forces, form of nucleon-nucleon potential, elementary discussion on Yukawa's theory.

UNIT- III. NUCLEAR MODELS 09 LECTURES

Liquid drop model, Bohr-Wheeler theory of fission, Experimental evidence for shell structure, single-particle Shell model, validity, and limitations of Shell model., Spin-Orbit coupling, Magic numbers, Applications of Shell model like Angular momenta and parities of nuclear ground states.

UNIT-IV .NUCLEAR DECAY 11 LECTURES

Elementary ideas of alpha decay and its selection rules, Beta and Gamma decay: Fermi's theory of beta decay, allowed and forbidden transitions, selection rules, non-conservation of parity in beta decay, direct evidence for the neutrino, gamma–decay and selection rules (derivation of transition probabilities not required). Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions.

UNIT-V. PARTICLE PHYSICS 11 LECTURES

Classificationoffundamentalforces.Elementaryparticlesandtheirquantumnumbers(charge,spin,parity,iso spin, strangeness, etc.). Gellmann- Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance. Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics

REFERENCEBOOKS:

- Nuclear Physics: Irving Kaplan (Narosa),2002.
- Basic Ideas and Concepts in Nuclear Physics: K. Hyde(Institute of Physics)2004
- Introduction to High Energy Physics: D. H. Perkins(Cambridge University Press), 4thed.2000.
- Elementary Particles: I.S. Hughes (Cambridge University Press),3rded.1991.
- Introduction to Quarks and Partons: F. E. Close (Academic Press, London), 1979.

➤ Introduction to Particle Physics :M.P. Khanna(Prentice Hall of India, New Delhi),2004

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1	2	2	1	1
CO2	3	3	1	-	1	2	1	-
CO3	1	3	-	1	1	2	2	2
CO4	2	3	-	1	2	1	-	-

MPH-212 FIBER OPTICS & LASERDEPARTMENTALELECTIVE-I

L-3, T-1, P-0 Credits–4 Max Marks: 100

Objective: This course will enable students to study the applications and operation of fiber optics and laser technology.

Course outcomes:

CO1: Explain various optical phenomena.

CO2: Understand various absorption and scattering phenomena in optics.

CO3: To know about basic laser theory.

CO4: To know about laser production and threshold conditions.

UNIT-I:FIBER OPTICS 10LECTURES

Optica1 fiber modes and configuration, fiber types, Ray optics, representation, mode of the circular wave guide, Waveguide equation, Wave equation for Step index fiber, Model equation, modes in step index fiber, power flow in step index fiber.

UNIT–II:LOSSES & WAVEGUIDE 10LECTURES

Fiber Material fabrication attenuation, Absorption, Scattering losses. Radiative losses, Core & Cladding Losses, Signa l distortion in optical waveguide, Information capacity determination, Group delay, Material Dispersion, Wave Guide Dispersion.

UNIT-III:BASIC LASER THEORY 10LECTURES

Historical background of laser, Einstein coefficients and stimulated light amplification :population inversion, creation of population inversion in three level &four level lasers.

UNIT-IV:LASER AMPLIFIER 10LECTURES

Interaction of photons with electrons and holes in a semiconductor, Rates of emission and absorption, Condition for amplification by stimulated emission, the laser amplifier.

UNIT-V LASER & ITS TYPES 10LECTURES

LightEmittingDiode,LightsourceMaterial,InternalQuantumEfficiency,Modulationcapability,Transient Response, Power band width product, LASER diode, LASER -diode structure and Threshold Conditions, Model properties and radiation pattern modulation.

REFERENCE BOOKS:

- Optics Fibre: G. Keiser
- Opto-e1ectronics:Ghatak
- Introduction of Fiber Optics: Ajay Ghatak & K. Tyagrajan

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	-	-	2	2	1	1
CO2	2	3	2	2	1	-	1	2
CO3	2	1	1	-	1	2	-	-
CO4	2	3	-	1	2	3	2	1

MPH-213 ELECTRONICS-I

L-3, T-1, P-0 **Credits–4** **Max Marks: 100**

Objective: This course will enable students to study the applications and operation of digital electronics.

Course outcomes:

CO1: Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.

CO2: Ability to identify basic requirements for a design application and propose a cost-effective solution.

CO3: To develop skill to build and troubleshoot digital circuits.

CO4: The ability to identify and prevent various hazards and timing problems in a digital design.

UNIT-I BASIC LOGIC CIRCUIT **10 LECTURES**

Introduction of basic gates, universal gates, number systems and codes, Boolean algebra, switching characteristics of semiconductor devices. logic gate characteristics, Logic families- RTL, DTL, TTL, ECL interfacing , ECL and TTL, MOS logic MOSFET NAND and NOR gates, CMOS- NAND and NOR gates.

UNIT-II LOGIC DESIGN **10 LECTURES**

Minimization of Boolean functions, Karnaugh Map and Applications, Analysis and Synthesis of combinational circuit Simplification of Boolean algebra using K-map, minterm and maxterm, design of binary adder, subtractor ,digital comparator, parity generator/checkers, priority encoder, BCD to 7 segments decoder.

UNIT III.COMBINATIONAL LOGIC CIRCUITS: **10 LECTURES**

arithmetic circuits – Half adders, Full adders; Digital Comparators, Encoders, Decoders, multiplexer, multiplexer tree, demultiplexer and demultiplexer tree.

UNIT IV SEQUENTIAL CIRCUIT DESIGN–I **10 LECTURES**

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. Different types of Counters: Ripple Counter, Asynchronous and Synchronous Counters, UP/Down Counters, Modulo (MOD) Counters.

UNIT V SEQUENTIAL CIRCUIT DESIGN-II **10 LECTURES**

Shift Registers: Serial in ,Serial out, Parallel in Serial out Shift Registers, Parallel in Parallel out Shift registers, Bidirectional Shift Registers, Shift register counters, Shift Register Application, Application of Counters. Introduction to Synchronous sequential Machines.

REFERENCE BOOKS:

- M. Morris Mano. "Digital Logic and Computer Design",
- M. Morris Mano, "Digital Design" ,Pearson Education Asia,
- Thomas L Floyd "Digital Fundamentals"

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	1	2	3	1	1
CO2	2	2	1	-	1	2	1	-
CO3	1	1	-	1	1	2	-	-
CO4	2	1	-	-	2	3	-	-

MPH-214 ELECTRONICS-II

L-3, T-1, P-0 Credits–4 Max Marks: 100

Objective: This course will enable students to study the applications and operation of digital electronics.

Course outcomes:

CO1: Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.

CO2: Ability to identify basic requirements for a design application and propose a cost-effective solution.

CO3: To develop skill to build and troubleshoot digital circuits.

CO4: The ability to identify and prevent various hazards and timing problems in a digital design.

UNIT-I MICROWAVE & OPTICAL DEVICES: 10 LECTURES

Microwave Electronics. Characteristics. feature of microwave Application of microwave, Generation of microwave by tubes, Limitation of conventional tubes, Klystron, Reflex Klystron, Magnetron, Travelling wave tube.

Optical Devices: Laser and Laser resonator, LEDs, Semiconductor photo detectors; PINs and APDs, Photodiodes, APD, Photoconductor.

UNIT-II MICROWAVE MEASUREMENTS (FREQUENCY,POWER,IMPEDANCE). 10 LECTURES

Optical modulator: Electro optics modulation (amplitude and phase). Optical coupler: Coupling of light from one fiber to other with the use of evanescent wave, directional couplers, optical switch, phase, and amplitude modulator**.**

UNIT-IV WAVEGUIDE AND TRANSMISSION NETWORKS: 10 LECTURES

Wave guides coaxial, rectangular, and cylindrical; resonators; filters; couplers; branching networks. Antennas-dipole, array; reflectors, steering strip, microstrip and coplanar structure.

Feedback control systems: Feedback system, stability, performance criteria, servo systems, automatic control principle.

UNIT V 8085 MICROPROCESSOR:- 10 LECTURES

Microprocessor and its architecture and its operation , Memory interfacing, Addressing Modes ,Memory Mapped I/O , Introduction to 8085/8080A Instructions , Data Transfer Operation , Arithmetic Operation , Logic Operations, Branch Operation , Writing Assembly Language programs , Interrupts , Timing Diagram, and instruction executionin8085.

UNIT-VI INTERFACINGI/ODEVICES:- 10 LECTURES

Basic interfacing concept, Interfacing output Displays, Interfacing InputDevices,Intel8212I/Oport, Programmable Peripheral Interface Intel 8255 , Programmable Interrupt Controller Intel 8259A , Direct Memory Access(DMA)and8257DMA Controller. D/A Converter andA/D Converter.

REFERENCE BOOKS:

- P. Bhattacharya-Semiconductor opto electronics devices.
- RE Collin- Foundations of Microwave engineering.
- S.Y. Liao –Microwave Devices on circuits.
- J. Ryder– Networks, Lines and Field.
- A .Papoulis–Signal Analysis
- Electronic and Radio Engineering–F.E Terman.

- Digital Electronics By Goathmann.
- 7.Microwave:K.C.Gupta
- 2.Microwavecircuits:A.Y.Liyo
- Electronics communication system; George Kenedy

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	1	2	3	1	1
CO2	2	2	1	-	1	2	1	-
CO3	1	1	-	1	1	2	-	-
CO4	2	1	-	-	2	3	-	-

MPH-263: Electronics–I Lab

L-0, T-0 P-4 **Credits–2** **Max Marks: 100**

Objective: The aim of this course is to give an extended knowledge of digital electronics.

Course Outcomes:

CO1: To understand the working of digital circuits.

CO2: To understand the mechanism of adders.

CO3: Understand about the working of flip flops.

CO4: To know the working of counters, registers, and multivibrators

1. To verify the truth table of Logic gates.
2. To verify the truth table of Universal Logic gates.
3. To study half adder
4. To study full adder
5. To study S-R flip flop
6. To study JK flip flop
7. To study JKMS flipflop
8. To study counters
9. To study Registers
10. Study of IC -555 as a stable Stable multivibrator
11. Study of IC- 555as mono-stable multivibrator
12. Study of IC -555 as bi-stable multivibrator
13. Design and study of an ECLOR-NOR circuit

Note: Each student is required to perform at least 07 of the above experiments.

REFERENCE BOOKS:

1. Practical Digital Electronics by Nigel P. Cook-Goodreads

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	1	2	3	1	1
CO2	2	2	1	-	1	2	1	-
CO3	1	1	-	1	1	2	-	-
CO4	2	1	-	-	2	3	-	-

MPH-264: GENERAL PHYSICS LABORATORY-II

L-0, T-0 P-4 **Credits–2** **Max Marks: 100**

Objective: The aim of this course is to give an extended knowledge of general physics.

Course Outcomes:

CO1: To understand the working filters.

CO2: To understand the mechanism of phase shifters.

CO3: Understand about the working of microprocessors.

CO4: To know about the computer programs of performing various arithmetic operations.

List of experiments:

1. Design and study of an Active band pass filter Design and study of an active phase Shifter Design and study of an active phase shifter.
2. Write the following programs using 8085 Microprocessor:
   a. Addition of numbers using direct addressing mode
   b. Subtraction of numbers using direct addressing mode
   c. Addition of numbers using indirect addressing mode
   d. Subtraction of numbers using indirect addressing mode
3. Multiplication by repeated addition.
4. Division by repeated subtraction.
5. Handling of 16-bit Numbers.
6. Use of CALL and RETURN Instruction.
7. Arranging data in Ascending order
8. Arranging data in Descending order
9. Finding largest number
10. Finding smallest number

Note: Each student is required to perform at least 07 of the above experiments.

REFERENCE BOOKS:

- Microprocessor Architecture, Programming, and Applications with the 8085"by R Gaonkar
- "The 8051Microcontroller and Embedded Systems: Using Assembly and C" by Muhammad Ali Mazidi
- "Advanced Microprocessors and Peripherals" by A K Ray and K M Bhurchandi
- "Fundamentals of Microprocessors And Microcontrollers" Ram B
- "Introduction to Microprocessors and Microcontrollers" by Crisp John Crisp.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	-	2	2	2	1	1
CO2	1	-	1	-	1	-	1	-
CO3	1	3	-	3	1	2	-	-
CO4	2	-	-	-	2	1	2	-

SEMESTER-IV

MPH-221: MEASUREMENT TECHNIQUE

L-3, T-1 P-0 **Credits–4** **Max Marks: 100**

Objective: This course is to get exposure with various aspects of instruments and their usage through various modes.

Course outcomes:

CO1: The student will demonstrate an understanding of the basic principles, theories, and laws of physics through the description of physical systems and understanding.

CO2: Ability to understand construction of CRO.

CO3: To develop skill to understand the working of various generators and analysis instruments.

CO4: The ability to understand the working of various digital instruments.

UNIT-I:BASIC OF MEASUREMENT: **10 LECTURES**

Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage. Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier-amplifier. Block diagram ac milli voltmeter, specifications and their significance

UNIT-IICATHODE RAY OSCILLOSCOPE: **10 LECTURES**

Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac frequency, time. Special features of dual trace, introduction to digitaloscilloscope,probes.DigitalstorageOscilloscope:Blockdiagramandprincipleofworking.

UNIT-IIISIGNALGENERATORSANDANALYSISINSTRUMENTS: **10 LECTURES**

Block diagram, explanation, and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

UNIT-IV:IMPEDANCEBRIDGES&Q-METERS: **10 LECTURES**

Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q-Meter. Digital LCR bridges.

UNIT-V:DIGITALINSTRUMENTS: **10 LECTURES**

Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution.

REFERENCE BOOKS:

- Instruments &Instrumentation by A K Sawney
- Digital measurement techniques by T. S. Rathore
- Electronic Measurement Techniques by D. F. A. Edwards.
- Metrology & Measurement by Bewoor

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	3	-	2	2	2	1	1
CO2	2	-	1	-	3	2	1	-
CO3	1	2	-	1	1	2	-	-
CO4	1	3	-	-	2	1	-	-

MPH-222: NANO SCIENCE AND TECHNOLOGY DEPARTMENTAL ELECTIVE-II

L-3, T-1 P-0 **Credits–4** **Max Marks: 100**

Objectives: Introduction to the underlying principles and applications of the emerging field of nanotechnology and nanoscience along with practical synthesis of nanomaterials.

Course outcomes:

CO1: To develop the understanding of nano dimension in science.

CO2: To understand the quantum mechanical phenomena associated in nano materials.

CO3: To develop skill to understand various characterization techniques.

CO4: The ability to understand about various ceramic materials.

UNIT-1:INTRODUCTION TO NANO SCIENCE AND NANOTECHNOLOGY 10 LECTURES

Introduction on nanomaterials, Properties of materials & nanomaterials, role of size in Nanomaterials: nanoparticles, semiconducting nanoparticles, nanowires, nanoclusters, quantum wells, thin films, nano-compositor and advantages. Introduction to Carbon Nanostructures: Graphene, fullerenes, Carbon Nanotubes.

UNIT-II:QUANTUM MECHANICS FOR NANOSCIENCE 10 LECTURES

Electronic structure of 0-D, 1-D, 2-D, 3-D. Resonant tunneling quantized energy levels, Reflection and transmission by a potential step and by a rectangular barrier, band structure and density of states at Nanoscale. Semiconductorandmetallicdots,opticalspectra,Discretechargestates,Electricaltransport in0-D,coulombblockadephenomena.

UNIT-III: GROWTH TECHNIQUES OF NANOMATERIALS 10 LECTURES

Top-Down & Bottom-Up, Lithographic techniques, Non lithographic techniques, Fabrication of Nanomaterials by different Methods: -Inert gas condensation, Arc discharge, Sputtering, Laser ablation, Laser pyrolysis, Ball Milling, Molecular beam epitaxy, Chemical vapour deposition, Electro deposition , chemical precipitation, Sol gel and green synthesis.

UNIT-IV:CHARACTERIZATIONTOOLSOFNANOMATERIALSANDAPPLICATIONS 10LECTURES

X-ray diffraction, Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM), TEM, Scanning Tunneling Microscopy (STM), Atomic force Microscopy (AFM). UV-visible, FTIR and Raman spectroscopy. Nano sensors :biology and environment: Quantum dot, hetero structure laser and single electron devices**.**

UNIT-V:CERAMICMATERIALS 10LECTURES

Refractories, silica and silicates, glasses, glass-forming constituents, types of glasses, perovskite structure of mixed oxides, lime, cement, cement concrete, reinforced cement concrete (RCC),pre-stressed concrete, rocks and stones, clay and clay-based ceramics, chemically bonded ceramics.

REFERENCEBOOKS:

- Poole and Owens: Introduction to Nanotechnology
- Nanoscale materials-Liz Marzan and Kamat
- Nanoscience & Technology: Novel structure and phenomena by Ping Sheng (Editor)

- Nano Engineering in Science & Technology: An introduction to the world of nano design by Michael Rieth.
- Nano tubes and Nanowires-C N R Rao and A Govindaraj R C S Publishing
- Nalva: Handbook of Nano structured Materials and Nanotechnology

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	1	2	3	1	1
CO2	2	2	1	-	1	2	1	-
CO3	1	1	-	1	1	2	-	-
CO4	2	1	-	-	2	3	-	-

MPH-223: ELECTRONIC COMMUNICATION SYSTEM
(SPECIALIZATION ELECTIVE PAPER-III)

L-3, T-1 P-0 **Credits–4** **Max Marks: 100**

Objective: To understand the details of communication and transmission system.

Course outcomes:

CO1: To develop the understanding of communication system.

CO2: To understand the modulation and demodulation of frequency.

CO3: To understand the analog and pulse modulation.

CO4: The ability to understand about the broadband communication system.

UNITI: INTRODUCTION TO COMMUNICATION SYSTEM **10 LECTURES**

Information transmitter, channel noise, receiver, need for modulation bandwidth requirements, noise and its types, representation of AM, frequency spectrum, power relations in AM wave, techniques for generation of AM, AM transmitter, AM receiver types, single and multi-super hetro dyne receivers, communication receivers

UNITII: FREQUENCY MODULATION AND RADAR SYSTEM **10 LECTURES**

Description of FM systems, mathematical representation, comparison of wide band and narrow band FM, FM generation techniques, FM demodulators, FM receivers

UNIT-III: ANALOG MODULATION **10 LECTURES**

Fundamentals of modulation, Frequency spectra in AM modulation, power in AM modulated. class C amplifier, Efficiency modulation, linear demodulation of AM waves, frequency conversion, SSB system, Balanced modulation, filtering the signal for SSB, phase shift method, product detector,

UNITIV: PULSE COMMUNICATION **10 LECTURES**

Information theory, Pulse modulation: PAM, PTM, PWM, PPM, PCM(in brief), pulse modulation, types of pulse modulation, pulse amplitude modulation (PAM), pulse width modulation (PWM), pulse position modulation (PPM)and pulse code modulation (PCM), PCM transmission system, telegraphy.

UNITV: BROADB AND COMMUNICATION SYSTEM **10 LECTURES**

Frequency division multiplex (FDM), Time division multiplex (TDM), coaxial cables, fiber optics links, microwave links, tropospheric scatter links, submarine cables, satellite communication systems, elements of long-distance telephony

REFERENCE BOOKS:

- Haykin: Communication System
- Kennedy: Electronics and communication system
- Kulkarni: Microwave and radar engineering
- Roddy and Coolen: Electronics Communication

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	1	-	-	2	2	1	1
CO2	1	3	1	1	1	2	1	-
CO3	1	1	-	-	2	2	-	-
CO4	2	3	-	2	2	1	-	3

MPH-223: ELECTRONIC DEVICES

L-3, T-1 P-0 **Credits–4** **Max Marks: 100**

Objective: The aim of the course is to provide students with a thorough knowledge of Semiconductor.

Course outcomes:

CO1: To develop the understanding of microwave devices.

CO2: To understand the modulation and demodulation of frequency.

CO3: To understand the working of various memory devices.

CO4: The ability to understand about the radar systems.

UNITI:SEMI-CONDUCTOR DEVICES **10 LECTURES**

Review of p-n junction, metal semiconductor and metal oxide semiconductor junctions, review of JFET, MESFET and MOSFET-their frequency limits. Noise: Signal to noise ratio(SNR) and enhancement of SNR in instrumentation and communication

UNITII:MICROWAVE DEVICES **10 LECTURES**

Tunnel diode, transfer electron devices (Gunn diode), Avalanche transit time devices(Reed ,Impact diodes, parametric devices), vacuum tube devices, reflex klystron and magnetron.

UNITIII:MEMORY DEVICES **10 LECTURES**

Volatile static and D-RAM,CMOS and NMOS, nonvolatile-NMOS, ferroelectric semiconductors, optical memories, magnetic memories, charge coupled devices (CCD), Piezoelectric, pyroelectric, and magnetic devices, SAW and integrated devices.

UNITIV:EXTERNAL PHOTOELECTRIC EFFECT DETECTOR: **12 LECTURES**

Vacuum photodiode,photomultipliers,micro-channels,InternalPhotoelectric Effect detectors: PN junction photo diode, solar cell (open circuit voltage, short circuit current, fill factor), pin photodiode, avalanche photodiode, Phototransistor, Light emitting diode.

UNITV: RADAR SYSTEMS: **10 LECTURES**

Basics principals, pulsed radar systems, moving targets indication ,radar beacons, CW Doppler radar, frequency modulated CW radar, phased array radars, planar array, radar

REFERENCEBOOKS:

- Integrated Electronics By Millman & Halkias.
- Electronic Devices & Circuits By Millman & Halkias.
- Electronic Circuits –Discrete And Integrated By Schilling Belov.
- Micro Electronics By Millman And Grabel.
- Electronic Devices and Circuits –T.F. Bogart, J.S. Beasley and G. Rico, Pearson Education, 6th edition, 2004.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	-	2	2	3	3
CO2	1	3	1	-	1	2	1	-
CO3	1	3	3	-	2	2	-	-
CO4	2	3	-	-	2	1	1	-

MPH-271: MEASUREMENT TECHNIQUE LAB

L-0, T-0 P-4 Credits–2 Max Marks:100

Objective: The aim of this course is to give an extended knowledge of various measurement techniques.

Course Outcomes:

CO1: To understand the working of oscilloscope.

CO2: To understand the mechanism of multimeters.

CO3: Understand about the working of transformers.

CO4: To know the mechanism of balancing bridges.

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,
4. Use of Digital multimeter/VTVM for measuring voltages
5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil/transformer.
7. Study the layout of receiver circuit.
8. Troubleshooting a circuit
9. Balancing of bridges

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q-meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

Note: **Each student is required to perform at least 07 of the above experiments.**

REFERENCE BOOKS:

- A textbook in Electrical Technology- B L Theraja- S Chand and Co.
- Performance and design of AC machines-M G Say ELBS Edn.
- Electronic Devices and circuits, S. Salivahanan & N. S. Kumar, 3rd Ed., 2012,
- Tata Mc-Graw Hill Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008,
- Springer Electronic Devices, Thomas L. Floyd, 2008, Pearson India

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	1	-	-	2	2	1	1
CO2	1	3	1	1	1	2	1	-
CO3	1	1	-	-	2	2	-	-
CO4	2	3	-	2	2	1	-	3

MPH-273: ELECTRONIC COMMUNICATION SYSTEM
(SPECIALIZATION ELECTIVE PAPER-III) Lab
L-0, T-0 P-4 Credits–2 Max Marks:100

Objective: The aim of this course is to give an extended knowledge of electronic communication systems.

Course Outcomes:

CO1: To understand the working of modulation and demodulation.

CO2: To understand the mechanism of amplitude modulation.

CO3: Understand about the pulse modulation.

CO4: To know about the working of frequency modulation.

1. Study of Amplitude modulation & demodulation.
2. Study of frequency modulation & demodulation.
3. Study of phase modulation & demodulation.
4. Study of Amplitude shift keying.
5. Study of Phase shift keying.
6. Study of Frequency shift keying.
7. Study of Pulse Amplitude modulation & demodulation.
8. Study of Pulse frequency modulation & demodulation.
9. Study of pulse phase modulation & demodulation.
10. Study of pulse code modulation &demodulation.

Note: Each student is required to perform at least 07 of the above experiments.

REFERENCE BOOKS

- Communication Systems Engineering(2ndEdition):John G. Proakis
- Electronics Engineer's Reference Book- 6thEdition - Elsevier
- Electronic Communication System by-Kennedy

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	-	2	2	3	3
CO2	1	3	1	-	1	2	1	-
CO3	1	3	3	-	2	2	-	-
CO4	2	3	-	-	2	1	1	-