Credits :4 **Code:RR1PPH1**
Hours/Week : 6
Medium : English
Semester : 1

(For students admitted from 2015)

MATHEMATICAL PHYSICS

Unit 1: VECTOR FIELDS

Concept of vector and scalar fields – Gradient, divergence, curl and Laplacian Vector identities – Line , surface and volume integral- Gauss theorem, Green's theorem, Stoke's theorem and applications – Orthogonal curvilinear coordinates – expressions for gradient, divergence, curl and Laplacian in cylindrical and spherical co-ordinates.

Unit 2:
(a) Vector spaces

Definitions- Linear independence of vectors – Bilinear and quadratic forms – Schmidt's orthogonalisation process – Schwartz inequality.

(b) Tensors

Transformation of coordinates – Summation convention – Contravariant, covariant and mixed tensors – Rank of a tensor – Symmetric and antisymmetric tensors – contraction of tensors – Raising and lowering of suffixes – Metric tensors.

Unit 3: MATRIX THEORY

Solution of linear algebraic equations – rank of a matrix – Characteristic equation of a matrix – Eigen values and eigenvectors – Trace of a matrix- Cayley – Hamilton theorem – Reduction of a matrix to diagonal form – Hermitian and unitary matrices – Direct sum and products of matrices – Sylvester's theorem – Functions of matrices.

Unit 4: C LANGUAGE

Program structure – Constants, Variables and data types Operators and expressions – Managing input and output operations – IF statements – Switch statements – Goto Statements – Decision making and Looping : while, Do and For statements – Arrays – Handling of character Strings.

Unit 5: APPROXIMATE AND NUMERICAL METHODS – SOLUTIONS USING C PROGRAM

The method of least squares – Its matrix formulation – Numerical integration of first differential equations Trapezoidal rule – Simpson's rule (one third) – Error estimates – Euler and Runge – Kutta methods.

The Newton – Raphson method – Gauss elimination method – Evaluation of integrals by means of power series.

BOOKS FOR STUDY / REFERENCE:

1. A.W. Joshi, Matrices and Tensors in Physics, New Age International (P) Ltd., (1995).

2. P.K. Chattopadhyay, Mathematical Physics, New Age International (P) Ltd., (1990).

3. E. Kreyszig, Advanced Engineering Mathematics, 8th ed. John Wiley & Sons.(2006).

4. M.K. Venkataraman, Numerical methods in Science and Engineering, The National Publishing Company, Madras (1999).

5. S.S. Sastry, Introductory numerical methods, Prentice Hall of India (1998).

6. Programming in ANSI C, E. Balagurusamy-4th Edition, TMH Company Ltd., New Delhi, (2007).

7. Mathematical Physics, B.D Gupta- Vikas publishing house–4th Edition 2009.

8. Mathematical Physics, RajputB.S. –Pragati prakashan -23rd Edition-2011.

9. Numerical Methods, E. Balagurusamy- Tata McGraw Hill publishing Co.Ltd.,-1st Edition –(1999)

10. Numerical methods with programming in C – T.Veerarajan and T. Ramachandran – Tata McGraw Hill Publication co., Ltd., -2nd Edition -2005
11. Applied Mathematical for Engineers and Physicists –L.A. Pipes & Harvill L.R. – International student edition, Tata McGraw Hill Pub. Co.,(1970.)

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)

Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)

Part C 3x10 = 30 Answer Any **THREE** (One question from each unit)

Signature of the HOD

Credits : 5 **Code:RR1PPH2**
Hours/Week : 6
Medium : English
Semester : 1

(For students admitted from 2015)

CLASSICAL DYNAMICS & RELATIVITY

Unit 1: FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION

Mechanics of a particle and system of particles – Constraints – Generalized coordinates – D' Alembert's principle and Lagrange's equation – Hamilton's principle – Lagrange's equation of motion – Motion under central force: General features – The virial theorem – Applications.

Unit 2: LAGRANGIAN FORMULATION

(a) Rigid Body Dynamics

Euler angles – Moments and products of inertia – Euler's equations – Symmetrical top.

(b) Oscillatory Motion

Theory of small oscillations- Normal modes and frequencies -Two coupled harmonic oscillators- Linear triatomic molecule - Wave motion equation- Phase velocity, group velocity - dispersion.

Unit 3: HAMILTON'S FORMULATION

Hamilton's canonical equation of motion – Hamilton's equation from variational principle – Principle of least action – Canonical transformations – Poisson brackets – Hamilton – Jacobi method – Action angle variables – Kepler's problem in action angle variables.

Unit 4: NONLINEAR DYNAMICS

Linear and nonlinear oscillators -Phase trajectories- Fixed points and classification of fixed points - Period doubling phenomenon of doubling oscillators – Solitary waves – Numerical experiments of Kruskal and Zabusky Solutions.

Unit 5: RELATIVITY

Review of basic ideas of special relativity – Energy momentum four vectors – Minkowski's four dimensional spaces – Lorentz transformation as rotation in Minkowski's space – Thomas precession – Invariance of Maxwell's equation under Lorentz transformation

BOOKS FOR STUDY AND REFERENCE:

1.Classical Mechanics by Herbert Goldstein Narosa Publishing House,New Delhi(1996)

2. Classical Mechanics by Gupta Kumar,Pragathi Prakashan (2010).

3. M. Lakshmanan and K. Murali: Chaos in Nonlinear Oscillators, World Scientific Co., Singapore (1996) Chapter 2-4.

4..Lecture Notes from Centre for Nonlinear Dynamics, Department of physics, Bharathidasan University, Tiruchirapalli – 620024.

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions(Two questions from each unit)

Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)

Part C 3x10 = 30 Answer Any **THREE**(One question from each unit)

Signature of the HOD

Credits : 5 **Code:RR1PPH3**
Hours/Week : 6
Medium : English
Semester : 1

(For students admitted from 2015)

ELECTROMAGNETIC THEORY

Unit 1: ELECTROSTATICS

Coulomb's law, Gauss's law, Poisson and Laplace equations, multipole expansion of a charge distribution- electrostatic boundary conditions, calculation of potential: Laplace equation - method of separation of variables using Cartesian, Spherical, Cylindrical coordinates. Application to parallel, spherical, cylindrical condenser, the classic image, Position & Magnitude, Potential & Intensity, the induced surface charges, and the force between the charge and the plane.

Unit 2: MAGNETOSTATICS

Biot-Savart law: Long straight wire, Circular coil, Solenoid, the divergence and curl of B, Ampere's circuital law, application of Ampere's law - B due to long straight wire, Solenoid, Toroid, Force between two parallel wires, comparison of electrostatics and magnetostatics, magnetic vector potential, magnetostatic boundary conditions, multipole expansion of a current distribution, magnetic susceptibility and permeability.

Unit 3: ELECTROMAGNETISM

Displacement current –equation of continuity, energy in the electromagnetic field, Poynting's theorem, Poynting vector, Maxwell's equations, vector and scalar potentials, Gauge transformations - Lorentz gauge, Coulomb gauge.

Unit 4: PLANE ELECTROMAGNETIC WAVES AND WAVE PROPAGATION

Plane electromagnetic waves in free space, propagation of E.M.W in isotropic dielectrics, propagation of E.M.W. in anisotropic dielectrics-propagation of E.M.W. in conducting media-Propagation of E.M.W. in ionized gases, Reflection and refraction of E.M.W, Fresnel formulae, Brewster's Law and polarization of E.M.W, total internal reflection and critical angle.

Unit 5: RADIATING SYSTEMS

Oscillating electric dipole, Radiation from an oscillating dipole, Electric quadrupole Radiation, Radiation from a small current element, Radiation from a linear antenna, Radiation from a linear half wave antenna, antenna arrays.

BOOKS FOR STUDY:

1. K.L. Chopra, G.C. Agrawal K. Nath & Co Meerut. Electromagnetic theory. (Electrodynamics 2005)

2. J.D. Jackson, Classical Electrodynamics, Wiley Eastern, 1988.

3. Satyaprakash Kedarnath & Ramnath & Co Meerut. Electromagnetic Theory and Electrodynamics-2005.

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)

Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)

Part C 3x10 = 30 Answer Any **THREE** (One question from each unit)

Signature of the HOD

Credits : 5 **Code:RR1PPHP1**
Hours/Week : 6
Medium : English
Semester : 1

(For students admitted from 2015)

PHYSICS PRACTICALS - I

(GENERAL & ELECTRONICS)

Any **Fifteen** experiments (Choosing a minimum of **seven** experiments from each part)

A. GENERAL EXPERIMENTS

1. Determination of q, n, σ by elliptical fringes method.
2. Determination of q, n, σ by hyperbolic fringes method.
3. Determination of Stefan's constant.
4. Identification of prominent lines by spectrum photography – Copper spectrum.
5. Identification of prominent lines by spectrum photography – Iron spectrum
6. Determination of e / m of an electron by magnetron method
7. Determination of e / m of an electron by Thomson's method
8. Determination of L of a coil by Anderson's method.
9. Photoelectric effect (Planck's constant Determination).
10. Stefan's Law - Verification.
11. Determination of e/m – magnetron.
12. Laser grating - Determination of λ.

B. ELECTRONICS EXPERIMENTS

1. Construction of transistorized power supply using bridge rectifier.
2. Design and study of monostable multivibrator
3. Design and study of bistable multivibrator.
4. Design and study of Wein bridge Oscillator (Transistor)
5. Design and study of Phase shift Oscillator (Transistor)
6. Characteristics of FET.
7. Characteristics of UJT.
8. Characteristics of SCR.
9. Characteristics of LDR.
10. FET oscillator.
11. Transistor power amplifier.
12. Relaxation oscillator using UJT.
13. Study of a feedback amplifier – Determination of band width, input and output impedances.

Question Paper Pattern:

Maximum Marks : 60
Exam Duration : 4 Hours

Signature of the HOD

Credits : 4 **Code:RR1PPHEL1**
Hours/Week : 6
Medium : English
Semester : 1

(For students admitted from 2015)

COMMUNICATION ELECTRONICS

Unit 1: ANTENNAS

Antennas – Equivalent circuits – Thin linear antenna – Loop antennas – Radiation fields – Polarization – Isotropic radiator – Power gain – Effective parameters of an antennas – Dipole arrayed antennas – HF, UHF and Microwave antennas

Unit 2: MICROWAVE GENERATION AND APPLICATION

Klystron – Magnetron – Traveling Wave Tube – Microwave Propagation through waveguides – HOI and EOI modes – Attenuators – Crystal Detection – Measurement of SWR – Radar equation – Detection and ranging – Transmitters and Receivers.

Unit 3: COMMUNICATION SYSTEMS

Amplitude modulation – AM transmitters-Single side Band Principles – Balanced Modulator – SSB Generation and Reception – Frequency Modulation – FM transmitters – FM detectors – Pulse Modulation – Pulse Time Modulation –Pulse Width Modulation – Pulse Code Modulation – Delta Modulation.

Unit 4: OPTIC FIBER COMMUNICATION

Introduction – Electromagnetic wave Propagation in step index fiber and graded index fibers – Single mode fiber – Types of single mode fibers – Fiber parameters – Sources and detectors (semiconductor types) – Optic fiber communication system.

Unit 5: MULTIPLE ACCESS METHODS AND NETWORKS

Frequency Division Multiple Accessing (FDMA) – Time Division Multiple Accessing (TDMA) – Carrier Sense Multiple Accessing (CSMA) – ALOHA – Code Division Multiple Accessing (CDMA)

Types of Networks (Circuit Switching, Message Switching, Packet - switched Networks) – Design features of Computer Communication Networks – ISDN – LAN – WAN – OSI Protocol of Network Architecture – Introduction to Mobile Telephone Communication (The Cellular concept).

BOOKS FOR STUDY / REFERENCE:

1. Dennis Ruddy and John Coolen, Electronic Communications. PHI, New Delhi(1991)

2. G.Kennady, Electronic Communication systems, Tata Mc Graw Ltd. (1999).

3. Gowar, Optical Communication, Prentice Hall of India Ltd. (1993).

4. H.Taub and D.L.Schilling, Principles of Communication Systems, Tata Mc GrawHill Edition(1986).

5.Louis E.Frenzel, Coomunication Electronics Principles and Applications, Tata Mc GrawHill Edition.(2006).

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)

Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)

Part C 3x10 = 30 Answer Any **THREE** (One question from each unit)

Signature of the HOD

Credits : 5 **Code:RR2PPH4**
Hours/Week : 6
Medium :English
Semester : 2

(For students admitted from 2015)

QUANTUM MECHANICS

Unit 1: FORMULATION OF QUANTUM MECHANICS

Derivation of Schrodinger's wave equation - Physical interpretation and condition on the wave function –Box normalization -Expectation value – Ehrenfest Theorem – Postulates in Quantum mechanics – Heisenberg's uncertainty Principle.

Unit 2: OPERATOR FORMALISM

Operator formalism – Linear operators – Self ad joint operators – Parity operator – Commutators – Simultaneous Eigen Functions – Physical meaning of Eigen functions and Eigen values.

Exactly solvable systems:

Particle in a box – Square well Potentials – Linear harmonic oscillator – Rigid Rotator – Hydrogen atom.

Unit 3: APPROXIMATION METHODS.

Time independent perturbation theory:

Non - Degeneration case. First and Second order perturbation – Degenerate case – Stark effect – Variation method – Applications.

Time dependent perturbation theory:

Constant perturbation – Harmonic perturbation – Stimulated emission and absorption – Einstein's coefficients.

Unit 4: ANGULAR MOMENTUM

Angular momentum operators in Spherical polar coordinates – Eigen value spectrum – commutation relations of J , Jx , Jy, Jz ,Jx + - Eigen value spectrum of J and Jz by commutation relation – Matrix representation of J , Jx , Jy ,Jz.

Matrix mechanics – Schrodinger's picture – The Heisenberg picture – the interaction picture – Dirac's Bra and Ket Vectors – Hilbert space.

Unit 5: RELATIVISTIC WAVE MECHANICS

The Klein – Gordan equations – Charge and current densities – Dirac's equation – Dirac's Relativistic Hamiltonian – Dirac's Matrices – Free particle solutions – Significance of negative energy states – spin angular momentum.

BOOKS FOR STUDY:

1. Quantum Mechanics - Satya Prakash, Pragati Prakashan Meerut, (2013).
2. Quantum Mechanics by Ajoy Ghatak, S. Lokanathan, Springer Science, Kulwer Academic Publisher, (2004)
3. Quantum Mechanics Leonard I. Schiff , Tata McGraw Hill New Delhi. (1968.)

REFERENCES:

1. A Text Book Of Quantum Mechanics – P. M .Mathews and Venkatesan – Tata McGraw Hill (1976).
2. Advanced Quantum Theory and Fields - S.L. Gupta I. D. Gupta S. Chand and company
New Delhi,(1982)
3. Angular momentum Techniques in Quantum Mechanics – V. Devanathan, Springer,(1999).

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)

Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)

Part C 3x10 = 30 Answer Any **THREE**(One question from each unit)

Signature of the HOD

Credits : 5 **Code:RR2PPH5**

Hours/Week : 6

Medium : English

Semester : 2

(For students admitted from 2015)

NUCLEAR AND PARTICLE PHYSICS

Unit 1: NUCLEAR STRUCTURE

General properties of Nucleus -Nuclear radius, charge, spin and magnetic moment –Nuclear mass – Binding energy –Nuclear stability- Semi empirical mass formula –Mass parabolas –Liquid drop model – magnetic moment and the shell model

Nuclear Forces: Deuteron-Basic properties – Ground state of deuteron-Meson theory of nuclear forces-Yukawa potential.

Unit 2: RADIOACTIVE DECAYS

Geiger -Nuttal law-Gamow's theory of Alpha decay –Pauli's Neutrino hypothesis – Fermi's theory of beta decay – Selection Rules – Non conservation of parity in beta decay – Gamma ray emission-Selection rules-Multi polarity in Gamma transition -Internal conversion – Nuclear isomerism.

Radioactive growth and decay- Ideal equilibrium-Transient equilibrium-secular equilibrium-Determination of the age of the earth –carbon dating.

Unit 3: NUCLEAR FISSION

Types of Fission-– Mass and kinetic energy distribution of fission fragments – Neutron emission in fission –Fissile and fertile materials- Spontaneous fission – Deformation of Liquid drop –Bohr wheeler theory of nuclear fission – Quantum effects - Nuclear chain reactions – critical size -Four factor formula(derivation)-General aspects of nuclear reactor design – Classification of reactors – power and breeder reactor

Nuclear fusion – Solar fusion – Controlled thermonuclear reactions – Thermo nuclear bomb- Pinch effect- comparison of fission and fusion.

Unit 4: NUCLEAR REACTIONS

Kinds of nuclear reactions – Conservation laws-nuclear reaction kinematics- Q-value determination (relativistic and non-relativistic) -- Level width-Nuclear cross sections – Partial wave analysis of scattering and reaction cross section –Different stages of nuclear reaction - Compound nucleus –Formation and decay - Direct reactions- Theory of Stripping and pick-up reactions- Resonance scattering – Breit – Wigner formula derivation – Scattering amplitude – Expression in terms of Green's function – Born approximation and its validity .

Unit 5: ELEMENTARY PARTICLES

Four types of interactions - classifications of elementary particles – Conservation laws - Isospin –Hyper charge – Strangeness quantum numbers – Parity – charge conjugation – Time reversal – Quark model – SU (3) Multiplets of Hadrons – Discovery of Hyperon – μ mesons – pi mesons – k-mesons CP violation in neutral k- mesons decay – Baryons – Leptons.

BOOKS FOR STUDY :

1. Elements for Nuclear Physics –M.L. Pandya & R.P.S. Yadav-Kedernath & Ramnath.
2. Nuclear Physics- S.B.Patel- New Age International.(1991).
3. Nuclear Physics –D.C.Tayal-Himalaya Publications.(1998).
4. Physics of the Nucleus –Gupta & Roy –Books & Allied.

BOOKS FOR REFERENCE:

1.Nuclear Physics-R.R.Roy & B.P.Nigam Wiley Eastern India.(1967).
2.Nuclear Physics-Srivastva.B B (2011). Indian Books Limited.
3.Atomic and Nuclear Physics-Shatendra Sharma.Pearson Edition (2012)

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)
Part B 5x 5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)
Part C 3x10 = 30 Answer Any **THREE** (One question from each unit)

Signature of the HOD

Credits : 5 **Code:RR2PPH6**

Hours/Week : 6

Medium : English

Semester : 2

(For students admitted from 2015)

CONDENSED MATTER PHYSICS

Unit 1 :CRYSTAL STRUCTURE:

Two Dimensional Bravais lattices - Three Dimensional Bravais lattices - X-ray Diffraction – Laue Equations - Interpretation of Bragg's equation – Ewald construction - Reciprocal Lattice - Properties of Reciprocal Lattice – Imperfection in crystals – Thermal Vibration point defects, Line defect and surface defects .

Unit 2: THERMAL PROPERTIES OF SOLIDS:

Lattice heat capacity – Planck distribution – Einstein model – Debye model of the Lattice heat capacity – Thermal conductivity of solids - Thermal conductivity due to electrons and phonons – Thermal resistance of solids – anharmonicity and thermal expansion.

Unit 3 :CONDUCTORS AND SUPERCONDUCTORS:

Electrical conductivity and ohms law – Weidemann – Franz Law – Lorentz Law – electrical resistivity of metals – nearly free electron model – Tight binding approximation – experimental study of Fermi surface (anomalous skin effect, cyclotron resonance de Hass – Van Alphen Effect) - Meissner effect – Thermodynamics of superconductivity transistion – Origin of energy gap – London Equation - Coherence length - BCS theory – Type I and Type II Super Conductors – Josephson Effect.

Unit 4: SEMICONDUCTORS AND DIELECTRICS:

Carrier concentration in semiconductors – mobility of charge carriers - effect of temperature on mobility - electrical conductivity in semiconductors - Hall effect in Semiconductors - Macroscopic electric field – Local electric field at an atom - Dielectric Constant and Polarizability – Classical theory of electronic Polarizability – Piezo - Pyro Ferro electric properties of crystals – Ferro electricity.

Unit 5:MAGNETIC PROPERTIES OF SOLIDS:

Origin of permanent magnetic moments – Langevin's classical theory of diamagnetism and paramagnetism – Quantum theory of Paramagnetism- Ferromagnetism – Weiss molecular field – Temperature dependence of spontaneous magnetisation- Ferromagnetic domains-domain theory of ferromagnetism – Antiferromagnetism – Ferrimagnetism.

BOOKS FOR STUDY / REFERENCE:

Kittel. Introduction to Solid State Physics. 5th Edition. John Wiley and sons New Delhi. (2003).
J. Dekker, Solid State Physics. Macmillan. Madras. (1971).
N.W Asheroft and N.D. Mermin, Solid State Physics, Holt Reinhart and Winston, International Edition, Philadelphia (1978)
R.L.Singhal. Solid State physics, Kedarnath and Ramnath and Co. Mccrut, 3rd Edition. New Delhi (1987)
J.P.Srivastava, Elements of Solid state physics, Second EditionPrenlice Hall of India, New Delhi 2008.

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)
Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)
Part C 3x10 = 30 Answer Any **THREE** (One question from each unit)

Signature of the HOD

Code:RR2PPHP2

Credits : 5
Hours/Week : 6
Medium : English
Semester : 2

(For students admitted from 2015)
PHYSICS PRACTICAL – II
ADVANCED GENERAL EXPERIMENTS
(Any Fifteen)

1. Four probe method – Determination of resistivity of powered samples.
2. Determination of carrier concentration and Hall coefficients in semiconductors.
3. Determination of magnetic susceptibility of liquid by Guoy method.
4. Determination of magnetic susceptibility of powered sample Guoy method.
5. Determination of magnetic susceptibility of solid in the form of thin rod by Guoy method of liquids.
6. Determination of magnetic susceptibility of liquids by Quincke's method.
7. Determination of dielectric constant of a liquid by RF oscillator method.
8. Determination of wavelength and thickness of film by using Michelson's interferometer.
9. Brass spectrum – Determination of composition.
10. Determination of wavelength and fine structure using – F.P etalon
11. Thickness and resolving power of LG Plate.
12. Iodine characteristics absorption spectra.
13. Charge of an electron by spectrometer.
14. Polarizabillity of liquids by finding the refractive indices at different wavelengths.
15. Determination of wage length of monochromatic source using biprism
16. Determination of refractive index of liquids using biprism (by scale & telescope method).
17. Determination of e/m of an electron by Zeeman Effect (L.G. plate).
18. Determination of specific rotatory power of a liquid using polarimeter.
19. Rydberg's constant using spectrometer.
20. Magneto resistance of power samples using CF Bridge
21. Forbe's method of determining thermal conductivity.
22. "G "Factor determining by using ESR spectrometer.
23. Optical Fiber – measurements of attenuation coefficient and Numerical aperture.
24. Determination of bulk modulus of a liquid by ultrasonic wave propagation.
25. Determination of dielectric constant at high frequency by Lecher Wire.

Question Paper Pattern:
Maximum Marks : 60
Exam Duration : 4 Hours

Signature of the HOD

Credits : 4 **Code:RR2PPHEL2**
Hours/Week : 6
Medium : English
Semester : 2

(For students admitted from 2015)

APPLIED MATHEMATICAL PHYSICS

Unit 1: COMPLEX VARIABLES

Functions of a complex variable – Differentiability – Cauchy – Riemann conditions – Integrals of complex functions – Cauchy's integral theorem and integral formula – Taylor's and Laurent's Series – Residues and singularities – Cauchy's residue theorem.

Unit 2: FOURIER SERIES AND INTEGRAL TRANSFORMS

Fourier series – Dirichlet's conditions – Sine and cosine series – Fourier integrals – Fourier transforms – Faltung theorem – Application to heat and wave equations .

Unit 3: GREEN'S FUNCTIONS AND INTEGRAL EQUATIONS

Green's functions – properties – Methods of solutions in one dimension - Linear integral equations – Fredhelm and Volterra type – Neumann series – Eigen function expansion-Applications.

Unit 4: SPECIAL FUNCTIONS

Gamma and Beta functions – Series solution – Legendre, Bessel and differential equation, laguerres differential equation and their solution – Rodrigue's formula –strum Liouville theorem - Generating functions – Orthogonality relations.

Unit 5: GROUP THEORY

Basic definitions – Multiplication table – Subgroups, Cosets and classes – Direct product groups – point groups and space groups – Representation theory – Homomorphism & Isomorphism – Reducible and irreducible representations – Schur's lemmas – The great Orthogonality Theorem – Charactor Tables – C2V.

BOOKS FOR STUDY:

1. Sathya Prakash,Mathematical Physics, Sultan Chand &Sons , New Delhi (2010).

2.H.K. Dass Mathematical Physics, S.Chand & Company Ltd,New Delhi (1997).

BOOKS FOR REFERENCE:

1. L.A. Pipes and L.R. Harvill, Applied Mathematics for Engineers and Physicists, International Student Edition, McGraw Hill, Book Company, Singapore, (1970).
2. A.W. Joshi, Elements of Group Theory, for Physicists, Wiley Eastern Ltd., New Delhi (1982).
3. F.A. Cotton, Chemical Applications of Group Theory, Wiley Eastern Ltd., New Delhi (1987).
4. P.K. Chattopadhyay, Mathematical Physics, Wiley Eastern Ltd., New Delhi (1990).
5. E. Kreyszig, Advanced Engineering Mathematics, 8^{th} ed. John Wiley, NY, 1999.

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)

Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)

Part C 3x10 = 30 Answer Any **THREE**(One question from each unit)

Signature of the HOD

Credits : 5 **Code:RR3PPH7**
Hours/Week : 6
Medium : English
Semester : 3

(For students admitted from 2015)

STATISTICAL MECHANICS

Unit 1: STATISTICAL THERMODYNAMICS

Energy and first law of thermodynamics - Heat content and Heat capacity-Specific heat – Entropy and second law of thermodynamics – thermodynamic potential and the reciprocity relations – Maxwell's relations – Deductions – Properties of thermodynamic relations – Gibb's-Helmholtz relation - Nernst Heat theorem of third law – consequences of third law –Gibb's phase rule – chemical potential.

Unit 2: KINETIC THEORY

Boltzmann transport equation and its validity - Boltzmann's H-theorem and its analysis – Maxwell – Boltzmann distribution - method of most probable distribution - Transport phenomena- Mean free path - Conservation laws - Zero and first order approximations – Viscous hydrodynamics – Navier – Stoke's equation.

Unit 3: CLASSICAL STATISTICAL MECHANICS

Macro and micro states – statistical equilibrium – Phase space and Ensembles – Micro canonical ensemble and Grand canonical ensembles – Liouville's theorem – Maxwell – Boltzmann distribution law - Principles of equipartition of energy – Partition function – Relation between partition function and thermodynamic quantities

Unit 4: QUANTUM STATISTICAL MECHANICS

Black body and Planck's radiation – Photons – Specific heat of solids – Einstein's Quantum theory – Debye's quantum mechanical theory –Ideal Gas - Energy, pressure and thermal properties – Bose – Einstein condensation – Liquid helium – Fermi – Dirac gas – Properties – Degeneracy – Electron gas – Free electron model and thermionic emission.

Unit 5: ADVANCED TOPICS IN STATISTICAL MECHANICS

Ising and Heisenberg models – Elements of non-equilibrium – phenomena – Fluctuations – Weiner – Khinchine theorem – Thermodynamics of irreversible processes – Onsager's reciprocity relations.

BOOKS FOR STUDY / REFERENCE:

1. F. Reif, Statistical and Thermal physics, McGraw Hill, International Edition, Singapore (1979)

2. B.R. Agarwal and N. Eisnor, Statistical Mechanics, Wiley Eastern Limited, New Delhi, 2nd ed.

3. R. Huang, Statistical Mechanics, Wiley Eastern Ltd., New Delhi, (1983)

4. F. Mandl, Statistical physics, John Wiley, London, (1971)

5. C. Kittel, Thermal physics, 2nd Edn.(1980). Publisher Alexis Hart.

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)

Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)

Part C 3x10 = 30 Answer Any **THREE** (One question from each unit)

Signature of the HOD

Credits : 5 **Code:RR3PPH8**
Hours/Week : 6
Medium : English
Semester : 3

(For students admitted from 2015)

SPECTROSCOPY

Unit 1: HIGH RESOLUTION SPECTROSCOPY & IR SPECTROSCOPY:

High Resolution Spectroscopy :

Lummer – Gherke Interferometer – Fabrey–Perot interferometer – Michelson interferometer – Applications.

IR Spectroscopy:

Introduction - Vibrating diatomic molecule as a Harmonic Oscillator – as a Unharmonic Oscillator – parallel bonds of Symmetric Top Molecules –Perpendicular Bonds of Symmetric Top Molecules – IR spectrometer.

Unit 2: APPLICATIONS IN ATOMIC AND MOLECULAR STRUCTURES

Central field approximation – Thomas – Fermi model – Hartree's self-consistent field method – Hartree-Fock equation – Hydrogen ion – Hydrogen molecule Born Opponheimer approximation – Heitler London theory of hydrogen.

Molecular Orbital Theory – LCAO treatment of molecular orbitals of C_2H_6 and C_2H_4 – Hueckel's molecular approximation .

Unit 3: MICROWAVE SPECTROSCOPY

Rotational spectra of diatomic molecules – Rigid rotator –Frequency of rotational spectral lines – selection rule of rotational spectra – diatomic molecule as a non-rigid rotator - Rotational Spectra of polyatomic molecules – Linear –Symmetric - asymmetric top molecules- microwave spectrometer – construction and working – applications

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Unit 4: RAMAN AND ELECTRONIC SPECTROSCOPY

Raman effect –properties of Raman lines – difference between Raman and IR spectra - quantum theory of Raman effect – Pure rotational spectra - vibrational rotational Raman spectra – Raman spectrometer – applications.

Progressions and sequences - Franck – Condon principle – Rotational fine structure of electronic vibration spectra – Fortrat diagram.

Unit 5: RESONANCE SPECTROSCOPY

NMR – Basic principles – Quantum description – Bloch equations – Spin Lattice Relaxation – Spin–Spin Relaxation– chemical shift - Single Coil and double Coil NMR Spectrometer

ESR principle – ESR theory– ESR Spectrum – g Factor - Hyperfine structure of hydrogen, deuterium Tritium – ESR Spectrometer – Applications.

BOOKS FOR STUDY :

1. Molecular structure and Spectroscopy-G.Aruldhas-PHI Publishers.(2004)
2. Atomic and Molecular Spectra, Laser-Rajkumar-Kedernath & Ramnath.
3. Elements of Spectroscopy- Gupta,Kumar,Sharma-PragatiPrakashan Publications.

BOOKS FOR REFERENCE :

1.Introduction to Atomic Spectra – White –PH –New Delhi.(1934).
2. Fundamentals of molecular spectroscopy – C.N.Banwell – McGraw Hill. (1966).
3. Spectroscopy – B.P.Straughan and S.Walker – Science paperback. (1976)

Question Paper Pattern:
Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)
Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)
Part C 3x10 = 30 Answer Any **THREE** (One question from each unit)

Signature of the HOD

Credits : 5 **Code:RR3PPH9**
Hours/Week : 6
Medium : English
Semester : 3

(For students admitted from 2015)

MICROPROCESSOR AND MICROCONTROLLER

Unit I: INTEL 8085

Basic components of a digital computer – CPU – I/O – Memory – Semiconductor memory Microprocessor INTEL 8085 architecture – Pin diagram – Various registers – Timing and Control unit.

Instruction cycle – Fetch – Execute operation – Machine cycle and state – Instructions and data flow – timing diagram – timing diagram for opcode fetch cycle – Memory read cycle – I/O read cycle – memory write cycle – I/O write cycle.

Unit II: ASSEMBLY LANGUAGE PROGRAMMING

Instruction set – Data transfer group – Arithmetic group – Logical group – Branch group – Machine control group – Addressing modes – Stack – Subroutine – Macro – Delay subroutine.

Assembly language programme – addition – subtraction – Multiplication – BCD arithmetic – To find the biggest and smallest number in a data array – arranging a list of numbers in ascending or descending order-complement, shift.

Unit III: PERIPHERAL DEVICES AND THEIR INTERFACING

Interfacing memory and I/O devices – I/O mapped I/O and memory mapped I/O – Memory and I/O interfacing – Data transfer schemes – Programmable Peripheral Interface (PPI) INTEL 8255 -Programmable DMA controller INTEL 8257 —Programmable Interrupt Controller (PIC) INTEL 8259 - USART 8251.

Unit IV: MICROCONTROLLER – 8051

Overview of 8051 Family – pin descriptions of 8051 – Registers – Program counter – Stack ,PSW, SFR – Addressing modes – Jump Call Instructions – Time delay generations and Calculations - Arithmetic and Logic instructions –Bit instructions – Assembly Language Programming.

Unit V: MICROPROCESSOR AND MICROCONTROLLER APPLICATIONS
Microprocessor interfacing and applications:

Interfacing 7 segment LED display - temperature measurement – Measurement of frequency, voltage and current – traffic control interfacing.

Microcontroller interfacing and applications:

Interfacing – Interfacing of Stepper motor- keyboard Interface.

BOOKS FOR STUDY :

1. B. Ram, Fundamentals of Microprocessors and Microcomputers, 5th edn, Dhanapat Rai Publications (P) Ltd., New Delhi (2001).

2. Muhammad Ali Mazidi, Janice Gillispie Mazidi – the 8051 Microntroller and Embedded systems, pearson education, Delhi, Seventh Indian reprint 2004.

BOOKS FOR REFERENCE:

1.Ramesh S. Goankar, Microprocessor Architecture Programming and Applications with the 8085, 5th edn., Pergaman International Publishing (India) Pvt.Ltd.
2. A.P. Godse, Microprocessors and its Applications(First Edition Pune 2006).
3. A.Nagoor kani,Microprocessor and Microcontroller's ,RBA Publications,Chennai-2006.

Question Paper Pattern:
Maximum Marks : 75
Exam Duration : 3 Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit).
Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit).
Part C 3x10 = 30 Answer Any **THREE** (One question from each unit.

Signature of the HOD

Credits : 5 **Code: RR3PPHP3**
Hours/Week : 6
Medium : English
Semester : 3

(For students admitted from 2015)

PRACTICAL – III

Paper III and IV

Select at least Three experiments from each of Four groups and a minimum of Fifteen experiments for each semester (III & IV)

Group A-Analog Experiments

1. Construction of dual power supply for IC experiment 0-5V,9-0-9V.
2. Characteristics of Op-amp, open loop ,closed loop gain, input impedance, output impedance,C.M.R.R.
3. Op-amp – Adder, subtracter, sign changer, differentiator and integrator
4. Op-amp Low pass, high pass filters.
5. Op amp- band pass and all pass filters.
6. Op-amp Frequency divider and Schmitt trigger.
7. Op-amp-sine wave –Wien's oscillator
8. Op amp- square, triangular & ramp wave generator.
9. Op-amp log, antilog and II order transfer function amplifier.
10. Op-amp- solving simulataneous equations.
11. One-Shot multivibrator – using ICs – determination of pulse width.

Group B-Digital Experiments

1.IC-Universal gates NAND and NOR.

2. Half adder and full adder using NAND gates.

3. Half and Full subtractors.

4. Multiplexer – Demultiplexer.

5. Study of Flip-Flops.

6. Verification of DeMorgan's theorem using NAND gates and simplification of Boolean expressions.

6. Simplification of Boolean expressions by Karnaugh map and verification of Boolean expressions.

8. One bit digital comparator using EXOR and NAND gates

9. Frequency divider using IC 555.

10. Study of counter 7490 (0-9 and 0-99).

11. Study of 7 segment display decoders- 7447.

12. Shift registers using IC.

13. D/A conversion – R- 2R and weighted resistor network – to determine the Resolution Linearity and dual slope.

14. A/D conversion – successive and dual slope.

15. Study of memory circuits – RAM, ROM, EPROM,PROM

16. Digital comparator – 4 bit using ICs.

17. Study of modulation and demodulation using IC

Group C-Microprocessor 8085 Experiments

1. 8-bit addition , subtraction, multiplication and division using 8085/ z80

2. 16 bit addition, 2's complement and 1's complement subtraction

3. Conversion from decimal to octal, hexa decimal system.

4. Conversion from octal, hexa to decimal system.

5. Interfacing hexa key board (IC 8212)

6. Study of seven segment display add on board.

7. Study of DAC interfacing (DAC 0800)

8. Study of ADC interfacing (ADC 0809)

9. Study of timer interfacing (IC 8253)

10. Study of programmable interrupt controller (IC 9259)

11. Traffic control system using Microprocessor.

12. Microprocessor as digital clock.

13. Generation of square, triangular, saw tooth staircase and sine waves using DAC 0800.

14. Microprocessor interface as digital thermometer.

15. Control of stepper motor using microprocessor.

16. Microcontroller – Mathematical operations.

17. Microcontroller – Ascending and Descending.

18.Microcontroller- smallest and biggest.

Group D-Computer- C Programme

1. Solving equations by Newton – Raphson's method.
2. Solving equations by Successive approximation method.
3. Solution of simultaneous linear algebraic equations by Gauss elimination method.
4. Solution of simultaneous linear algebraic equations by Gauss-Seidal method.
5. Interpolation and Extrapolation of data using Least square curve fitting method.
6. Interpolation and Extrapolation of data using Lagrange and Newton Method.
7. Numerical Integration by Simpson method.
8. Numerical Integration by trapezoidal Method.
9. Numerical differentiation by Euler Method.
10. Numerical differentiation by Runge Kutta method (II order)
11. Numerical Integration by Gauss – Lagrange Quadrature.

Maximum Marks : 60
Exam Duration : 4 Hours

Signature of the HOD

Credits : 4 **Code:RR3PPHEL3**
Hours/Week : 6
Medium : English
Semester : 3

(For students admitted from 2015)

THIN FILM PHYSICS

Unit I: INTRODUCTION

Thin films: an over view – Advantages of thin film devices over their bulk counterparts-Film growth stages- Nucleation stage - Island structure stage-Coalescence stage- Channel stage and continuous film stage - Crystal structure and imperfections: classification of crystals - crystal lattice and unit cell – Crystal planes and Miller indices – Crystal system and symmetry- Interplanar spacing-crystal imperfections-point defects- line defects-surface defects-volume defects-colour centers

Unit II : DEPOSITION TECHNIQUES

Physical deposition methods:Vacuum evaporation- Thermal evaporation - Electron beam evaporation- Flash evaporation- Reactive evaporation-Pulsed laser deposition - Molecular beam epitaxy – Sputtering techniques.

Chemical deposition methods: chemical vapour deposition- closed space sublimation- Spray pyrolysis – Chemical bath deposition –Electro-less plating- Electro chemical deposition – Sol-gel technique – Spin coating- SILAR method.

Unit III: THICKNESS, STRUCTURAL AND ELECTRICAL PROPERTIES

Thickness measurement: Weight gain method- surface profilometer- optical interference method – multiple beam interferometry – ellipsometry-Fizeau method

Structrual properties: X-ray diffraction- Powder diffraction technique for polycrystalline thin films-Determination of structural parameters.

Electrical properties: Electrical resistivity- Sheet resistance - Four point probe method –van der Pauw technique - Hall probe method to find mobility, Carrier concentration and resistivity.

Unit IV: OPTICAL, SURFACE AND MAGNETIC STUDIES

Optical properties: UV-vis-NIR spectrophotometer- Transmission and absorption spectra of thin films- Optical band gap - absorption co-efficient- Photoluminescence spectroscopy

Surface morphological properties: scanning electron microscopy (SEM)-atomic force microscopy (AFM)- transmission electron microscopy (TEM) –scanning tunneling microscopy (STM) .

Magnetic properties of thin films- VSM-SQUID.

Unit V: APPLICATIONS

Discrete resistive components- Thermistor, Varistor, Strain gauge element- Capacitor- Hall probe element- Active devices- Micro electronics, Integrated circuits and other applications- Interference filters- Anti -reflection coatings –spintronics -Thin film gas sensors- Solar cell applications.

BOOKS FOR STUDY AND REFERENCE

1. Thin film fundamentals- A. Goswami (New Age, New Delhi, 1996)
2. Thin film phenomena- K. L.Chopra (Robert E. Krieger Publishing company, 1979)
3. Hand book of thin film technology - L. T. Maissel & Gang (McGraw Hill, New York, 1983)
4. Hand book of Deposition technologies for films and coatings- R. F. Bunshah (Noyes Publications, New Jersey, USA, 1994)
5. Introduction to thin films- K. Ravichandran, K. Swaminathan, B. Sakthivel (Research India Publication, New Delhi, 2013)

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)

Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)
Part C 3x10 = 30 Answer Any **THREE** (One question from each unit)

Signature of the HOD

Credits : 5 **Code: RR4PPHP4**

Hours/Week : 6

Medium : English

Semester : 3

(For students admitted from 2015)

PRACTICAL – IV

Paper III and IV

Select at least Three experiments from each of Four groups and a minimum of Fifteen experiments for each semester (III & IV)

Group A-Analog Experiments

1. Construction of dual power supply for IC experiment 0-5V,9-0-9V.

2. Characteristics of Op-amp, open loop ,closed loop gain, input impedance, output impedance, C.M.R.R.

3. Op-amp – Adder, subtracter, sign changer, differentiator and integrator

4. Op-amp Low pass, high pass filters.

5. Op amp- band pass and all pass filters.

6. Op-amp Frequency divider and Schmitt trigger.

7. Op-amp-sine wave –Wien's oscillator

8. Op amp- square, triangular & ramp wave generator.

9. Op-amp log, antilog and II order transfer function amplifier.

10. Op-amp- solving simultaneous equations.

11. One-Shot multivibrator – using ICs – determination of pulse width.

Group B-Digital Experiments

1. IC-Universal gates NAND and NOR.
2. Half adder and full adder using NAND gates.
3. Half and Full subtractors.
4. Multiplexer – Demultiplexer.
5. Study of Flip-Flops.
6. Verification of DeMorgan's theorem using NAND gates and simplification of Boolean expressions.
7. Simplification of Boolean expressions by Karnaugh map and verification of Boolean expressions.
8. One bit digital comparator using EXOR and NAND gates
9. Frequency divider using IC 555.
10. Study of counter 7490 (0-9 and 0-99).
11. Study of 7 segment display decoders- 7447.
12. Shift registers using IC.
13. D/A conversion – R- 2R and weighted resistor network – to determine the Resolution Linearity and dual slope.
14. A/D conversion – successive and dual slope.
15. Study of memory circuits – RAM, ROM, EPROM,PROM
16. Digital comparator – 4 bit using ICs.
17. Study of modulation and demodulation using IC.

Group C-Microprocessor 8085 Experiments

1. 8-bit addition , subtraction, multiplication and division using 8085/ z80
2. 16 bit addition, 2's complement and 1's complement subtraction
3. Conversion from decimal to octal, hexa decimal system.
4. Conversion from octal, hexa to decimal system.
5. Interfacing hexa key board (IC 8212)
6. Study of seven segment display add on board.
7. Study of DAC interfacing (DAC 0800)
8. Study of ADC interfacing (ADC 0809)
9. Study of timer interfacing (IC 8253)
10. Study of programmable interrupt controller (IC 9259)
11. Traffic control system using Microprocessor.
12. Microprocessor as digital clock.
13. Generation of square, triangular, saw tooth staircase and sine waves using DAC 0800.
14. Microprocessor interface as digital thermometer.
15. Control of stepper motor using microprocessor.
16. Microcontroller – Mathematical operations.
17. Microcontroller – Ascending and Descending.
18. Microcontroller- smallest and biggest.

Group D-Computer- C Programme

1. Solving equations by Newton – Raphson's method.
2. Solving equations by Successive approximation method.
3. Solution of simultaneous linear algebraic equations by Gauss elimination method.
4. Solution of simultaneous linear algebraic equations by Gauss-Seidal method.
5. Interpolation and Extrapolation of data using Least square curve fitting method.
6. Interpolation and Extrapolation of data using Lagrange and Newton Method.
7. Numerical Integration by Simpson method.
8. Numerical Integration by trapezoidal Method.
9. Numerical differentiation by Euler Method.
10. Numerical differentiation by Runge Kutta method (II order)
11. Numerical Integration by Gauss – Lagrange Quadrature.

Maximum Marks : 60
Exam Duration : 4 Hours

Signature of the HOD

Credits : 5 **Code:RR4PPHPW**

Hours/Week : 12

Medium : English

Semester : 4

(For students admitted from 2015)

PROJECT WORK

- To be submitted at the end of fourth semester.
- Viva after Practical IV Examinations.

Signature of the HOD

Credits : 4 **Code:RR4PPHEL4**
Hours/Week : 6
Medium : English
Semester : 4

(For students admitted from 2015)

LASERS AND APPLICATIONS

Unit 1: FUNDAMENTALS OF LASER:

Lasers – Characteristic properties – Directionality – intensity – monochromaticity Coherence – principles of lasers – absorption – spontaneous emission – stimulated emission – Einstein's theory of stimulated emission – population inversion – methods of achieving population inversion -2,3,4 level pumping schemes – Amplification and gain-Optical resonator and its action- Schawlow and Townes Threshold condition.

Unit 2:OPTICAL PROCESSES THEORY:

Waves and interference – Coherence – Temporal and Spatial Coherence – Coherence of the field and the size of the source- coherence and monochromaticity-Line broadening mechanisms.

Cavity Configuration – Plane Parallel Cavity – Confocal, Hemispherical, Long Radius Cavity – Modes – Longitudinal And Transverse – Single Mode Operations-Properties of Laser modes.

Unit 3:TYPES OF LASERS:

Introduction – Ruby Laser – Three level system-U3+ in CaF2 Laser-A four level system-Nd:YAG laser-Construction and working – He-Ne laser – working principle – energy level diagram – Argon ion laser – Helium cadmium laser – molecular gas laser – CO_2 laser – principle – construction and working –Tunable dye Laser.

Unit 4:DYNAMICS OF LASER PROCESSES:

Production of a giant pulse – Q-switching – Mechanical shutter-Electro optical shutter-Shutter using saturable dyes-Peak power emitted-Laser amplifiers-Cavity dumping- Mode locking –Techniques for mode locking- Mode pulling –Hole burning.

Unit 5: APPLICATIONS OF LASERS:

Holography – Optical communications-Interference-Testing of optical systems-NLO-Harmonic generation-Doppler free two photon spectroscopy-isotope separation - Lasers in computers – weapons – medical applications – industrial applications.

List of Books for study:

1.An introduction to lasers,theory and applications-M.N.Avadhanulu,S.Chand &Co.,New Delhi (2001).
2. Laser and Non-linear Optics – B.B.Laud- Tata McGraw Hill Publications.

List of Books for Reference:

1. Lasers and their Applications – Beesley – Taylor and Francis – London. (1972).
2. Lasers principles and applications – J. Wilson, J.F.B. Hawkes – Prentice Hall – (1987).
3. Lasers theory and Applications-K.Thyagarajan,A.K.Ghatak,Cambridge University Press (1981).
4. Engineering Physics-R.K.Gaur & S.L.Gupta (8^{th} edition) Dhanpat Rai Publications,New Delhi.(2001).

Question Paper Pattern:

Maximum Marks : 75
Exam Duration : 3Hours

Part A 10x2 = 20 Answer **All** Questions (Two questions from each unit)

Part B 5x5 = 25 Answer **All** Questions (Either or Type - Two questions from each unit)

Part C 3x10 = 30 Answer Any **THREE** (One question from each unit)

Signature of the HOD

Credits : 4 **Code:RR4PPHEL5**
Hours/Week : 6
Medium : English
Semester : 4

(For students admitted from 2015)

NANO PHYSICS

Unit 1: NANOSCALE SYSTEMS:

Nanotechnology – Emergence of Nanotechnology - Size - properties - History and Scope -Classification of nanostructured materials - Challenges and Future prospects.

Unit 2: NANO MATERIALS:

Nano Materials -Fullerene - Carbon Nano Tubes (CNT) - Quantum Dots - Synthesis - purification – properties - Applications – CNT Transistor - Nanoshells - Nanowires.

Unit 3: SYNTHESIS ROUTES:

Top down and bottom up approaches: Gas phase condensation – Vacuum deposition - Physical vapor deposition (PVD) - chemical vapor deposition (CVD) - Sol-Gel- Ball milling –spray pyrolysis - dip-pen nanolithography

Unit 4: CHARACTERIZATION TECHNIQUES:

Principles of electron microscopes - Scanning Electron Microscopy (SEM) - Transmission Electron Microscopy (TEM) - Scanning Probe Microscopy (SPM) - Principle and working of Atomic Force Microscopy (AFM) and Scanning tunneling microscopy (STM).

Unit 5: APPLICATIONS:

Nano electronics-Energy -Nanosensors –Nano medicines –Nanotribology –NEMS – MEMS - Defence and space Applications.

Books for study:

1.NANO:The Essentials-T. Pradeep TATA McGraw HILL, December 2006.
2.Nanotechnology –Booker and Boysen –Wiley and Sons 1st Edition 2006.

Question Paper Pattern:
Maximum Marks: 75
Exam Duration: 3 Hours

Part A 10x2 = 20 (Two Questions From Each Unit)
Part B 5x5 = 25 (Either or Type - Two Questions From Each Unit)
Part C 3x10 = 30 (One Question From Each Unit)

Signature of the HOD