Credits : 5
Hours/Week : 6
Medium : English

Code:R1PP1

Semester : 1
(For students admitted from2011 onwards)

MATHEMATICAL PHYSICS

Unit 1: Vector Fields

Concept of vector and scalar fields – Gradient, divergence, curl and Laplacian Vector identities – Line integral, surface integral 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 – Eigenvalues 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.

List of Books for Study / Reference:

1. A.W. Joshi, matrices and Tensors in Physics, Wiley Eastern Ltd., New Delhi (1975).

2. P.K. Chattopadhyay, Mathematical Physics, Wiley Eastern Ltd., New Delhi, (1990).

3. E. Kreyszig, Advanced Engineering Mathematics, 8^{th} ed. Wiley, NY, (1999).

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-4 Edition, TMH Company Ltd., New Delhi, (2007).

7. Mathamatical Physics, B.D Gupta- Vikas publishing house -2007

8. Mathamatical Physics, RajputB.S. –Pragati prakashan -2007

9. Numerical Methods, E. Balagurusamy- Tata McGraw Hill publishing Co. ltd.,-1^{st} edition -1999

10. Programming in C, By Shyamala Krishnan.

11. Numerical methods with programming in C – T.Veerarajan and T. Ramachandran – Tata McMgraw Hill Publication co., Ltd., -2^{nd} Edition -2005

12. Applied Mathematical for Engineers and Physcist –L.A. Pipes & Harvill L.R. – International student edition, TataMcGraw Hill Pub. Co.,

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
Hours/Week : 6
Medium : English

Code:R1PP2

Semester : 1
(For students admitted from2011 onwards)

CLASSICAL DYNAMICS & RELATIVITY

Unit 1: Fundamental Principles and Lagrangian Formulation

Mechanics of a particle and system of particles – Constraints – Generalized coordinates – D's 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 harmonics 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 and angle variables – Kepler's problem in action – angle variables.

Unit 4: Nonlinear Dynamics

Regular and Chaotic Motions: Linear and nonlinear oscillators phase trajectories Fixed points and limit cycles Period doubling phenomenon – Solitary waves – Kdv equation – 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

List of Books for Study and Reference:

1. Classical Mechanics by Goldstein.
2.Classical Mechanics by Gupta Kumar.
3.Classical Mechanics by N. K. Biswas
4.M. Lakshmanan and K. Murali: Chaos in Nonlinear Oscillators, world scientific Co., Singapore (1996) Chapter 2-4.
5.Lecture Notes from Centre for Nonlinear Dynamics, Department of physics, Bharathidasan University, Tiruchirapalli – 6200024.

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
Hours/Week : 6
Medium : English

Code:R1PP3

Semester : 1
(For students admitted from2011 onwards)

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 co ordinates. 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 wire, 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 electro magnetic 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 electro magnetic waves in free space, propagation of E.M.W in isotropic dielectrics, propagation of E.M.W. in Anisotropic Dielectric-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.

List of Books for study:

1. K.K. 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
Hours/Week : 4
Medium : English

Code:R1PPP1

Semester : 1

(For students admitted from2011 onwards)

PRACTICAL – I

BASIC PRACTICAL (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 bulk modulus of a liquid by ultrasonic wave propagation.
4. Determination of Stefan's constant.
5. Identification prominent lines by spectrum photography – Copper spectrum.
6. Identification of prominent lines by spectrum photography – Iron spectrum
7. BII loop – Energy loss of a magnetic material- Anchor ring using B.G.
8. Determination of dielectric constant at high frequency by Lecher Wire.
9. Determination of e / m of an electron by magnetron method
10. Determination of e / m of an electron by Thomoson's method
11. Determination of L of a coil by Anderson's method.
12. Photoelectric effect (Planck's constant Determination).

B. Electronics Experiments

13. Construction of transistorized power supply using bridge rectifier.
14. Study of a feedback amplifier – Determination of band width, input and output impedances.
15. Darlington Pair amplifier.
16. Design and study of monostable multivibrator.
17. Design and study of bistable multivibrator.
18. Design and study of Wein bridge Oscillator (Transistor)
19. Design and study of Phase shift Oscillator (Transistor)
20. Characteristics of FET.
21. Characteristics of UJT.
22. Characteristics of SCR.
23. Characteristics of Tunnel diode.
24. Characteristics of LDR.
25. Common source amplifier using FET.
26. Common drain amplifier using FET
27. FET oscillator.
28. Transistor power amplifier.
29. Relaxation oscillator using UJT.
30. Preparation of PCB.

Question Paper Pattern:

Maximum Marks : 60
Exam Duration : 4 Hours

Signature of the HOD

Credits : 4
Hours/Week : 6
Medium : English

Code:R1PPEL1

Semester : 1
(For students admitted from2011 onwards)

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-VHF, 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 fiber-Fiber parameter- sources and detectors (semiconductor types)-Optic fiber communication system.

Unit 5: Colour Television

Essentials of colour television – Perception- Three colour theory- Luminescence-Hue and Saturation-TV camera – Image orthicon-VIDICON- -Delta gun and Precision inline picture tubes- PAL , NTSC, SECAM colour TV systems - PAL colour receiver-Block diagram- Merits and demerits.

List of 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.
3. Gowar, Optical Communication, Prentice Hall of India Ltd.
4. R.R. Gulati, Monochrome and Colour Television,Wiley Eastern.

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
Hours/Week : 6
Medium :English

Code:R2PP4

Semester : 2
(For students admitted from2011 onwards)

QUANTUM MECHANICS

Unit 1: Formaulation of Quantum Mechanics

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

Unit 2: Opeator Formalism

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

Exactly solvable systems:

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

Unit 3: Approximation method for stationary states.

Time independent perturbation theory – Non - Degenaration case. First and Second order perturbation – Degenerate case – Stark effect – Variation method – Applications.

Methods for time-dependent problems:

Time dependent perturbation theory - constant perturbation – Hormonic perturbation – Stimulated emission and absorption – Einstein's coefficients.

Unit 4: Angular Moementum

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

LIST OF BOOKS FOR STUDY:

1. Quantum Mechanics by Sathiya Prakash.
2. Quantum Mechanics by Gatak Loganathan.
3. Quantum Mechanics L. T. Schiff, Tata McGraw Hill New Delhi – 1968.

REFERENCES:

1. A Text Book Of Quantum Mechanics – P. M .Mathews and Venkatesan – Tata McGraw Hills(1976).
2. Advanced Quantum Theory and Fields S.L. Gupta I. D. Gupta S . Chand and company - New Delhi.
3. Angular momentum Techniques in Quantum Mechanics – V . Devanathion, Kluwer ,Netherland (1966).

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
Hours/Week : 6
Medium : English

Code:R2PP5

Semester : 2
(For students admitted from2011 onwards)

NUCLEAR AND PARTICLE PHYSICS

Unit 1: Nuclear Structure

Nuclear radius, charge distribution, spin and magnetic moment – Determination of nuclear mass – Binding energy – Semiembrical mass formula –Mass parabolas –Liquid drop model – Nuclear shell model – magnetic moment and the shell model- scattering length.

Nuclear Forces

Exchange forces – Yukawa's meson theory – Yukawa potential – Ground state of deuteron

Unit 2: Radioactive Decays

Alpha decay – Gamow's theory – Geiger Nuttal law – Fermi's theory of beta decay – Selection Rules – Non conservation of parity in beta decay – Internal conversion – Nuclear isomerism.

Detection And Counters

Interaction of charged particles and X-rays with matter – Basic principles of particle detectors – Proportional counters and Geiger – Muller counters – Solid states and semiconductor detectors.

Unit 3: Nuclear Fission

Characteristics of fission – Mass and energy distribution of nuclear fragments – Nuclear chain reactions – Four factor formula – Bohr- Wheeler's theory of nuclear fission – Fission reactors – Power & breeder type reactors.

Nuclear Fusion

Basic fusion processes – Solar fusion – Controlled thermonuclear reactions – Pinch effects.

Unit 4: Nuclear Reactions

Energetics of reactions – Q-equation – Level widths in nuclear reaction – Nuclear reaction cross sections – Partial wave analysis – Compound nucleus model – Resonance scattering – Breit – Wigner one level formula – Direct reactions – Stripping and pick-up reactions.

Scattering Process

Scattering amplitude – Expression in terms of Green's function – Born approximation and its validity – Alpha particle scattering.

Unit 5: Elementary Particles

Four types of interactions and classifications of elementary particles – Isospin – Isospin quantum numbers – Strangeness & hyper charge – Hadrons – Baryons – Leptons – Invariance principles and symmetries – Invariance under charge-parity(CP), Time(T) and CPT – CP violation in neutral K-meson decay – Quark model – SU(3) symmetry – Gell-Mann – Nishijima formula –

List of Books for Study / Reference:

1. R.R .Roy & B.P. Nigam, Nuclear Physics, Wiley Eastern India – New Delhi.
2. Nuclear Physics by D.C. Thayal.
3. Nuclear Physics by Sri Vastava.

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
Hours/Week : 6
Medium : English

Code:R2PP6

Semester : 2
(For students admitted from2011 onwards)

SOLID STATE PHYSICS

Unit 1: Crystal Structure

Crystal classes and systems 2d, 3d – lattices Bravais lattices point groups Plane groups – space groups – Bonding of common crystal structures NaCl , CsCl, ZnS,Dimond Reciprocal Lattice, Ewald's sphere construction – Diffraction and structure factor systematic absences Wilson plot – Brillouin zones.

Unit 2: Lattice Vibrations and thermal properties

Vibrations of mono atomic lattices – Lattice with two atoms per primitive cell –Quantization of Lattices vibrations – phonons momentum – Inelastic scattering of neutrons by phonons.

Lattice heat capacity – Planck distribution – Einstein model – Density of modes in one dimension – Debye model of the Lattice heat capacity – Thermal conductivity – Umklapp process – Specific heat of solids.

Unit 3: Semiconductor Crystals.

Hall effect – Thermal conductivity of metals –Nearly free electron model – Bloch functions Kronig Penney model n Electron in a periodic potential Bloch theorem Crystal momentum of an electron energy hands in metals and insulators Semiconductor crystals – Band gap – Tight bound approximation – Effective mass and density of status – De'zIIass – Van Alphen effect.

Unit 4: Dielectrics and Ferroelectrics

Macroscopic electric field – Local electric field in an atom – Dielectric constant and polarization catastrophe Ferroelectric domains Antiferro electricity Pizo electricity Ferro elasticity.

Ferromagnetism and anti ferromagnetism

Ferromagnetic order – Curie point and the exchange integral – Temperature dependence of saturation magnetization Magnons Thermal excitation Ferrimagnetic order Curie temperature and susceptibility of ferrimagnets – Antiferromagnetic order Susceptibility below Neel temperature – Antiferromagnetic magnons.

Unit 5: Superconductivity

Occurrence of superconductivity - Meissner effect - Thermodynamics of superconductivity transition - London equation - coherence length - BCS theory - Flux Quantization – type I and type II super conductors – Josephson tunneling – dc and ac Josephsons effects – High temperature super conducting materials.

List of Books for study / Reference

1. C . Kittel , Introduction to Solid State Physics, 5th edition, Eiley Eastern New Delhi (1983)
2. J . Dekker, Solid State Physics, MacMillan, Madras (1971)
3. J.S. Blackmore ,Solid Stater Physics, 2nd Edition ,Cambridge University Press, Cambridge – London (1994)
4. N.W. Asheroft and N.D.Mermin, Salid State Physics, Holt Reinhart and Winston, International edition, Philadelphia,(1978)
5. R . L . Singhal Solid State Physics, Kedarnath and Ramnath and Co . Mccrut , 3rd editin , New Delhi,(1987)
6. M . M . Woolfson, An Introduction to X - ray crysrallography, Cambridge University Press, UK(1980)
7. G. II Stout & L.II. Jensen, X –ray Structure determination, John Wiley & Sons, Inc NY(1989)
8. Gupta Kumar, Solid State Physics.

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
Hours/Week : 4
Medium : English

Code:R2PPP2

Semester : 2

(For students admitted from2011 onwards)

PRACTICAL – II

ADVANCED GENERAL EXPERIMENTS (Any Fifteen)

1. Four probe method – Determination of resistivities 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. Salt analysis by using Spectrograph.
11. Determination of wavelength and fine structure using – F.P etalon
12. Thickness and resolving power of LG Plate.
13. ALO band spectrum
14. CN band spectrum
15. Iodine characteristics absorption spectra
16. Charge of an electron by spectrometer
17. Polarizabillity of liquids by finding the refractive indices at different wavelengths.
18. Determination of wage length of monochromatic source using biprism
19. Determination of refractive index of liquids using biprism (by scale & telescope method).
20. Determination of e/m of an electron by Zeeman Effect (L.G. plate).
21. G.M. Counter – plateau, resolving time and absorption coefficient determination.
22. Determination of specific rotatory power of a liquid using polarimeter.
23. Rydberg's constant using spectrometer.
24. Determination of coefficient of coupling by AC bridge method.
25. Magneto resistance of power samples using CF Bridge
26. Forbe's method of determining thermal conductivity.
27. "G "Factor determining by using ESR spectrometer.
28. Determination of dielectric loss using CRO.
29. Laser grating Determination of λ.
30. Optical Fiber – measurements of attenuation coefficient and Numerical aperture.

Question Paper Pattern:

Maximum Marks : 60
Exam Duration : 4 Hours

Signature of the HOD

Credits : 4
Hours/Week : 6
Medium : English

Code:R2PPEL2

Semester : 2

(For students admitted from2011 onwards)

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 – Eigenfunction expansion.

Unit 4: Special Functions

Gamma and Beta functions – Series solution – Legendre, Bessel and differential equation and their solution – Rodrigue's formula – 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 – Character Tables – C2V.

List of Books for Study / 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
Hours/Week : 6
Medium : English

Code:R3PP7

Semester : 3
(For students admitted from2011 onwards)

STATISTICAL MECHANICS

Unit 1: Thermodynamics and Their Consequences

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 thermodynamics relations – Gibb's-Hermholtz relation - Nernst Heat theorem of third law – consequences of third law – phase-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 fee path - Conservation laws - Zero and first order approximations – Viscous hydrodynamics – Navier – Stokes 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 theory – Debye's theory –Ideal Bose 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 – Onsagar's reciprocity relations.

List of 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. Kittal, Thermal physics, 2nd ed.

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
Hours/Week : 6
Medium : English

Code:R3PP8

Semester : 3
(For students admitted from2011 onwards)

SPECTROSCOPY

Unit 1: Atomic Structure

Vector model – Spin orbit interactions – Fine structure – Hyperfine structure – Lamb shift – Spectra of alkali atoms – Doublet separation – Intensities – Coupling schemes for many electron system – Quantum theory of Zeeman, Stark and Paschen Back effects for many electron systems.

High Resolution Spectroscopy

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

Unit 2: Approximations in Atomic and Molecular Structures

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

Molecular Orbital Theory

Concepts of atomic, hybrid and molecular orbitals – LCAO treatment of molecular orbitals of CH_4, C_2H_6 and C_2H_4 – Hueckel's molecular approximation .

Unit 3: Spectra of Diatomic and Polyatomic Molecules – Microwave Spectroscopy

Rotational spectra of diatomic molecules – Rigid rotator – Non rigid rotator - Isotopic Effect in Rotational spectra – Rotatinal Spectra of polyatomic molecules – Linear, Symmetric top and asymmetric top molecules.

IR Spectroscopy

Vibrating diatomic molecule as a Harmonic Oscillator – as a Unharmonic Oscillator – Symmetric Top Molecules – Parallel Bonds of Symmetric Top and Perpendicular Bonds of Symmetric Top Molecules.

Unit 4: Raman And Electronic Spectroscopy

Raman effect – quantum theory of Raman effect – Rotational and vibrational Raman shirts of diatomic molecules – Raman Spectrometer – Applications..

Electronic spectroscopy of Molecules

Electronic spectra of diatomic molecules – Franck – Condon principle – Dissociation energy and dissociation products – Rotational fine structure of electronic vibration transitions.

Unit 5: Resonance Spectroscopy

NMR – Basic principles – Quantum mechanical description – Bloch equations – Spin Lattice Relaxation – Spin–Spin Relaxation and lattice relation times – Experimental methods – Single Coil and double Coil NMR Spectrometer –ESR Spectroscopy : ESR – basic principles- Theory of ESR– ESR Spectrum – g Factor - Hyperfine structure For Deutarium and Tritium - – ESR Spectrometer – Applications.

List of Books for study / Reference:

1. White, Introduction to Atomic Spectra, prentice hall, New Delhi (1984).

2. C.N. Banwell, Fundamentals of Molecular Spectroscopy, McGraw Hill, New York 4th ed. (1999)

3. G. Herzberg, Molecular spectra and Molecular structure vol I, II & III, Van nostrand Reinhold Co.

4. A.K. Chandra, Introductory Quantum Chemistry, Tata McGraw Hill Ltd., New Delhi, 4th ed.

5. G.M. Barrow, Introduction to Molecular Spectroscopy, McGraw Hill Ltd., Singapore (1985).

6. Spectroscopy by B.P. Straughan and S. Walker.

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
Hours/Week : 6
Medium : English

Code:R3PP9

Semester : 3
(For students admitted from2011 onwards)

MICROPROCESSOR

Unit 1: 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.

Opcodes and openands – word size – Instruction cycle – Fetch – Execute operatrion – 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 2: Assembly Language Programming

Introduction set – Data transfer group – Arithmetic group – Logical group – Branch group – Machine control group – Addressing modes – Assembling language programme for addition – subtraction – Multiplication – BCD arthimetic – choosing the biggest and smallest numbers fro a list – arranging a list of numbers in ascending or descending order.

Unit 3: 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 DMA controller INTEL 8257 – Burst mode – Cycle stealing – Serial data transfer.

Types of interfacing devices – Programmable peripheral Interface (PPI) – Architecture of INTEL 8255 – operating modes – Programmable Interrupt Controller (PIC) – INTEL 8259 – Internal registers of 8259.

Unit 4: Data acquisition system

Analog to Digital (A/D) converter – Clock for A/D converter – ADC 0800 – Block diagram – Zero and Full Scale adjustment – Interfacing of ADC 0800 – Digital to Analog Converter (DAC) – operating principle – DAC 0800.

Unit 5: Microprocessor Applications

Delay subroutine using one register , register pair ,two registers – three registers – microprocessor based systems – temperature measurement – strain measurement – stepper motor interfacing – square and pulse wave generator – microcontroller – intel 8051 – block diagram – description of 8051 – series of microcontrollers.

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List of Books for study / Reference:

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

2. Ramesh S. Goankar, Microprocessor Architecture Programming and Applications with the 8085, 5th ed., Penram International Publishing (India) Pvt.Ltd.

3. Marris Mano, Computer System Architecture, PHI Ltd., New Delhi (1994).

4. Malvino, Electronic Principles, 5th ed, Tata McGraw Hill Ltd., New Delhi (1995).

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
Hours/Week : 4
Medium : English

Code: R3PPP3

Semester : 3

(For students admitted from2011 onwards)

PRACTICAL – III

Analog and Digital experiments(Any fifteen only)

1. **Construction of dual power supply for IC.**
2. **Multiplexer – Demultiplexer.**
3. **Study of Flip-Flops.**
4. **Verification of deMorgan's theorem and simplification of Boolean expressions.**
5. **Half adder and full adder**
6. **Simplification of Karnaugh map method and verification**
7. **Characteristics of Op-amp, open loop differential gain, output resistance, C.M.R.R and frequency response.**
8. **Op-amp – Adder, subtractor, sign changer, differential and integrator**
9. **Op-amp Low pass, high pass, band pass and active filters.**
10. **Op-amp Frequency divider and Schmitt trigger.**
11. **Op-amp-sine, square, triangular & ramp wave generator.**
12. **Op-amp log, antilog and II order transfer function amplifier.**
13. **Op-amp- solving simulatancous equations.**
14. **One-Shot multivibrator – using ICs – determination of pulse width.**
15. **Digital comparator using EXOR and NAND Gates**
16. **Frequency divider using IC 555.**
17. **Study of counter 7490 (0-9 and 0-99).**
18. **Study of 7 segment display decoders- 7447.**
19. **Shift registers using IC.**
20. **D/A conversion – R- 2R and weighted resistor network – to determine the Resolution Linearity and dual slope.**
21. **A/D conversion – successive and dual slope.**
22. **Study of memory circuits – RAM, ROM, EPROM,PROM**
23. **Half and Full subtractors.**
24. **Digital comparator – 4 bit using ICs.**
25. **Study of modulation and demodulation using IC.**

Question Paper Pattern:

Maximum Marks : 60
Exam Duration : 4 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 : 4
Hours/Week : 6
Medium : English

Code:R3PPEL3

Semester : 3
(For students admitted from2011 onwards)

THIN FILM PHYSICS

Unit 1: Introduction

Thin Film and overview – Nucleation – thermodynamics of nucleation – nucleation models – Capilary model – Atomistic model or Statisical model – nucleation stages – film growth stage – Island structure stage – Coalescence stage – Channel and continuous film stage – grain size and deposition parameters.

Unit 2: Semiconducting Films

Introduction – Intrinsic and extrinsic semiconductor – impurity – doping – Trap, recombination centre etc., - surface states – Impurity sub band – degeneracy – transport properties and basic parameters – conductivity and resistivity – actvation energy and energy gap – Hall effect – mobility of charge carier – carrier concentration.
Magnto resistance – Seebeck effect.

Unit 3: Film Preparation Techniques

Introduction -Physical Vapour Deposition(PVD), Chemical Vapour Deposition(CVD)– Evaporation**,** Sputtering, Spray pyrolysis, Dip coating, Spin coating, Laser evaporation, Molecular Beam Epitaxial.

Unit 4: Measurements

Thickness measurements, Rutherford Back Scattering - Resistivity measurements, Transmission, Absorption- bandgap refractive index – Scanning Electron Microscopes (SEM)- X ray Diffraction (XRD)- photoluminescence – EDAX – AFM – Principle, technique and instrumentation.

Unit 5: Applications

Thin film capacitor, Resistor, Transistor, Sensors and Actuators, Thin film super conducting device,- Carbon Nano Tubes(CNT), Flexible light Emitting Diode (LED) and Liquid crystal Display (LCD) – Fuel cells, Solar cells etc.

List of Books for study / Reference:

1. Thin film phenomena by K. L. Chopra
2.Hand book of Thin film Technology by Meisel and Reinhand Glang.
3.Thin film Fundamentals – A.Goswami – New Age International Publishers – 1996
4. Hand book of Deposition technologies for films and coating – R.F.Bunshah

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
Hours/Week : 4
Medium : English

Code:R4PPP4

Semester : 4

(For students admitted from2011 onwards)

PRACTICAL – IV
ADVANCED ELECTRONICS – II
MICROPROCESSOR AND COMPUTER LABORATORY

(Any fifteen only – Choosing minimum of six from each)

A. Microprocessor Practicals.

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 to 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 Microprocessors.**
12. **Microprocessor as digital clock.**
13. **Generation of square, triangular, saw tooth staircase and sine waves using DAC 0800.**
14. **Microprocessor as digital thermometer.**
15. **Control of stepper motor using microprocessor.**
16. **Microcontroller – Mathematical operations.**
17. **Microcontroller – Ascending and Descending.**

B. Computer Practicals (by C language)

18. **Solving equations by Newton – Raphson's method.**
19. **Solving equations by Successive approximation method.**
20. **Solution of simultaneous linear algebraic equations by Gauss elimination method.**
21. **Solution of simultaneous linear algebraic equations by Gauss-Serial method.**
22. **Interpolation and Extrapolation of data using Least square curve fitting method.**
23. **Interpolation and Extrapolation of data using Lagrange and Newton Method.**
24. **Numerical Integration by Simpson method.**
25. **Numerical Integration by trapezoidal Method.**
26. **Numerical differentiation by Euler Method.**
27. **Numerical differentiation by Runge Kutta method (II nd order)**
28. **Numerical Integration by Gauss – Lagrange Quadrature.**

Question Paper Pattern:

Maximum Marks : 60

Exam Duration : 4 Hours

Signature of the HOD

Credits : 4
Hours/Week : 6
Medium : English

Code:R4PPEL4

Semester : 4

(For students admitted from2011 onwards)

LASERS AND APPLICATIONS

Unit 1:

Lasers – Characteristic properties – Directionality – intensity – monochromatic-ity Coherence – principles of lasers – absorption – spontaneous emission – stimulated emission – Einstein's theory of stimulated emission – population inversion – methods of achieving population inversion – Schawlow and Townes Threshold condition.

Unit 2:

Laser beam characterstics – Coherence – Temporal And Spacial Coherence – Polarisation – Amplification And Gain

Cavity Configuration – Plane Parallel Cavity – Confocal, Hemispherical, Long Radius Cavity – Modes – Longitudinal And Transverse – Single Mode Operations.

Unit 3:

Types of Lasers – Solid State Lasers – Ruby Laser – Construction and working Semiconductor – GaAs laser – advantages – Gas lasers – HeNe laser – working principle – energy level diagram – argon ion laser – helium cadmium laser – molecular gas laser – Co2 laser – principle – construction and working.

Unit 4:

Continuous wave and pulsed lasers – Nd- YAG laser – Tunable laser – Qswitching – mode locking – Mode pulling – frequency doubling – Laser amplifiers.

Unit 5

Applications of lasers – interferometry – testing of optical systems – Holography – Lasers in communication – in computers – weapons – medical applications – industrial applications.

List of Books for study / Reference:

1. Lasers and their Applications – Beesley – Taylor and Francis – London
2. Lasers principles and applications – J. Wilson, J.F.B. Hawkes – Prentice Hall – 1987.
3. Laser and Non-linear Optics – B.B.Laud- Tata McGraw Hill Publications.

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
Hours/Week : 6
Medium : English

Code:R4PPEL5

Semester : 4
(For students admitted from2011 onwards)

NANO PHYSICS

Unit 1:

Introduction – Nano and Nature –Principles of Microscope – SEM,TEM Electronmicroscopies – Scanning probe microscopies- Optical microscopies – X –ray diffraction.

Unit 2:

Fullerence- Synthesis and purification- Pressure effect – conductivity and superconductivity of fullerence – unusual properties.

Carbon Nano Tubes (CNT) - Synthesis and purification – properties- Applications – Nanotubes of other materials – CNT Transistor.

Unit 3:

Semiconductor Quantum Dots – Synthesis – Structure – Properties – Uses Nanoshells- Types – Properties – Applications – Data Storage.

Unit 4:

Nanosensors – Based on Optical properties- Quantum Size Effect- Physical properties – Electrochemical sensor – Smart Dust – Optical based and electrical based sensor – Blue Laser.

Unit 5:

Molecular Nano machines – Motors and Machines – Molecular Devices - Single molecular devices – Nanomedicines – Nanotribology –NEMS – MEMS - Applications.

List of Books for study / Reference:

NANO : The Essentials (TATA McGraw – HILL, December -2006)
T.Pradeep
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

Credits : 5
Hours/Week : 6
Medium : English

Code:R4PP10

Semester : 4
(For students admitted from2011 onwards)

MATERIAL SCIENCE

Unit : 1

Histrorical Perspective of Materials science – Bond energy,bond length,bond type – Covalent bonding – Ionic bonding – Metallic bonding – Hydrogen bond – Variation in bond character and properties – Crystal imperfections – Point, Line, Surface, Volume defects – dislocations – Edge, Screw, and motion of a dislocations.

Unit : 2 Elastic Behaviour and Fracture

Atomic model of elastic behaviour – modulus as a parameter in design – rubber like elasticity – Relaxation process of anelastic behaviour – Viscoelastic behaviour – Spring dash pot models.

Fracture – Ductile,brittle fracture- difference between them – fracture toughness - ductile to brittle transistions – method of protection against fracture – Fatigue fracture.

Unit : 3 Plastic Deformation and Creep

Plastic deformation – tensile stress – strain curve – plastic deformation by slip – shear strength of perfect crystals – stress to move a dislocation – effect of temperature – multiplication of dislocation during deformation – effect of preceipitate – particle on dislocation motion – creep – creep resistant materials – Mechanism of strengtheing in metals.

Unit : 4 Dielectric Polarization

Polarization of dielectrics – Lorentz field – electronic, ionic, orientation, space charge polarization – Frequency and temperature effects on polarization – breakdown of dielectric – Ferro,ferri and piezo electric materials.

Unit : 5 Modern Engineering Materials

Polymers (structure,properties and applications) – conducting polymers – ceramics – super strong materials – cermets – High temperature materials – Metal Matrix Composities (MMC) – Thermoelectric materials – Nuclear engineering materials – Corrossion and oxidation materials – prevention.

Books for study

1. Materials Science – Dr. M.Arumugam – Anuradha Agencies – 2009
2. Materilals Science and Engineering: A First Course – V.Raghavan - 5th Edition – Phi Learing (2009)

Books for Reference:

1. Fudamentals of solid state physics – Saxena Gupta Saxena – Pragathi Prakash Publications – Meerut – 2003
2. Introduction to solid state physics - 7^{th} edition – John Wiley and Sons Inc. - 1996.
3. Solid State Physics – A.J.Dekker - Mac Millian Publications -
4. Solid State Physics – R.L. Singhal – Kedarnath & Ramnath Co., Meerut , NewDelhi.

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