GOVERNMENT ARTS COLLEGE (AUTONOMOUS), COIMBATORE 641 018

DEPARTMENT OF PHYSICS

M.Sc. PHYSICS CURRICULUM FOR THE STUDENTS ADMITTED FROM 2015-2016 ONWARDS

UNDER CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER – I

S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Exam Duration	Hrs/ Week	Passing Minimum	
					Internal	External	Total			External	Total
1.		A	Paper 1: Classical and Statistical Mechanics	5	25	75	100	3 Hrs	5	38	50
2.		A	Paper 2: Quantum Mechanics - I	5	25	75	100	3 Hrs	5	38	50
3.		A	Paper 3: Mathematical Physics	5	25	75	100	3 Hrs	5	38	50
4.		B	Elective I: Problems in Advanced Physics – 1	2	25	75	100	3 Hrs	3	38	50
	TOTAL			**17**			**400**		**18**		
5.		A	Practical I: General Experiments	Examination at the end of Second Semester					6		
6.		A	Practical II: General Electronics	Examination at the end of Second Semester					6		

SEMESTER – II

S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Exam Duration	Hrs/ Week	Passing Minimum	
					Internal	External	Total			External	Total
1.		A	Paper 4: Quantum Mechanics - II	5	25	75	100	3 Hrs	5	38	50
2.		A	Paper 5: Solid State Physics	5	25	75	100	3 Hrs	5	38	50
3.		A	Paper 6: Electromagnetic Theory	5	25	75	100	3 Hrs	5	38	50
4.		B	Elective II: Problems in Advanced Physics – 2	2	25	75	100	3 Hrs	3	38	50
5.		A	Practical I: General Experiments	4	40	60	100	4 Hrs	6	30	50
6.		A	Practical II: General Electronics	4	40	60	100	4 Hrs	6	30	50
	TOTAL			**25**			**600**		**30**		

SEMESTER – III

S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Exam Duration	Hrs/ Week	Passing Minimum	
					Internal	External	Total			External	Total
1.		A	Paper 7: Molecular Spectroscopy	5	25	75	100	3 Hrs	5	38	50
2.		A	Paper 8: Nuclear Physics	5	25	75	100	3 Hrs	5	38	50
3.		A	Paper 9: Advanced Electronics	5	25	75	100	3 Hrs	5	38	50
4.		B	Elective III: Problems in Advanced Physics – 3	2	25	75	100	3 Hrs	3	38	50
	TOTAL			**17**			**400**		**18**		
5.		A	Practical III: Advanced Experiments	Examination at the end of Fourth Semester					6		
6.		A	Practical IV: Microprocessor and Special Electronics	Examination at the end of Fourth Semester					6		

SEMESTER – IV

S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Exam Duration	Hrs/ Week	Passing Minimum	
					Internal	External	Total			External	Total
1.		A	Paper 10: Material Science	5	25	75	100	3 Hrs	5	38	50
2.		A	Paper 11: Optical and Thin Film Physics	5	25	75	100	3 Hrs	5	38	50
3.		A	Paper 12: Numerical Methods and Object Oriented Programming in C^{++}	5	25	75	100	3 Hrs	5	38	50
4.		B	Elective IV: Soft Skill (ONLY PRACTICAL & VIVA-VOCE EXAMINATION)	2	40	60	100	4 Hrs	3	30	50
5.		A	Practical III: Advanced Experiments	5	40	60	100	4 Hrs	6	30	50
6.		A	Practical IV: Microprocessor and Special Electronics	5	40	60	100	4 Hrs	6	30	50
7.		A	Project and Viva-voce	4	20	80	100	--	--	40	50
	TOTAL			**31**			**700**		**30**		

Subject		Part	No. of Papers	Credit/Paper	Total Credit	Total Marks
Core Papers		A	12	5	60	1200
Practical Papers	Practical I & II	A	2	4	8	200
	Practical III & IV	A	2	5	10	200
Project and Viva-voce		A	1	4	4	100
Elective – Theory		B	3	2	6	300
Elective – Practicals		B	1	2	2	100
Total			**21**		**90**	**2100**

SEMESTER I: PAPER 1 : CLASSICAL AND STATISTICAL MECHANICS

UNIT 1:

Lagrangian Formulation: Mechanics of a system of particles – Conservation of linear momentum, angular momentum and energy – Principle of virtual work and D'Alembert's principle – Lagrange's equations of motion from this principle

Hamiltonian Theory: Hamiltonian's equations of motion – Cyclic variables – Principle of least action – Canonical transformations – Equations of canonical transformations and generating functions – Lagrange's bracket – Poisson bracket and its properties – Equation of motion in Poisson bracket notation

UNIT 2:

Hamilton Jacobi Theory: Hamilton Jacobi equations for Hamilton's principal and characteristic functions – Harmonic oscillator problem – Separation of variables method – Action and angle variable – Linear harmonic oscillator application

Oscillatory Motion: Stable and unstable equilibrium – Theory of small oscillations – Normal coordinates and normal modes of vibration – Parallel pendulum – Double pendulum – Linear triatomic molecule

UNIT 3: Mechanics of Rigid Body Motion

Generalized coordinates for rigid body motion – Euler's theorem – Chasles' theorem – Euler's angles – angular momentum of rigid body: Angular velocity, Angular momentum, Moments and products of inertia – Principle axes transformation –Equations of motion of a rigid body – Euler's equations – The motion of a symmetric top under the action of gravity : First integrals of equations of motion, Precession without nutation, Nutational motion, Fast top and Sleeping top

UNIT 4: Classical Statistics and Partition Functions

Maxwell Boltzmann distribution law – Maxwell's distribution of speeds – Most probable speed, Average speed and Root mean square speed – Degree of freedom – Law of equipartition of energy – Atomicity of gases

Microcanonical ensemble – Partition functions – Entropy of a perfect gas – Gibb's paradox – Gibb's canonical ensemble – Grand canonical ensemble

UNIT 5: Quantum Statistics

Bose-Einstein distribution law – Fermi Dirac distribution law – Black body radiation and Planck's radiation law – Bose – Einstein gas – Degeneracy and Bose- Einstein condensation –Fermi -Dirac gas – electron gas in metals – Thermionic emission

Books for Study:

1. Classical Mechanics by Gupta, S.L. Kumar and Sharma (Units 1,2 &3)
2. Statistical Mechanics by Gupta & Kumar (Units 4 &5)

Books for Reference:

1. Classical Mechanics by H.G. Goldstein
2. Classical Mechanics by Gupta &Satyaprakash
3. Classical Mechanics by N.C. Rane& P.S. Joag

SEMESTER I: PAPER 2 : QUANTUM MECHANICS - I

UNIT 1:Matrix Formulation of Quantum Mechanics

Hilbert space – Dirac's bra and ket notation – Operators as matrices – Matrix form of wave functions – Unitary transformation: Change of basis – Properties of unitary transformations – Schrodinger picture – Heisenberg picture – Interaction picture –Matrix theory of harmonic oscillator

UNIT 2: Spherically Symmetric Systems

Schrödinger's equation for spherically symmetric potentials – Three dimensional harmonic oscillator – Rigid rotator with free axis – Solution of wave equation and eigen function for the rotator – Rigid rotator in a fixed plane – The Hydrogen atom - ϕ, θ and r equations and their solutions – Energy eigen values for the hydrogen atom – Degeneracy – The normal state of hydrogen atom

UNIT 3: Angular Momenta and their Properties

Angular momentum operator – Spin angular momentum – Total angular momentum – Commutation relations of total angular momentum with components – Eigen values of J^2 and J_z – Eigen values of J_+ and J_- - Explicit form of angular momentum matrices – Addition of angular momenta: Clebsch Gordon Coefficients - Calculation of Clebsch Gordon Coefficients for $j_1 = ½$, $j_2 = ½$

UNIT 4: Time Independent Approximation Methods

Time independent perturbation theory for the non-degenerate levels and degenerate levels (First and Second Order) – Normal Helium atom – First order Stark effect in Hydrogen – Perturbed energy in case of hydrogen (Zeeman Effect)

Variation Method – Ground state energy of the hydrogen atom – Zero point energy of one dimensional harmonic oscillator

UNIT 5: Identical Particles and Spin

The WKB approximation and its validity condition – Transmission through a barrier – Identical particles – Symmetric and anti-symmetric wave functions – Construction of symmetric and anti-symmetric wave functions – Pauli's exclusion principle – Physical significance – Pauli's spin operator – Commutation relations

Books for Study:

1. Quantum Mechanics by S.L. Gupta, V. Kumar, H.V. Sharma and R.C. Sharma
2. Advanced Quantum Mechanics by Satyaprakash and Swati Saluja

Books for Reference:

1. Quantum Mechanics by Lenoard I Schiff
2. A Textbook of Quantum Mechanics by PM Mathews and K. Venkatesan

SEMESTER I: PAPER: 3 MATHEMATICAL PHYSICS

UNIT 1: **Complex Variables**:
Function of a complex variable - Analytic function - Harmonic functions – problems - Complex integration - Cauchy's theorem - Cauchy's integral formula - Taylor's expansion - Laurent's expansion - Residue and contour integration - Cauchy's residue theorem - Computation of residue - Evaluation of definite integrals (without Jordan's lemma)

UNIT 2: **Differential Equations and Special Functions**:
Bessel's equations – solution - Function of first kind - Half order function - Recurrence formula - Generating function, Legendre's equations – solution – Polynomials - Generating function - Recurrence relations - Rodrigue's formula - Orthogonality property, Hermite's equations – solution – Polynomials - generating function - Recurrence formulae - Rodrigue's formula - Orthogonality property

UNIT 3: Fourier Series and Integrals:
Definition - Evaluation coefficients - Even and odd functions - Dirichlet's theorem and Dirichlet's conditions - half range series in interval 0 to π - change of interval from $(-\pi, \pi)$ to (-l, l) - complex form of Fourier series - Fourier series in interval (0, T) - uses of Fourier series - physical examples (square, sawtooth and triangular) - properties – Parseval's Identity - Fourier Integrals

UNIT 4:Laplace Transform:
Definition-conditions for existence and proof of their validity-properties-Laplace transform of some simple functions-Laplace transform of derivative-Laplace transform of an integral-laplace transform of periodic functions-Inverse Laplace transform-Fourier Mellin theorem-Evaluation of inverse Laplace transform by Bromwich integral-properties-Application of Laplace transform

UNIT 5:Group Theory:
Concept of group - Abelian groups - Generation of finite group - Group multiplication table - Rearrangement theorem – subgroup - Lagrange theorem – Cosets - Conjugate elements and classes - Normal subgroups - Factor groups - Isomorphism and Homomorphism - group of symmetry of an equilateral triangle and square - Representation theory - Reducible and irreducible representations - Schur's Lemma I and II - Great orthogonality theorem - the character of representations - character tables - C_{2v} Group

Books for Study

1. Mathematical Physics with Classical Mechanics by Sathyaprakash, Sulthan Chand & Sons

Books for Reference:

1. Advance Engineering Mathematics by Kreyzig, Wiley Eastern
2. Mathematical Physics by Arfen and Weber
3. Mathematical Physics by BD Gupta, Vikas Publishing House 2nd Edition 1997
4. Mathematical physics by Rajput, PragathiPrakashan
5. Elements of Group theory for Physicists by Joshi , Wiley Eastern

SEMESTER I: ELECTIVE-I: PROBLEMS IN ADVANCED PHYSICS – 1

UNIT 1: Mathematical Methods of Physics

Dimensional analysis - Vector algebra and vector calculus - Linear algebra – matrices – Cayley Hamilton Theorem – Eigen values problems - Linear ordinary differential equations - Special functions (Hermite, Bessel and Legendre functions) - Fourier series - Fourier and Laplace transforms - Elements of complex analysis - Laurent series; poles, residues and evaluation of integrals – Elementary ideas about tensors - Introductory group theory - SU(2), O(3) - Elements of computational techniques - root of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, Solution of first order differential equation using Runge-Kutta method - Finite difference methods - Elementary probability theory, random variables, binomial, Poisson and normal distributions.

UNIT 2: Classical Mechanics

Newton's laws - Phase space dynamics, stability analysis - Central force motions - Two body Collisions , Scattering in laboratory and Centre of mass frames - Rigid body dynamics, moment of inertia tensor, non-inertial frames and pseudo forces - Variational principle, Lagrangian and Hamiltonian formalism and equations of motion - Poisson brackets and canonical transformations - Symmetry, invariance and conservation laws and cyclic coordinates - Periodic motion: small oscillations, normal modes - Special theory of relativity, Lorentz transformations, relativistic kinematics and mass–energy equivalence.

Books for Study:

CSIR-UGC NET/JRF/SET Physical Science by Dr. Surekha Tomar
Upkar Prakahan, Agra (NOTE: Problems only from Book for Study)

Question Paper Pattern:

Part A	25 Multiple Choice Questions (13 questions from Unit 1 & 12 questions from Unit 2)	Unit 1: Pages: 38 – 55 Unit 2: Pages: 148 – 168	25×1=25
Part B	Unit 1 (Any 5 Questions out of 9)	Pages: 101 – 122	5×5=25
Part C	Unit 2 (Any 5 Questions out of 9)	Pages: 185 – 205	5×5=25
		Total	75

SEMESTER II: PAPER 4: QUANTUM MECHANICS – II

UNIT 1: Time Dependent Perturbation and Semi-classical Theories

Time Dependent Perturbation theory – First and Second order transitions – Fermi Golden rule – Harmonic perturbation – Emission and absorption of radiation – Einstein's transition probabilities by perturbation theory – Adiabatic and sudden perturbations

UNIT 2: Quantum Theory and Scattering

Scattering cross-section – Relation connecting scattering cross-section and scattering amplitude – Green's function – Born approximation and condition for its validity – Scattering by a screened coulomb potential – Rutherford scattering formula – Scattering by (i) Square-well potential and (ii) Gaussian potential – Partial wave analysis – Optical theorems and Phase shifts – Scattering lengths and effective range theory for low energy scattering

UNIT 3: Relativistic Quantum Mechanics

Klein Gordan equation – Charge and current densities – Application of Klein Gordan equation to Hydrogen atom – Dirac equation for a free particle – Dirac matrices – Free particle solution – Particle density and current density – Magnetic moment of electron – Existence of electron spin – Negative energy states – Properties of gamma matrices

UNIT 4: Quantum Field Equations

Field – Quantization procedure for particles – Lagrangian formulation – Hamiltonian formulation – Quantum field equations – Second quantization – Quantization of Schrödinger equation (Non-relativistic case) – Creation, annihilation and number operators – Anti-commutation relations

UNIT 5: Theory of Many Electron Atoms

Slater rules – Examples – Hund's rules – Various electron configuration – Examples – Hartree Self consistent field – Hatree equation – Hatree-Fock Self consistent field – Hatree-Fock equation – Treatment of Molecules – Born Oppenheimer approximation – Feynman rules – Examples

Books for Study:

1. Quantum Mechanics by S.L. Gupta, V. Kumar, H.V. Sharma and R.C. Sharma (Units 1 & 2)
2. Quantum Mechanics by Sathyaprakash and Swati Saluja (Units 3 & 4)
3. Quantum Chemistry – 4th Edition by IRA N Levine (Unit 5)

Books for Reference:

1. Quantum Mechanics by Lenoard I Schiff
2. A Textbook of Quantum Mechanics by PM Mathews and K. Venkatesan
3. Quantum Mechanics by Sakurai
4. Introduction to Quantum Mechanics by Shankar
5. Quantum Mechanics by Thangappan
6. Advanced Quantum Chemistry by Prasad

SEMESTER II: PAPER 5: SOLID STATE PHYSICS

UNIT 1:Reciprocal Lattice: Unit cell – Space lattice – Bravais lattices – Miller indices – Graphical construction of reciprocal lattice – Vector development of reciprocal lattice – Properties of reciprocal lattice – Reciprocal lattice to simple cubic, bcc and fcc lattice

Crystal Diffraction: Bragg's law – correction – Bragg's law in three dimensions – Von Laue treatment – Powder photograph method – Calculation of lattice constants of cubic and hexagonal crystals from XRD data – Calculation of particle size using Debye-Scherrer formula from XRD data – Diffraction of electrons and neutrons.

UNIT 2:Imperfections in Crystals: Classification of defects – Point defects – Schottky defect – Expressions for number of vacancies – Frenkel defect – Expressions for number of vacancies – Colourcentres: F and F' centres – Line defects: Edge and Screw dislocation– Grain Boundaries

Bonding in Solids: Ionic bonding – Energy of formation of NaCl molecule – Madelung Constant (linear array and three dimension) – Potential energy diagram – Cohesive energy – Calculation of Repulsive exponent – Born-Haber cycle –Characteristics of ionic bond – Characteristics of covalent, metallic, molecular and hydrogen bonding.

UNIT 3:Lattice Vibrations: Elastic vibrations of continuous media – Vibrations of one dimensional monoatomic lattice – Group and phase velocities – Normal modes of vibration – Vibration of one dimensional diatomic lattice – Optical and acoustical branch – Forbidden frequency band – Facts about diatomic lattice – The concept of phonons – Momentum of phonons – Inelastic scattering of photons by phonons and scattering of neutrons by phonons.

Thermal Properties of Solids: Classical theory of lattice specific heat – Einstein's theory – Debye's model – Debye approximation – Limitations.

UNIT 4:Free Electron Theory Of Metals: Free electron gas – Drude and Lorentz theory – Electrical and thermal conductivities – Wiedemann and Franz ratio – Variation of electrical resistivity with temperature – Sommerfeld quantum model – Energy levels, density of states and Fermi energy (in one dimension) – Electronic Specific heat - Thermionic emission – Richardson and Dushman equation – Schottky effect – Failure of free electron model.

UNIT 5:Band Theory of Solids: Energy spectra in atoms, molecules and solids – Wave equation in a periodic potential – Bloch theorem – Kronig-Penny model – Different zone schemes – Brillouin Zones in two dimensional square lattice – Distinction between metals, insulators and semiconductors

Optical Phenomena in Crystals: Photoconductivity – Absorption edge of crystals – simple model of photoconductor – Photosensitivity – Types of traps – Excitons – Luminescence – Polaron.

Book for Study:

1. Solid State Physics, S.L. Gupta and V. Kumar, K. Nath& Co.

Books for Reference:

1. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern Ltd.
2. Solid State Physics, A.J. Dekker, Macmillan India Ltd.
3. Solid State Physics, R.L. Singhal, KedarNath Ram Nath& Co.
4. Solid State Physics, S.L. Kakani& C. Hemarajani, Sultan Chand & Sons.

SEMESTER II: PAPER 6: ELECTROMAGNETIC THEORY

UNIT 1: Electrostatics and Magnetostatics

Dielectric polarization – External field of a dielectric medium - The electric field inside a dielectric - Electric displacement vector D –Dielectric constant - Polarization of non-polar molecules – Polarization of polar molecules

Current density –Biot –Savart's law - Ampere's circuital law – Lorentz force formula – Magnetic scalar and vector potential (derivation only) – Magnetization and magnetization current - Magnetic intensity, susceptibility and permeability

UNIT 2: Field equation and propagation of EM Waves

Equation of continuity , Displacement current – The Maxwell's equation (derivation) – Physical significance – Poynting vector – Electromagnetic potentials – Concept of gauge – Lorentz gauge – Propagation of plane electromagnetic waves in free space; in isotropic; in anisotropic; in conducting media – Wave guides – Rectangular waveguides

UNIT 3: Interaction of EM Waves with matter

Boundary conditions at interface between two media – Reflection and refraction of electromagnetic wave – Fresnel's formula – Brewster's law and polarization of EM waves – Total internal reflection and critical angle – Reflection from metallic surface

Scattering and scattering parameters – Scattering by a free electron – Scattering by a bound electron – State of polarization of scattered radiation – Dispersion – Normal and Anomalous – Dispersion in gases, liquids and solids

UNIT 4: Fields of Moving Charges and Radiating Systems

Retarded potential – Lienard-Wiechert potentials – Field of a point charge in uniform rectilinear motion – Fields of a point charge in arbitrary motion – Radiation from an accelerated charged particle at low velocity – Radiation from an accelerated charged particle at high velocity

Oscillating electric dipole – Radiation from an oscillating dipole – Radiation from small current element – Linear half wave antenna, Antenna arrays (Qualitative Treatment)

Unit 5: Relativistic Electrodynamics

Purview of special theory of relativity – Four vectors and tensors – Transformation equations for ρ and J – Transformation equations for A and Φ – Transformation equations for field vector E and B – Covariance of Maxwell's equation in 4-vector form – Covariance of Maxwell's equation in 4-tensor form – Covariance and transformation law of Lorentz force

Book for Study:

1. Electromagnetic Theory by Chopra and Agarwal(K. Nath & Co., Meerut)

Books for Reference:

1. Electrodynamics by Gupta Kumar and Singh(Pragati Prakashan, Meerut)
2. Electromagnetic theory and Electrodynamics by Sathya Prakash (K. Nath & Co., Meerut)
3. Classical Electrodynamics by Jackson
4. Introduction to Electromagnetic fields and Waves by Lorrain and Carson

SEMESTER-II: ELECTIVE-II: PROBLEMS IN ADVANCED PHYSICS – 2

UNIT 1: Quantum Mechanics

Wave-particle duality - Wave-function in coordinate and momentum representations - Commutators and Heisenberg's uncertainty principle – Matrix representation – Dirac's bra and ket notation - Schrödinger equation (time-dependent and time-independent) – Eigen value problems such as particle in a box, harmonic oscillator, etc.- Tunneling through a barrier - Motion in a central potential - Orbital angular momentum, Angular momentum algebra, spin - Addition of angular momenta - Hydrogen atom ,spin-orbit coupling, fine structure - Time-independent perturbation theory and applications - Variational method WKB approximation - Time dependent perturbation theory and Fermi's golden rule - Selection rules –Semi-classical theory of radiation – Elementary theory of scattering, phase shift, partial waves, Born approximation - Identical particles – Pauli's exclusion principle - Spin-statistics connection – Klein Gordon and Dirac equations

UNIT 2: Electromagnetic Theory

Electrostatics: Gauss's law and its applications-Laplace and Poisson equations, boundary value problems- Magneto statics: Biot-Savart law, Ampere's theorem. Electromagnetic induction-Maxwell's equations in free space and linear isotropic media- Boundary conditions on the fields at interfaces- Scalar and vector potentials- gauge invariance- Electromagnetic waves in free space, Dielectrics and conductors- Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction- Dynamics of charged particles in static and uniform electromagnetic fields- Radiation from moving charges, dipoles and retarded potentials.

Books for Study:

CSIR-UGC NET/JRF/SET Physical Science by Dr.SurekhaTomar
Upkar Prakahan, Agra(NOTE: Problems only from Book for Study)

Question Paper Pattern:

Part A	25 Multiple Choice Questions (13 questions from Unit 1 & 12 questions from Unit 2)	Unit 1: Pages: 330 – 348 Unit 2: Pages: 224 – 244	25×1=25
Part B	Unit 1 (Any 5 Questions out of 9)	Pages: 388 – 424	5×5=25
Part C	Unit 2 (Any 5 Questions out of 9)	Pages: 285 – 301, 305 – 307, 312,313	5×5=25
		Total	75

PRACTICAL – I – GENERAL EXPERIMENTS

Examination at the end of SECOND Semester

(Any 12)

1. Young's Modulus – Elliptical fringes (Cornu's Method)
2. Young's Modulus – Hyperbolic fringes (Cornu's Method)
3. Stefan's constant
4. Rydberg's constant – Solar Spectrum
5. e/m by Thomson's Method
6. Thermal conductivity by Forbe's Method
7. Viscosity of liquid by Mayer's Disc Method
8. Specific heat of liquid by Ferguson's method
9. Thermistor – Determination of Temperature co-efficient and Band gap energy
10. Diffraction at a prism table – Determination of wavelength
11. Four Probe Method – High Conductivity sample
12. Four Probe Method – Low Conductivity sample
13. Laser Experiments
14. Biprism on Optical bench – Determination of wavelength
15. Hartmann's Formula (Spectrometer)
16. Charge of an electron using spectrometer
17. Determination of Audio Frequency – Bridge method
18. Compressibility of a liquid – Ultrasonic method
19. Characteristics of Solar cell
20. Thermionic Work Function
21. Determination of refractive index of a liquid by Air Wedge method
22. Determination of refractive index of a liquid by Newton's ring method
23. Dielectric loss using CRO

PRACTICAL – II – GENERAL ELECTRONICS

Examination at the end of SECOND Semester

(Any 15)

1. Regulated and dual power supply construction
2. Hartley Oscillator (i) Using Transistor and (ii) Using Op. Amp.
3. AstableMultivibrator using (i) IC 555 and (ii) Op. Amp.
4. Differentiator and integrator using Op. Amp.
5. RC coupled amplifier – Frequency response
6. Characteristics of FET
7. Common source FET amplifier
8. Common drain FET amplifier
9. Characteristics of UJT
10. UJT relaxation oscillator
11. Op. Amp as Schmitt Trigger
12. Clipping and Clamping Circuits
13. D/A converter using Op. Amp
14. Design of Low Pass, High Pass and Band Pass filters
15. Parameters of Op. Amp.
16. Differential Amplifier – Op. Amp.
17. Frequency response of an Op. Amp.
18. Sign Changer, Scale Changer, Adder and Subtractor using Op. Amp.
19. AC Amplifier – Inverting, Non-inverting, Voltage Follower using Op. Amp.
20. Bistable Multivibrator using IC 555
21. Characteristics of tunnel diode
22. Analog to Digital converter using IC74148

SEMESTER III: PAPER 7: MOLECULAR SPECTROSCOPY

UNIT 1: **Microwave Spectroscopy**: Classification of molecules – Interaction of radiation with rotating molecule – Rotational spectra of rigid diatomic molecule – Isotope effect – Intensity of rotational lines – Non-rigid rotator – Rotational spectra of linear polyatomic molecules and symmetric top molecules – Microwave spectrometer.
Infra-red Spectroscopy: The energy of a diatomic molecule – Simple harmonic oscillator – Anharmonic oscillator – Hot bands – Diatomic vibrating rotator – Vibration-Rotation spectra of linear molecules and symmetric top molecules – IR spectrophotometer – Fourier Transform IR spectroscopy (Basic Ideas)

UNIT 2: **Raman Spectroscopy**: Principle – Classical Theory – Quantum Theory – Pure rotational Raman spectra of linear molecules – Vibrational coarse and rotational fine Raman spectra– Rule of mutual exclusion – Comparison between Raman and IR spectra – Raman Spectrometer.
Nonlinear Raman Phenomenon: Hyper Raman effect – Classical treatment – Experimental techniques – Stimulated Raman scattering – Inverse Raman effect – Coherent anti-stokes Raman scattering – Photo-acoustic Raman scattering.

UNIT 3: **Electronic Spectroscopy**: The Born-Oppenheimer approximation – Vibrational course structure – Progressions and sequences – Frank Condon Principle – Rotational fine structure of electronic vibration spectra – Fortrat Diagram.
Photoelectron Spectroscopy: Principle – Instrumentation – Information from photoelectron spectra – Basic Ideas on ultraviolet photoelectron spectroscopy (UPES) and X-ray photoelectron spectroscopy (XPS)

UNIT 4: **NMR Spectroscopy**: Quantum description of Nuclear Magnetic Resonance – Rules predicting spin number of nuclei responding to NMR – Chemical shift – Instrumentation – Spin-lattice and spin-spin relaxation – Bloch equations and complex susceptibility – Line width.
ESR Spectroscopy: Comparison between NMR and ESR – Theory – Lande'ssplitting factor (g) – Hyperfine splitting – Instrumentation.

UNIT 5: **Mossbauer Spectroscopy**: Recoilless emission and absorption – Instrumentation – Isomer shift – Quadrupole interaction – Magnetic hyperfine interaction.
NQR Spectroscopy: Theory – The quadrupole nucleus – Principle of NQR – Instrumentation.
Atomic Absorption Spectroscopy: Principle – Grotrian diagram – Distinction between atomic absorption and flame emission spectroscopy – Advantages and disadvantages of AAS – Instrumentation.

Books for Study:
1. Molecular Structure and Spectroscopy – G. Aruldhas, Printice Hall of India (Units 1, 2, 3 and 4)
2. Spectroscopy (Atomic and Molecular) GurdeepChatwal and Sham Anand, Himalaya Publishing House (Unit 5)
3. Solid State Physics, S.L. Gupta and V. Kumar, K. Nath& Co (Unit 4 and 5)

Books for Reference:
1. Spectroscopy Volume I, II and III by SP Straugan and S. Walker
2. Fundamentals of Molecular Spectroscopy by CN Banwell, Tata McGraw Hill Publishing Co. Ltd.

SEMESTER III: PAPER 8 : NUCLEAR PHYSICS

UNIT 1:

Quantum Numbers : Quantum numbers for individual nucleons – Isospin – parity – Nuclear angular momentum – Nuclear magnetic dipole moment – Quadrupole moment.

Mass Spectroscopy: Bainbridge and Jordan mass spectrograph – Neir's double focussing mass spectrometer – Mass synchrometer.

UNIT 2:

α-ray – Determination of q/m of α particle – Determination of the charge of α particles – Range of α particles – Experimental measurement of the range of α particles – Range – Velocity – Energy – Life relations - α particle spectra – Gamow's theory of α decay

Beta ray – Determination of e/m of β particles: Kaufmann's experiment - β ray spectra – Magnetic spectrograph – Origin of the line and continuous spectrum – Neutrino hypothesis – Indirect method – Direct method – Fermi theory of β decay

γ ray – Wavelength measurement by crystal diffraction – Origin of γ rays – Nuclear isomerism – Internal conversion – Internal pair creation

UNIT 3:

Nuclear Forces: Nuclear forces – Properties – Charge independence – Spin dependence of nuclear forces – exchange forces – Meson theory of nuclear forces – Isotopic spin formalism.

Nuclear Models: Liquid drop model – Spontaneous fission – Activation energy – Shell model – Prediction of angular momenta of nuclear ground states by shell model – Collective model – Optical model.

UNIT 4:

Nuclear Reactions: Kinds of reaction and conservation laws – Energy of Nuclear reaction – Continuum theory of Nuclear reaction – Resonance – Breit and Wigner dispersion formula – Stages of a nuclear reaction.

Nuclear Reactors: Nuclear reactors – Pressurized Water Reactor – Boiling Water Reactor – Fast Breeder Reactor – Neutron cycle in a thermal nuclear reactor – Fusion reactors – Biological and other effects of nuclear radiations.

UNIT 5:

Elementary Particles: Classification – Particle interaction – conservation laws – Strangeness – Hyper charge – Isospin – Charge conjugation – Parity – Time reversal – CPT theorem – SU (3) Symmetry – Quarks – Quarks masses – Quantum numbers – Isospin of quarks – Quantum Chromodynamics.

Books for Study:

1. Nuclear Physics by DC Tayal (Units 1,2,3 & 4)
2. Modern Physics – IV Edition by Beiser (Unit 5)

Books for Reference:

1. Nuclear Physics by B. V. Srivastava
2. Nuclear Physics by Pandya and Yadav

SEMESTER III: PAPER 9: ADVANCED ELECTRONICS

UNIT 1:Integrated Circuits: Fabrication and Characteristics

Integrated circuit technology – Basic monolithic circuits – Epitaxial growth – Masking and etching – Diffusion of impurities – Transistor for monolithic circuits – Monolithic diodes – Integrated resistors- Integrated capacitors – Monolithic circuit layout – Additional isolation methods – LSI and MSI – Metal semiconductor contact.

UNIT 2:Integrated Circuits as Analog System Building Blocks

Linear analog systems: Basic Op.Amp. applications – Sign changer – Scale changer – Phase shifter – Summing amplifier – Voltage to current converter – Current to voltage converter – DC voltage follower – Differential DC amplifier – Stable AC coupled amplifier – Analog integration and differentiation – Electronic analog computation

Nonlinear analog systems: Comparator – Sample and hold circuits – D/A converter: Binary weighted resister and ladder type – A/D converter: Successive type and Dual-slop converters

UNIT 3: Flip-flop, Minimization Techniques and Synchronous Counters

Flip-flops:S-R,Clocked S-R, D, J-K, T,Master-Slave J-K flip-flops – Their state diagrams and characteristic equations – Edge triggering in flip-flops

Boolean algebra and Minimization Techniques: Basic laws of Boolean algebra – De Morgan's theorems – Sum-of-products and Product –of-sums - Karnaugh map (up to four variables only) –Don't care conditions

Design of Synchronous Counters: Design of MOD-3, MOD-6 ,and MOD-10 counters using JK Master-slave flip-flops only – Register – 4 bit shift Register – Serial-in serial-out, Serial-in Parallel-out, Parallel-in Serial-out and Parallel-in Parallel-out – Design of four bit self-correcting ring counter using D-flip-flop

UNIT 4: Microprocessors

8085 microprocessors – Microprocessor communication and bus timings – Demultiplexing the bus AD_7 - AD_0 – Generating control signals – A detailed architecture of 8085 microprocessor – 8085 machine cycles and bus timings – Opcode fetch machine cycle – Memory read machine cycle – Memory interfacing: Memory structure and its requirements – Basic concepts in memory addresses interfacing – Address decoding – interfacing circuit – Address decoding and memory address interfacing the 8155 memory section

UNIT 5: Programming the 8085

8085 programming model – Instruction classifications – Instruction and data format – 8085 Instructions: Data transfer operations – Logic operations – Branch operations – Programming techniques – Looping, counting and indexing – Additional data transfer and 16-bit arithmetic instructions – Counters and time delays – Simple programs – Addition, subtraction, multiplication, division, setting bits, masking bits

Books for Study:

1. Integrated Electronics by Millman and Halkias, TMH Publications (UNIT 1&2)
2. Digital Circuits and Design by S. Salivahanan and S. Arivazhagan, Vikas Publishing(UNIT 3)
3. Microprocessor Organizations and Architecture by Ramesh S. Gaonkar(UNIT 4 & 5)

Books for Reference:

1. Handbook of Electronics by Gupta and Kumar
2. Introduction to Microprocessors by D.S.Matur

SEMESTER III: ELECTIVE III- PROBLEMS IN ADVANCED PHYSICS – 3

UNIT 1: Atomic & Molecular Physics

Quantum states of an electron in an atom- Electron spin-Stern and Gerlach experiment - Spectrum of helium and alkali atom-Relativistic corrections for energy levels of hydrogen atom- Hyperfine structure and isotopic shift- Width of spectrum lines- L-S & J-J couplings- Zeeman, Paschen-Bach and Stark effects – X-ray spectroscopy - Electron spin resonance, NMR, chemical shift – Rotational, Vibration, Electronic and Raman spectra of diatomic molecules- Frank Condon principle and selection rules - Spontaneous and stimulated emission, Einstein A & B coefficients - Optical pumping - Population inversion - Rate equation - Modes of resonators and coherence length.

UNIT 2: Electronics

Semiconductor device physics including diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices, device structure, device characteristics, frequency dependence and applications-

Opto-electronic devices including solar cells, photo-detectors, LEDs –High frequency devices including generators and detectors - Operational amplifiers and their applications- Digital techniques and applications (registers, counters, comparators and similar circuits)- A/D and D/A converters - Microprocessor and Microcontroller basics.

Books for Study:

CSIR-UGC NET/JRF/SET Physical Science by Dr. Surekha Tomar
Upkar Prakahan, Agra **(NOTE: Problems only from Book for Study)**

Question Paper Pattern:

Part A	25 Multiple Choice Questions (13 questions from Unit 1 & 12 questions from Unit 2)	Unit 1: Pages:771 - 787 Unit 2: Pages: 570 – 586, 595 – 600	25×1=25
Part B	Unit 1 (Any 5 Questions out of 9)	Pages: 819 – 833, 844 – 848	5×5=25
Part C	Unit 2 (Any 5 Questions out of 9)	Pages: 637 – 649, 694 - 700	5×5=25
		Total	75

SEMESTER IV: PAPER 10: MATERIALS SCIENCE

UNIT 1: Dielectric materials

Polarization – Dielectric constant – Different types of polarization – Total polarizability – Frequency and Temperature effects on polarization – Dielectric loss – Local field – Clausius – Mossotti relation- Dielectric breakdown – Different types of breakdown – Different types of dielectric materials – Active and Passive dielectrics – properties and applications of dielectric materials – Ferroelectric materials – Applications – Piezoelectric materials – Applications.

UNIT 2: Magnetic Materials

Types of magnetic materials – Paramagnetic materials – Langevin theory of paramagnetism – Weiss theory of paramagnetism – Quantum theory of paramagnetism – Ferromagnetic materials – Ferromagnetic domains – Origin of domains – Exchange integral - Weiss theory of ferromagnetism – Antiferromagnetism – Neel temperature – Molecular field theory of antiferromagnetism – Ferrimagnetic materials.

UNIT 3: Semiconducting materials and Modern materials

Types of semiconducting materials – Mobility, Drift velocity and carrier concentration of intrinsic semiconductor and extrinsic semiconductor – Hall Effect – Experimental determination of hall coefficient.

Polymers – Plastics – Ceramics – High temperature materials – Thermoelectric materials – Nuclear engineering materials – Metallic glasses – Metal matrix composites – Biomaterials – Super strong materials.

UNIT 4: Superconducting materials and Optical materials

Superconductivity – Superconductors – Critical temperature and Critical magnetic field – Properties of superconducting materials – Meissner effect – Thermodynamics and Optical properties – Isotopic effect – Type I and Type II superconductors – London equation – Penetration depth – Cooper pair – BCS theory – coherence length – recent trends in high temperature superconductors – superconducting magnets – superconducting quantum interface devices (SQUID) – applications of superconducting materials.

UNIT 5: Nanomaterials

Introduction – synthesis of nanostructured materials – properties of nanomaterials – Electrical, Optical, Thermal, mechanical and magnetic properties – functional nanoscale devices – carbon nanotubes – properties of carbon nanotubes – structure of carbon nanotubes – fabrication of carbon nanotubes – application of carbon nanotubes – quantum dot lasers – fabrication of quantum dot lasers – nanomagnets – Ferrofluids – applications of nanomaterials.

Books for Study:

1. Solid State Physics by Gupta , Kumar and Sharma(Unit 1,2 and 4)
2. Handbook of Electronics by Gupta and Kumar (Unit 3)
3. Material Science by M. Arumugam (Units 3 and 4)
4. Nanostructured Materials by ParagDivvan and AshishBharadwaj (Unit 5)

Books for Reference:

1. Solid State Physics by Dekkar
2. Introduction to Solid State Physics by Kittel
3. Nanotechnology by ShaliniSuri
4. Solid State Physics by Saxena and Gupta

SEMESTER IV: PAPER 11: OPTICAL AND THIN FILM PHYSICS

UNIT 1: Polarisation of light and Nonlinear Optics

Polarization – Partial polarization – Polarization by reflection – Polarization by refraction – Polarization by scattering – Circular and Elliptical polarization – Quarter wave plate – Matrix representation of polarization – The Jones calculus – Eigen vectors of Jones matrices – Dichroism – Polaroids

Nonlinear optics: Introduction – Nonlinear polarization – Second harmonic generation – Phase matching – Sum and Difference frequency generation.

UNIT 2: Laser and Maser Physics

Maser: Principle of laser – Ammonia maser – Applications of Maser.

Laser – Characteristics of laser – Basic concepts of laser – Einstein's coefficients – Various pumping methods – Metastable states – Population inversion in three level and four level systems – Active medium – General laser system – Brewster's windows – Q –switching – Mode locking – Gain curve and laser operating frequencies – Neodymium laser – Carbon di oxide laser – Argon ion laser – Liquid laser – Dye laser – Semiconductor laser – Application of laser in various fields.

UNIT 3: Fibre optics

Basic principles – Total internal reflection – Fibre composition – Fibre dimensions – Fibre materials – Classification of optical fibres based on materials, modes and refractive index profiles – Acceptance cone – Numerical aperture – Transmission losses in optical fibre system components – LED, Laser, Photodiode and Avalanche Photodiode- Light wave communication using optical fibres – Applications in medical field.

UNIT 4: Thin film preparation

Thin film depositions technology – Thermal evaporation – Evaporation methods – Resistive heating – Electron bombardment heating – Cathodic sputtering – Sputtering process- Glow discharge sputtering – Chemical vapour deposition – Vacuum deposition apparatus – Substrate deposition technology

UNIT 5: Thickness Measurements and Surface Analysis

Film thickness and its control – Mass method : Gravimetric method and micro balance techniques – Crystal Oscillator – Quartz crystal thickness monitor with block diagram – Optical method: Interferometry – Fizeau fringes method – FECO fringes method

Electron microscope – Types of electron microscope – Scanning electron microscope (SEM) – Transmission electron microscope (TEM) – Applications of SEM and TEM

Books for Study:

1. Introduction to Modern Optics by G.R.Fowles(Unit 1)
2. Nonlinear optics by B.B.Laud (Unit 1)
3. Introduction to Laser Physics by Langyerl (Unit 2)
4. Handbook of Thin Film Technology by Leon I Meisael and ReinherdGleng (Unit 4)
5. Thin Film Fundamentals by Goswami (Unit 5)

Book for Reference:

1. Thin Film Phenomena by KL Chopra
2. Physics for Engineers by MR Srinivasan

SEMESTER IV:

PAPER 12: NUMERICAL METHODS AND OBJECT ORIENTED PROGRAMMING WITH C ++

UNIT 1: **Curve fitting by the method of least squares:** – Principle – Fitting a straight line ($y = ax + b$), Parabola ($y = ax^2 + bx + c$), Exponential curve ($y = ae^{bx}$) and a curve of the form $y = ax^b$– Calculation of the sum of the squares of residuals (for straight line fit and parabola fit) – Fundamental theorems of algebra (without problems)

Solution of algebraic transcendental equations: bisection method, iteration method, condition for convergence – Order of convergence – Newton-Raphson method – Geometrical meaning – Criterion for convergence – Order of convergence

Solution of simultaneous linear algebraic equations: Gauss elimination method – Method of triangularization

UNIT 2: Interpolation for equal intervals: Introduction – Gregory – Newton forward and backward interpolation formulae – Errors in the formulae – Interpolation for unequal intervals : Divided differences – Properties – Newton's interpolation formula – Lagrange's interpolation formula

Numerical integration: Newton-Cote's formula – Trapezoidal rule – Simpson's one-third rule

Numerical solution for ordinary differential equations: Point wise method : Taylor's series (First and second order ODE)- Step by step method : Euler's algorithm – Improved and modified Euler's methods – Runge – Kutta method of second and fourth orders (for first order ODE)

UNIT 3: Procedure oriented programming – OOP Paradigm – Basic concepts of OOPs – Objects – Classes – Data abstraction and encapsulation – Inheritance – Polymorphism – Dynamic binding – Message passing – Structure of C ++ program

Tokens – Key words – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Type compatibility – Declaration of variables- Dynamic initialisation of variables – Reference variables

UNIT 4: Operators in C ++: Scope resolution operators – Member dereferencing operators – Memory management operators – Manipulators – Type cast operators – Expressions and their types – Special assignment expressions –Implicit conversions – Operator over loading – Operator precedence – Control structures

UNIT 5: Functions in C ++: The main function – Function prototyping – Call by reference – Return by reference – In line functions – Default arguments – Constant arguments – Function overloading – Friend and virtual functions – Math library functions

Books for Study:

1. Numerical methods in Science and Engineering by P. Kandasamy, K. Thilagavathy& K. Gunavathy, S. Chand & Co., Ltd.
2. Object Oriented Programming with C ++ by E. Balagurusamy, TMH, 3rd Edition.

Books for Reference:

1. Numerical Methods in Science & Engineering by M.K. Venkatraman, The National Publishing Company, 5th Ed., 2004
2. The C ++ Programming Language, BjarneStroutstrup, Benjamin and Cummins Publications, 2nd Edition

SEMSTER IV: ELECTIVE-IV: SOFT SKILL

(PRACTICAL AND VIVA-VOCE EXAMINATION ONLY)

UNIT 1:

Introductory activities :Listening Skills-Definition – Types – Tips for effective listening – Academic listening – Listening to talks and presentations – Listening to announcements –Listening to radio and television- Effective listening and English –Activities

Writing Skills: Standard business letter –Report writing-Email drafting and Etiquette –Preparing agenda and writing minutes for meetings – Making notes on business conversations-Effective use of SMS – Case studies and documentation

UNIT 2:

7QC Tools – Flow diagram – types of flow diagram – Applications – Brain storming – Key elements – Methods – Uses – Data Collection – Purpose – Types of Data – Check Sheet – Interpretation – Errors in interpretation – Benefits of Data Collection – Graphs – Purpose – Types – Benefits

UNIT 3:

Stratifications – Steps for stratification – Source and Bases – Pareto Diagram – Principles for selection – Uses of Pareto Analysis – Pit falls – Cause and Effect Diagram – Making of cause and effect Diagram – Types of cause and effect diagram – Scatter Diagram – Making of Scatter Diagram – Pit falls – Need for a good scatter diagram – Histogram – Construction of Histogram – Interpretation and Shapes of Histogram- Uses of Histogram – control Chart –Types – Making of control charts – Interpretation

UNIT 4:

Quantitative aptitude – Problems on numbers – Ages – Time and Work –Calendar – Odd-man-out and series –Verbal Reasoning: Series completion analogy – Puzzle Test – Logical Sequence of words – Non-verbal reasoning: Figure formation and analysis.

UNIT 5:

Basics of Computers – Email – MS Word - MS Excel – Power point presentation

Books for Study:

1. Communication Skills – A Multi-skill Course, Course Team, Bharathiar University, Macmillan Publisher India Limited, Delhi, Reprint2011(Unit 1)
2. Problem Solving Techniques by K.Ganapathy, V.Narayana and B.Subramaniam, Quality circle forum of India, Revised Edition 2003 (Unit 2 & 3)
3. Verbal Reasoning by R.S.Aggawal,S.Chand & Co., New Delhi (Unit 4)
4. Basic Computers (Unit 5)

PRACTICAL III -ADVANCED EXPERIMENTS

Examination at the end of FOURTH Semester

(Any 12)

1. Arc Spectra-Constant Deviation Spectrometer-Brass
2. Arc Spectra-Constant Deviation Spectrometer-Iron
3. Arc Spectra-Constant Deviation Spectrometer-Copper
4. Absorption Spectra using Constant Deviation Spectrometer
5. Susceptibility by Quinke's method
6. Michelson's Interferometer-λ, $d\lambda$ and thickness of mica sheet
7. e/m by Magnetron method
8. Experiments with GM counter
9. Study of PN junction-Determination of reverse saturation current and material constant
10. Study of PN junction-Determination of Temperature co-efficient of junction voltage and energy band gap
11. Study of PN junction-Study of depletion capacitance and its variation with reverse bias
12. Characteristic study of photo-detectors using laser
13. Determination of Planck's constant
14. Susceptibility by Guoy method
15. e/m by Zeeman Effect
16. Determination of wavelengths of Hg Spectrum using Hartmann's formula using Hartmann's formula using double slit
17. Kelvin's Double Bridge – Determination of very low resistance
18. Hysteresis Curve –Magnetometer method
19. MATLAB programming- Radioactivity decay graph
20. MATLAB programming -Single and double integration
21. Matrix addition, multiplication and division using C Programming

PRACTICAL IV - MICROPRCESSOR AND SPECIAL ELECTRONICS

Examination at the end of FOURTH Semester

(Any 12)

1. 8085 ALP for addition, subtraction, multiplication and division
2. 8085 ALP –Masking off most significant four bits and setting bits using two different instructions
3. 8085 ALP-Subtraction using 1's and 2's complement methods
4. 8085 ALP-Finding largest and smallest numbers in any array and writing program to introduce a time delay
5. 8085 ALP-Sorting the array in ascending and descending order
6. 8085 ALP-Op.Amp.as triangular and square wave generator
7. 8085 ALP-LED interfacing
8. 8085 ALP-Traffic light controller
9. 8085 ALP-Stepper motor controller
10. 8085 ALP-Elevator controller
11. Design of sine wave oscillator using Op.Amp. – Wein bridge
12. Logarithmic amplifier using Op.Amp
13. Op.Amp as Analog to Digital converter-Binary ladder and weighted resistor methods
14. Op.Amp as Digital to Analog converter –Dual slope method
15. Solution of Simultaneous equations using Op.Amp
16. Op.Amp as Phase shift oscillator
17. Binary adder and subtractor using IC 7483 & 7486
18. Design of MOD 3 and MOD 5 counter using JK flip-flop
19. Design of MOD 10 counter using JK flip-flop
20. Design of self-correcting ring counter using D flip-flop
21. C++ Program to fit a straight line y=ax+b using the method of least squares
22. C++ Program to solve nonlinear equations using Newton-Raphson method
23. C++ Program to solve the system of linear equations using Newton-Raphson method
24. C++ Program to evaluate the integral using (1) Trapezoidal rule (2) Simpson's one-third rule
25. C++ Program to solve the first order differential equation (dy/dx) = f (x, y) using fourth orders Runge –Kutta method