GOVERNMENT ARTS COLLEGE (AUTONOMOUS)
COIMBATORE 641 018

DEPARTMENT OF PHYSICS

M.Sc. PHYSICS

CURRICULUM AND SYLLABUS

Under Choice Based Credit System (CBCS)
2018-2019 Onwards

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), COIMBATORE 641 018

DEPARTMENT OF PHYSICS

M.Sc. PHYSICS CURRICULUM FOR THE STUDENTS ADMITTED FROM 2018-2019 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.	18MPH11C	A	Paper 1: Classical and Statistical Mechanics	4	25	75	100	3 Hrs	5	38	50
2.	18MPH12C	A	Paper 2: Quantum Mechanics - I	4	25	75	100	3 Hrs	5	38	50
3.	18MPH13C	A	Paper 3: Mathematical Physics	4	25	75	100	3 Hrs	5	38	50
4.	18MPH14E	B	Elective I: Problems in Advanced Physics – 1	4	25	75	100	3 Hrs	3	38	50
	TOTAL			16			400		18		
5.		A	Practical I: General Experiments	Examination at the end of Second Semester					6		
6.		A	Practical II: General Electronic	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.	18MPH21C	A	Paper 4: Quantum Mechanics - II	4	25	75	100	3 Hrs	5	38	50
2.	18MPH22C	A	Paper 5: Solid State Physics	4	25	75	100	3 Hrs	5	38	50
3.	18MPH23C	A	Paper 6: Electromagnetic Theory	4	25	75	100	3 Hrs	5	38	50
4.	18MPH24E	B	Elective II: Problems in Advanced Physics – 2	4	25	75	100	3 Hrs	3	38	50
5.	18MPH25P	A	Practical I: General Experiments	3	40	60	100	4 Hrs	6	30	50
6.	18MPH26P	A	Practical II: General Electronic	3	40	60	100	4 Hrs	6	30	50
	TOTAL			22			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.	18MPH31C	A	Paper 7: Molecular Spectroscopy	4	25	75	100	3 Hrs	5	38	50
2.	18MPH32C	A	Paper 8: Nuclear Physics	4	25	75	100	3 Hrs	5	38	50
3.	18MPH33C	A	Paper 9: Advanced Electronics	4	25	75	100	3 Hrs	5	38	50
4.	18MPH34E	B	Elective III: Problems in Advanced Physics – 3	4	25	75	100	3 Hrs	3	38	50
	TOTAL			16			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.	18MPH41C	A	Paper 10: Material Science	4	25	75	100	3 Hrs	5	38	50
2.	18MPH42C	A	Paper 11: Optical and Thin Film Physics	4	25	75	100	3 Hrs	5	38	50
3.	18MPH43C	A	Paper 12: Numerical Methods and Object Oriented Programming in C^{++}	4	25	75	100	3 Hrs	5	38	50
4.	18MPH44P	B	Elective IV: Soft Skill (ONLY PRACTICAL & VIVA-VOCE EXAMINATION)	3	40	60	100	4 Hrs	3	30	50
5.	18MPH45P	A	Practical III: Advanced Experiments	3	40	60	100	4 Hrs	6	30	50
6.	18MPH46P	A	Practical IV: Microprocessor and Special Electronics	3	40	60	100	4 Hrs	6	30	50
7.	18MPH47V	A	Project and Viva-voce	15	20	80	100	--	--	40	50
	TOTAL			36			700		30		

Subject	Part	No. of Papers	Credit/Paper	Total Credit	Total Marks
Core Papers	A	12	4	48	1200
Practical Papers	A	4	3	12	400
Project and Viva-voce	A	1	15	15	100
Elective – Theory	B	3	4	12	300
Elective – Practicals	B	1	3	3	100
Total		21		90	2100

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 1: Classical and Statistical Mechanics**	**I**	**18MPH11C**

Objective: *To understand the concepts of classical mechanics and statistical mechanics*

UNIT 1:

Mechanics of a System of Particles and Lagrangian Formulation: Mechanics of a system of particles – Conservation of linear momentum - Conservation theorem for angular momentum – Conservation of energy – Hamilton's variational principle - Deduction of Lagrange's equations of motion from Hamilton's principle.

Hamiltonian Formulation of Mechanics: Hamiltonian – Hamilton's canonical equations of motion – Advantage of Hamiltonian approach – Concept of Principle of least action – Canonical transformations – Generating function – Condition for a transformation to be canonical.

UNIT 2:

Hamilton-Jacobi Theory: Hamilton-Jacobi method – Hamilton-Jacobi equation for Hamilton's characteristic function - Solution of harmonic oscillator problem by HJ method – Action and angle variables – Solution of harmonic oscillator problem by AAV method – Lagrange's brackets

Mechanics of Small Oscillations: Stable and unstable equilibrium – Lagrange's equations of motion for small oscillations – Normal co-ordinates and normal frequencies of vibration – The Parallel pendula – Double pendulum – Linear triatomic molecule.

UNIT 3:

Rigid Body Dynamics: Generalised co-ordinates for rigid body motion – Euler's theorem – Chasles' theorem – Euler's angles – Angular momentum of rigid body: Angular velocity, Angular momentum and Moments and products of inertia – Principal axes transformation – Equations of motion of a rigid body: Euler's equations – The motion of a symmetric top under the action of gravity.

UNIT 4:

Classical Statistics: Maxwell-Boltzmann distribution law – Maxwell's law of distribution of velocities – Mean values obtained from distribution law: Most probable speed, Mean speed, Mean square speed and Root mean square speed – Principle of equipartition of energy – Derivation of mean energy of harmonic oscillator -Microcanonical ensemble – Relation of entropy of a system in statistical equilibrium with thermodynamic quantities – Gibbs paradox – Partition function - Gibbs canonical ensemble – Grand canonical ensemble.

UNIT 5:

Quantum Statistics: Bose-Einstein statistics – Ideal BE gas: Gas degeneracy and Bose-Einstein condensation – Black body radiation and the Planck's radiation law - Fermi-Dirac statistics – Ideal FD gas: Electron gas, Free electron model and electronic emission – White dwarfs.

Books for Study:

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

Books for Reference:

1. Classical Mechanics by Herbert Goldstein
2. Classical Mechanics by Satya Prakash
3. Statistical Mechanics by Satya Prakash

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 2: Quantum Mechanics - I**	**I**	**18MPH12C**

Objective: *To learn the concept of quantum mechanics and their applications in microscopic systems.*

Unit 1: General formalism of quantum mechanics

Hilbert Space – Linear Operator – Eigen Functions and Eigen Values – Hermitian Operator – Postulates of Quantum Mechanics – Simultaneous Measurability of Observables – General Uncertainty Relation – Dirac's Notation – Equations of Motion; Schrodinger, Heisenberg and Dirac representation – momentum representation.

Unit 2: Energy Eigen value problems

Particle in a box – Linear Harmonic oscillator – Tunneling through a barrier – particle moving in a spherically symmetric potential – System of two interacting particles – Rigid rotator – Hydrogen atom

Unit 3: Angular Momentum

Orbital Angular Momentum – Spin Angular Momentum – Total Angular Momentum Operators-Commutation Relations of Total Angular Momentum with Components – Ladder operators – Commutation Relation of Jz with J+ and J- - Eigen values of J2, Jz- Matrix representation of J^2, J_z, J^+ and J^- – Addition of angular momenta – Clebsch Gordon Coefficients – Properties.

Unit 4: Approximation Methods

Time Independent Perturbation Theory in Non -Degenerate Case – Normal He atom – Degenerate Case – Stark Effect in Hydrogen atom – Variation Method – WKB Approximation and its validity condition – Transmission through a barrier

Unit 5: Many Electron Atoms

Indistinguishable particles – Pauli principle- Inclusion of spin – spin functions for two-electrons – The Helium Atom – Central Field Approximation – Thomas-Fermi model of the Atom – Slater rules – Examples – Hund's rule – Hartree Equation – Hartree-Fock equation – Treatment of molecules – Born Oppenheimer approximation – Feynman rules.

Books for Study:

1. Quantum Mechanics – Sathya Prakash and Swati Saluja
2. Quantum Mechanics – S.L. Gupta, V. Kumar, H.V. Sharma
3. Quantum Chemistry – Fourth Edition by IRAN Levine

Books for Reference:

1. A Text Book of Quantum Mechanics-P.M. Mathews & K. Venkatesan, Tata McGraw Hill 2010.
2. Quantum Mechanics – G. Aruldhas - Prentice Hall of India 2006
3. Introduction to Quantum Mechanics – David J.Griffiths Pearson Prentice Hall 2005
4. Quantum Mechanics – L.I. Schiff - McGraw Hill 1968
5. Quantum Mechanics-A. Devanathan-Narosa Publishing-New Delhi

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 3:Mathematical Physics**	**I**	**18MPH13C**

Objective: *To learn various mathematical concepts and techniques and to solve physics problems*

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 of 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, saw tooth 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.

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

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Elective-I: Problems in Advanced Physics – 1**	**I**	**18MPH14E**

Objective: *To develop problem solving skills in students and to motivate them to appear national level competitive examinations with confidence*

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, Laguerre 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
UpkarPrakahan, 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

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 4: Quantum Mechanics – II**	**II**	**18MPH21C**

Objective: *To introduce time dependent perturbation theory, scattering theory, role of relativity in quantum mechanics and quantum field theory*

Unit 1: Time Dependent Perturbation Theory

Time Dependent Perturbation Theory-First and Second Order Transitions-Transition to Continuum of States-Fermi Golden Rule-Constant and Harmonic Perturbation- Collision-Adiabatic and Sudden Approximation - Charged Particle in an Electromagnetic Field.

Unit 2: Scattering Theory

Scattering Amplitude - Expression in terms of Green's Function - Born Approximation and Its validity- Partial wave analysis - Phase Shifts – Asymptotic behaviour of Partial Waves-The Scattering Amplitude in Terms of Phase Shift- Scattering by Coulomb Potential and Yukawa Potential.

Unit 3: Theory of Radiation (Semi Classical Treatment)

Einstein's Coefficients-Spontaneous and Induced Emission of Radiation from Semi Classical Theory-Radiation Field as an Assembly of Oscillators-Interaction with Atoms-Emission and Absorption Rates-Density Matrix and its Applications.

Unit 4: Relativistic Wave Equation

Klein Gordon Equation-Plane Wave Equation-Charge and Current Density-Application to the Study of Hydrogen Like Atom-Dirac Relativistic Equation for a Free Particle-Dirac Matrices -Dirac Equation in Electromagnetic Field - Negative Energy States.

Unit 5: Quantum Field Theory

Quantization of Wave Fields- Classical Lagrangian Equation-Classical Hamiltonian Equation - Field Quantization of the Non-Relativistic Schrodinger Equation-Creation, Destruction and Number Operators-Anti Commutation Relations-Quantization of Electromagnetic Field Energy and Momentum.

Books for Study:

1. Quantum Mechanics – Satya Prakash
2. Quantum Mechanics – S.L. Gupta, V. Kumar, H.V. Sharma

Books for Reference:

1. Text Book of Quantum Mechanics -P.M. Mathews & K. Venkatesan-Tata McGraw Hill 2010
2. Quantum Mechanics – G Aruldhas - Prentice Hall of India 2006
3. Introduction to Quantum Mechanics – David J.Griffiths Pearson Prentice Hall, 2005
4. Quantum Mechanics – A Devanathan - Narosa Publishing-New Delhi
5. Quantum Mechanics – L.I Schiff - McGraw Hill 1968
6. Quantum Mechanics - A.K. Ghatak and S. Loganathan-McMillan India
7. Principles of Quantum Mechanics - R.Shankar, Springer 2005

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 5: Solid State Physics**	**II**	**18MPH22C**

Objective: *To learn the crystal structure, vibrational, thermal, electronic and optical properties of solid state systems*

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 – Determination of unit cell dimensions – Diffraction of electrons and neutrons.

UNIT 2:

Imperfections in Crystals: Classification of defects – Point defects – Schottky defect – Expression for number of vacancies – Frenkel defect – Expression for number of vacancies – Colour centres – 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.

Thermal properties of Solids: Classical theory of lattice specific heat – Einstien'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 – Wiedmann 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 – Brillouin Zones in two dimensional square lattice – Distinction between metals, insulators and semiconductors.

Optical phenomena in Crystals: Photoconductivity – Absorption edge of crystals – Photosensitivity – Types of traps – Excitons – Luminescence

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, Kedar Nath Ram Nath & Co.4. Solid State Physics, S.L. Kakani & C. Hemarajani, Sultan Chand & Sons.

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 6: Electromagnetic Theory**	**II**	**18MPH23C**

Objective: *To educate the basic concepts of electrostatics, magnetostatics, field equations, propagation of EM waves, interaction of EM waves with matter and field of moving charges and radiating systems*

Unit 1: Electrostatics and Magnetostatics

Gauss law - Dielectric and its polarisation – Electric displacement – Dielectric constant – Polarisibility – Polarisation of non-polar molecules: Lorentz equation for molecular field – Clausius-Mosotti relation – Polarisation of polar molecules: The Langevin equation – The Debye relation and study of molecular structure – Electrostatic energy-Current density – Biot Savart law – Ampere's Circuital law - Lorentz force law – Magnetic scalar potential – Magnetic vector potential – Magnetisation and Magnetisation current – Magnetic Intensity, Magnetic Susceptibilty and Permeability.

Unit 2: Field Equation and Propagation of EM waves

Equation of continuity - Displacement current - Maxwell's equations – Physical significance - Poynting vector - Electromagnetic potentials **A** and φ – Maxwell's equations interms of electromagnetic potentials - Non-uniqueness of electromagnetic potentials and concept of gauge – Lorentz gauge – Propagation of electromagnetic waves in free space - Propagation of E.M.W. in isotropic dielectrics - Propagation of E.M.W. in anisotropic dielectrics - Propagation of E.M.W. in Conducting media – Wave guide (Rectangular).

Unit 3: Interaction of EM waves with matter

Boundary Conditions at the interface between two media – Reflection and refraction of electromagnetic waves - Kinematic and dynamic properties – Fresnel's formula – Brewster's law and Polarisation of electromagnetic 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 – Dispersion: Normal and Anomalous – Dispersion in gases – Dispersion in liquids and solids.

Unit 4: Fields of Moving Charges and Radiating Systems

Retarded potentials – Lienard-Wiechert potentials - Fields 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 – Radiation from a linear antenna (Half wave) and Antenna Arrays (Qualitative treatment).

Unit 5: Relativistic Electrodynamics

Purview of special theory of relativity – Four vectors and Tensors – Transformation equations for ρ and $\mathbf{J}$ – Transformation equations for $\mathbf{A}$ and φ – Transformation equations for field vectors $\mathbf{E}$ and $\mathbf{B}$ – Covariance of Maxwell's equations in 4-vectors – Covariance of Maxwell's equations in 4-Tensor forms – 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 (Pragathi Prakasan, Meerut)
2. Electromagnetic theory and electrodynamics by Sathya Prakash (K.Nath & Co., Meerut)
3. Classical Electrodynamics by J. D. Jackson (Wiley Eastern Ltd., New Delhi)

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Elective-II: Problems in Advanced Physics – 2**	**II**	**18MPH24E**

Objective: *To develop problem solving skills in students and to motivate them to appear national level competitive examinations with confidence*

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. Surekha Tomar
UpkarPrakahan, 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

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**PRACTICAL – I – GENERAL EXPERIMENTS Examination at the end of SECOND Semester (Any 12)**	**II**	**18MPH25P**

Objective: *To develop the ability to handle physics laboratory equipments with ease and to determine various physical constants using appropriate experiments*

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. Spectrometer - Hartmann's constants – Determination of wavelength
16. Charge of an electron using spectrometer
17. Determination of Audio Frequency – Bridge method
18. Velocity and 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. Fresnel's biprism – Determination of the thickness of mica sheet.

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**PRACTICAL – II – GENERAL ELECTRONICS Examination at the end of SECOND Semester (Any 12)**	**II**	**18MPH26P**

Objective: *To learn the construction, trouble-shooting and interpreting the results of analog and digital experiments*

1. Regulated and dual power supply construction
2. Hartley Oscillator (i) Using Transistor (ii) Using Op. Amp
3. Astable multivibrator 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. Characteristics of UJT
9. UJT relaxation oscillator
10. Op. Amp as Schmitt trigger
11. Clipping and clamping circuits
12. D/A converter using Op. Amp
13. Design of Low pass, High pass and Band pass filters
14. Parameters of Op. Amp
15. Differential Amplifier- Op. Amp
16. Frequency response of an Op. Amp
17. Sign changer, Scale changer, Adder and Subtractor using Op. Amp
18. AC amplifier- Inverting, Non-inverting, Voltage follower using Op. Amp
19. Bistable multivibrator using IC 555
20. Analog to Digital converter using IC 74148

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 7: Molecular Spectroscopy**	**III**	**18MPH31C**

Objective: *To explore the principle, instrumentation and application of various spectroscopic techniques*

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's splitting 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 by G.Aruldhas, Printice Hall of India (Units 1, 2, 3)
2. Spectroscopy (Atomic and Molecular) by Gurdeep Chatwal and Sham Anand, Himalaya Publishing House (Unit 4 and 5)
3. Solid State Physics by 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.

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 8: Nuclear Physics**	**III**	**18MPH32C**

Objective: *To understand the properties of nucleus and fundamental particles and to realize the impact of nuclear physics on socio-economic and environmental factors*

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 and mass 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: Classification of 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) Himalaya Publishing House.
2. Modern Physics – IV Edition by Beiser (Unit 5) Mcgraw Hill.

Books for Reference:

1. Nuclear Physics by B. B. Srivastava, Rastogi Publications.
2. Nuclear Physics by Pandya and Yadav, Kedar Nath Ram Nath publishers.

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 9: Advanced Electronics**	**III**	**18MPH33C**

Objective: *To learn the functioning of analog and digital circuits and designing special devices using them. They also learn the architecture and programming 8085 microprocessor.*

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: Simultaneous type, counter type, 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-5, 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 – Ring counter – 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

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Elective III- Problems in Advanced Physics – 3**	**III**	**18MPH34E**

Objective: *To develop problem solving skills in students and to motivate them to appear national level competitive examinations with confidence*

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

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 10: Materials Science**	**IV**	**18MPH41C**

Objective: *To understand the characteristics of different types of materials and their applications*

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. Optical materials – Materials for optical sources and detectors – Fibre optic materials and their applications.

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

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 11: Optical and Thin Film Physics**	**IV**	**18MPH42C**

Objective: *To understand the optical and thin film technology to enable students to take up research in these field*

UNIT 1: Polarisation of light

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. Half – Wave plate, Analysis of Polarized light, Babinet Compensator, Fresnel's Rhomb; Double Imaging Polarizing Prims; Applications of Polarized light; Electro – optic and magneto – Optic Effects.

UNIT 2: Laser Physics

Laser – Characteristics of laser – Basic concepts of laser – Einstein's coefficients – Various pumpingmethods – Metastable states – Population inversion in three level and four level systems – Activemedium – 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 – Acceptancecone – 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 – Electrodeposition, Spray etc -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 Characterization

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. Introduction to Laser Physics by Langyerl (Unit 2)
3. Handbook of Thin Film Technology by Leon I Meisael and ReinherdGleng (Unit 4)
4. Thin Film Fundamentals by Goswami (Unit 3 and 5)

Book for Reference:

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

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Core 12: Numerical Methods and Object Oriented Programming with C ++**	**IV**	**18MPH43C**

Objective: *To learn numerical methods of computing certain mathematical quantities and to enable students to write C++ programming to solve problems in numerical methods.*

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 initialization 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, 2nd 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, Bjarne Stroutstrup, Benjamin and Cummins Publications, 2nd Edition

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**Elective-IV: Soft Skill (Practical and Viva-Voce Examination Only)**	**IV**	**18MPH44P**

Objective: *Students enhance their verbal, written and oral communication skills. They are empowered to meet any challenges and situations and come out with flying colours.*

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 – other softwares useful for science.

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)

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**PRACTICAL – III: ADVANCED EXPERIMENTS Examination at the end of FOURTH Semester (Any 12)**	**IV**	**18MPH45P**

Objective: *To train the students to apply the basic principles of physics to determine physical constants and characteristics of devices.*

1. Brass Arc Spectrum – Constant Deviation spectrometer
2. Iron Arc Spectrum – Constant Deviation spectrometer
3. Copper Arc Spectrum – Constant Deviation spectrometer
4. Absorption Spectra using Constant Deviation spectrometer
5. Susceptibility by Quincke's method
6. Susceptibility by Guoy method
7. e/m by Magnetron method
8. e/m by Zeeman Effect
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 Band gap energy
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. Study of Hall Effect in a semiconductor
15. Michelson's Interferometer – λ and $d\lambda$ and thickness of mica sheet
16. Determination of wavelengths of Hg spectrum using double slit- Hartmann's formula
17. Kelvin's double bridge – Determination of very low resistance
18. Hysteresis curve – Magnetometer method
19. Determination of Band gap energy of a semiconductor – Four probe method
20. Characteristics GM Counter
21. Determination of wavelength of a laser source using diffraction grating and thickness of a wire
22. Rydberg constant using hydrogen discharge tube and grating
23. MATLAB Programming - Radioactive decay graph
24. MATLAB Programming - Single and double integration

Year	Subject Title	Sem	Sub Code
2018-19 Onwards	**PRACTICAL–IV: Microprocessor and Special Electronics (Examination at the end of FOURTH Semester (Any 12)**	**IV**	**18MPH46P**

Objective: *To develop skills in programming and interfacing microprocessor and C++, to design and study analog and digital circuits*

1. 8085 ALP for addition, subtraction, multiplication and division
2. 8085 ALP for subtraction using 1's and 2's complement methods
3. 8085 ALP for finding the largest/smallest number in an array and sum of a finite series
4. 8085 ALP for sorting the array in ascending and descending order
5. 8085 ALP for BCD to binary and binary to BCD
6. Waveform generation using 8085
7. LED interfacing using 8085
8. Traffic light controller using 8085
9. Stepper motor controller using 8085
10. Digital clock using 8085
11. Design and study of Wien Bridge Oscillator using Op. Amp
12. Design and study of Phase shift Oscillator using Op. Amp
13. Solution of diferential equation using Op. Amp
14. Solution of simultaneous equations using Op. Amp
15. Op-amp as logarithmic and antilogarithmic amplifier
16. Design of MOD 3 and MOD 5 counters using JK flip-flop
17. Design of MOD 10 counter using JK flip-flop
18. Binary adder and subtractor using 7483 and 7486
19. Design of self-correcting ring counter
20. Three bit binary Up/Down counter using IC 7473
21. C++ Program to fit a straight line y=ax+b using method of least squares
22. C++ Program to solve nonlinear equations using Newton- Raphson method
23. C++ Program to solve system of linear equations using Newton- Raphson method
24. C++ Program to evaluate the intergral using (1) Trapezoidal rule (2) Simpson's 1/3rd rule
25. C++ Program to solve the first order differential equation using Runge-Kutta method