PART III

PHYSICS

B.Sc., B.Ed. LIBERAL OPTIONS

PART III: B.SC.B.ED.

Branch: PHYSICS

SEM	No.	CODE	Sub	Name of the course	CCE	UE	Total
I	Core 1		Main 1	Mechanics of particles, rigid bodies and continuous media	30	70	100
	Core 2		Main 2	Kinetic Theory and Thermodynamics	30	70	100
	Core 3		Main 3	Oscillations, waves and acoustics	30	70	100
	Core 4 (Supportive 1)		Anci 1-1	Mathematics-I	30	70	100
II	Core 5		Main 4	Optics	30	70	100
	Core 6		Main 5	Electricity and Magnetism	30	70	100
	Core 7		Main 6	Physics-Laboratory-I		50	50
				Physics-Laboratory-II		50	50
	Core 8 (Supportive 2)		Anci 1-2	Mathematics-II	30	70	100
III	Core 9		Main 7	Modern Physics ad Relativity	30	70	100
	Core 10		Main 8	Solid State Physics	30	70	100
	Core 11		Main 9	Atomic and Molecular Spectroscopy	30	70	100
	Core 12 (Supportive 3)		Anci 2-1	Chemistry-I	30	70	100
IV	Core 13		Main 10	Electronics	30	70	100
	Core 14		Main 11	Numerical Methods and Computational Physics	30	70	100
	Core 15		Main 12	Physics-Laboratory-III		50	50
				Physics-Laboratory-IV		50	50
	Core 16 (Supportive 4)		Anci 2-2	Chemistry-II	30	70	100
V	Core 17		Main 13	Nuclear Physics	30	70	100
	Core 18		Main 14	Quantum Mechanics	30	70	100
VI	Core 19		Main 15	Digital Electronics	30	70	100
	Core 20		Main 16	Physics-Laboratory-V		50	50
				Physics-Laboratory-VI		50	50
VII	Core 21		Main 17	Renewable energy and Energy harvesting	30	70	100
VIII	Core 22		Main 18	Physics-Laboratory-VII		50	50
				Physics-Laboratory-VIII		50	50

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CORE 1: MECHANICS OF PARTICLES, RIGID BODIES and CONTINUOUS MEDIA

Unit-I: Laws of Motion:

Vector algebra – Scalar and vector products – Derivatives of a vector with respect to a parameter limited to cartesian co-ordinates and plane polar co-ordinates – Ordinary differential equations: First order homogenous differential equations and second order homogenous differential equations with constant coefficients – Newton's Laws of Motion – Angular Velocity – Angular Momentum and Torque – Law of Conservation of Angular Momentum.

Unit-II : Gravitation :

Newton's Law of Gravitation – Keplar's Laws – Basic ideas of Global Positioning System (GPS). gravitational Potential and Field – Potential due to Uniform solid sphere and Spherical Shell.

Unit-III : Dynamics of Rigid Bodies:

Degrees of freedom -- Moment of Inertia – Radius of Gyration – Theorems of Moment of Inertia – Moment of Inertia of a circular disc – Solid sphere and Hollow sphere – Moment of Inertia of a Diatomic molecule – Kinetic Energy of rotations- Rotational Energy states of diatomic molecules. Precessional motion(qualitative)--Gyroscope. Rotational frames – Centrifugal and Coriolis forces – Foucault pendulum – Dynamics of system of particles – Centre of Mass – Collision: Direct impact of two smooth spheres, Determination of final velocities and Loss of kinetic energy.

UNIT-IV: ELASTICITY, VISCOSITY AND SURFACE TENSION:

Moduli of elasticity – work done in a strain – Torsional Pendulum – Determination of Rigidity Modulus – Bending of beams – bending moment - Young's Modulus – Uniform and non-uniform bending – Equation of continuity – Energy of a liquid-Euler's equation – Bernoulli's theorem – Applications. Critical velocity, Poiseullie's formulae – co-efficient of viscosity--Terminal Velocity and Stokes formula – Variation of Viscosity with temperature and pressure – Surface Tension – Molecular interpretation – Drop weight method.

Reference Books.

1. University Physics FW sears, M.W Zemansky and H.D Young 13 e, 1986, Addision Wesley
2. Mechanics : Berkeley Physics Physics course Volume 1: Charles Kittel et.al, 2007, Tata McGraw Hill.
3. Physics – Resnick, Halliday and Walker 9 e, 2010 Wiley.

Text Books:

1. D.S. Mathur, Mechanics (S. Chand & Co.)
2. D.S. Mathur, Elements of Propeties of matter (S. Chand & Co.)

CORE 2: KINETIC THEORY AND THERMODYNAMICS

UNIT-I : Laws of Thermodynamics:

Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermo dynamical Processes, Applications of First Law: General Relation between CP & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy- temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

UNIT-II: Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

UNIT-III: Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

UNIT-IV: Statistical Mechanics: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

REFERENCE BOOKS:

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
3. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
4. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 13
5. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
6. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
7. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publication

TEXT BOOKS

1. Brijlal and Subramanian, Heat and thermodynamics, (S.Chand & Co)
2. Mathur, Heat and thermodynamics, (S.Chand & Co).
3. J B.Rajam and CL.Arrora, A Textbook of Heat and thermodynamics, (S.Chand & Co)
4. A.B.Gupta and H.Roy, Thermal Physics, (Allied Books, New Delhi)

CORE 3: OSCILLATIONS, WAVES AND ACOUSTICS

UNIT-I

Superposition of Two Harmonic oscillations: Two collinear harmonic oscillators, Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats), Two perpendicular harmonic oscillators, Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses.

UNIT – II

Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity.

UNIT – III

Sound: Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem- Application to saw tooth wave and square wave - Wave intensity. Speed of longitudinal waves in a fluid - velocity of sound in air - dependence on pressure and temperature - normal mode vibrations of air columns.

UNIT-IV

Applied Acoustics: Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient
- Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditorium.

Reference Books:

1. Vibrations and Waves, I.G. Main, (Cambridge University press)
2. The Physics of Vibrations and Waves, H J Pain, (Wiley ELBS, 1976)
3. The mathematics of waves and vibrations, R K Ghosh, (Macmillan, 1975)
4. Oscillations and waves, A P French, (MIT Introductory Physics Series)
5. Vibrations and Waves, S.P.Puri, (Tata McGraw Hill)

Text Books:

1. Bajaj, Waves and Oscillations (Tata McGraw Hill)
2. D.P. Khandelwal, Oscillations and Waves (Himalaya Pub. House, Bombay)
3. M. Ghosh, A text book of Sound (S.Chand & Co.)

CORE 4: (SUPPORTIVE 1) MATHEMATICS I

UNIT-1 (ALGEBRA)

Matrices - Rank of a matrices - Consistency of a system of linear non-homogeneous equations (statement only) - Simple problems - Characteristic roots of a square matrix - Evaluation of Eigen values and Eigen vectors of a square matrix - Cayley Hamilton theorem (Θstatement only) - Simple problems.

UNIT -2 (TRIGNOMETRY)

De Moivre's theorem - Expansions of Cos(nΘ), Sin(n0) and tan(nΘ) - Powers of sines and cosines of Θ in terms of functions of multiples of Θ. Expansions of sin(Θ), cos(Θ) in a series of ascending powers of0- Limits and approximations.

UNIT-3 (FUNCTIONS OF COMPLEX VARIABLE)

Analytic functions - Cauchy Riemann equations - derivation and simple problems - Harmonic functions

UNIT-4 (VECTOR CALCULUS)

Vector differentiations - Scalar point functions - Vector point functions - Derivatives of a Vector point functions, sum of two vector point functions, product of scalar and Vector point function, Vector product - The vector operator Del, Gradient, Divergence and Curl - Simple application problems involving Cartesians - Laplace Operator.

UNIT - 5 (POLAR CO-ORDINATES)

Angle between radius and vector and tangent - Angle of intersection of two curves - Pedal equations of a curve

Text books:

1. S. Narayanan and T.K. Manicavachagom pillai, Calculus, S. Viswanathan Publishers
2. S. Narayan, Trignometry, S. Viswanathan Publishers, 2012
3. P. DuraiPandian, Complex Variable, Emerald Publishers, 1979
4. P. DuraiPandian, Vector Calculus, 1984
5. Vittal and Malini, Allied Mathematics, V.Margham Publishers, 1997

Reference Books:

1. George B.Thomas, Maurice D.Weir and Joel Hass, Thomas' Calculus 12'h Edition, Pearson Education, 2015
2. Er.vin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2011
3. Gilbert Strang, Linear Algebra and Its Applications, CENGAGE Leaming, 2007.

CORE 5: OPTICS

UNIT-I : Ray Optics: Fermat's principle and its applications: Principle of extreme path, Proof of laws of reflection and refraction, paraxial approximation, matrix method in paraxial optics, ABCD matrix.

UNIT-II: Reflection and refraction:

Snell's law of reflection and refraction, reflection and refraction at spherical surfaces: formula for refraction at single spherical surface, sign convention. Thick lens: matrix methods in paraxial optics, basic ideas of unit planes and nodal planes, Cardinal points of an optical system , general relationship, combination of thin lenses.

Aberration in images: chromatic aberrations; achromatic combination of lenses in contact and separated lenses. Monochromatic aberrations and their reduction. Properties of wavefront, Huygen's principle.

UNIT-III : Interference and diffraction:

Interference of light: The principle of superposition; two slit interference, coherence requirements for the sources, localized fringes in thin films, transition from fringes of equal thickness to those of equal inclination Michelson interferometer; its uses for determination of wavelength, wavelength difference and standardization of the meter. Intensity distribution in multiple beam interference; Fabry - Perot interferometer and concept of finesse.

Fresnel diffraction: Half-period zones, circular apertures and obstacles, straight edge, explanation of rectilinear propagation. Cornu Spiral and its applications Babinet's Principle.

Fraunhofer diffraction:

Diffraction at a single slit, a circular aperture and a circular disc. Resolution of images; Rayleigh criterion, resolving power of a telescope and a microscope -Outline of phase contrast microscope (no derivations).Diffraction grating: Diffraction at N parallel slits; plane diffraction grating, resolving power of gratings and prisms.

UNIT-IV: Polarization Optics: Electromagnetic nature of light. Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization. Double refraction, interference of polarized light, phase retardation plates (quarter wave and half wave plates).

REFERENCE BOOKS:

1. Optics, K D Meller, (Oxford University Press)
2. Optics, Smith and Thomson, (John Wiley and Sons, 1980)
3. Geometrical and Physical Optics, R S Longhurst, (Longmans, 1966)
4. Optics, A.N.Matveev, (Mir Publishers 1988)
5. Introduction to Classical and Modern Optics, Jurger R. Meyer –Arednt, (Prentice Hall)

TEXT BOOKS:

1. Ajoy Ghatak, Introduction to Modern Optics (Tata McGraw Hill)
2. Brijilal and Subramanian, Optics ((S.Chand & Co).
3. S.L. Kakani and H.C. Bhandrai, Optics (S.Chand & Co)
4. Jenkins and White, "Fundamentals of Optics" (McGraw-Hill)
5. B.K. Mathur, Principles of Optics, 1995, Gopal Printing.

CORE 6: ELECTRICITY AND MAGNETISM

UNIT-I: Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

UNIT-II: Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

UNIT-III : Magnetism: Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials.

UNIT-IV: Maxwell`s equations and Electromagnetic wave propagation: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field, Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

REFERENCE BOOKS:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
2. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ.Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

TEXT BOOKS:

1. K K Tewari, Electricity and Magnetism (S Chand and Co.)
2. Brijlal and Subramaniam, Electricity and Magnetism (S Chand and Co.)
3. S. Mahajan and A. A. Rangawala, Electricity and Magnetism, (Tata Me Graw - Hill)
4. Khare and Srivastava, Electricity and Magnetism, (Atmaram and sons, New Delhi.)

SEMESTER II

CORE 7: PHYSICS LABORATORY

PHYSICS LABORATORY – I

Choose any 8 experiments from the list given below

List of Experiments

1. Compound pendulum - determination of g, radius of gyration and moment of inertia
2. Young's modulus - non-uniform bending – Scale and Telescope.
3. Surface tension of a liquid and interfacial surface tension (water & kerosene) - method of drops.
4. Rigidity modulus - torsional oscillations without masses.
5. Specific heat capacity of a liquid and emissivity of a surface - method of cooling.
6. Thermal conductivity of a bad conductor- Lee's disc method.
7. Sonometer - determination of frequency and verification of laws of transverse vibrations.
8. Spectrometer- refractive index of a liquid - hollow prism.
9. P.O. box - resistivity and verification of laws of resistance.
10. Potentiometer - calibration of low range voltmeter (0 - 1.5 V).
11. Terminal velocity for bodies falling through a fluid
12. Jolly's constant volume air thermometer - determination of melting point of wax
13. Computer simulation of motion of equation of motion for a system of particles
14. Computer simulation of damped oscillator.
15. Computer simulation of spherical body falling in a viscous liquid.
16. Computer simulation of motion of molecular rotations as rigid bodies

Text Books

1. Practical Physics C.C Ouseph, V.J.Rao and V.Vijayendran
2. Practical Physics M.N.Srinivasan, Sultan son Pub.
3. D P Khandelwal, Laboratory Manual of Physics for UG classes (Vani Pub. House, New Delhi)
4. B Saraf et al, Physics through Experiments, Vol. 1, Mechanical Systems, (Vikas Publication House. New Delhi)
5. Verma, Ahluwalia, Sharma, Computational Physics, an Introduction (New Age Int. (P) Ltd.)

Reference Book

1. V Y Rajopadhye and V L Purohit, Text book of experimental Physics

PHYSICS LABORATORY – II

Choose any 8 experiments from the list given below

1. Young's modulus - cantilever - pin & microscope.
2. Melde's apparatus - determination of frequency.
3. Spectrometer –Determination N - minimum deviation method.
4. P.O. box - temperature coefficient of the material of a coil of wire.
5. Potentiometer - calibration of ammeter (0-1.5 amps).
6. Emf of thermocouple using digital thermometer
7. Study of characteristics of a thermistor
8. Stoke's method of viscosity determination
9. Study of laws of parallel and perpendicular axes fir estimation of moment of inertia
10. Kater's pendulum - determination of acceleration due to gravity at a place
11. Variation of period of oscillations of a spring (or rubber band) with mass and spring constant
12. Oscillations on a bifilar suspension
13. Y - Searle's method for determining Y, n and η of a material.
14. Computer simulation of motion of Study of coupled oscillators.
15. Computer simulation of analyzing a square wave-form for its harmonic components.
16. Computer simulation of Generation of phase space plots of simple harmonic oscillator
17. Computer simulation of motion of a single pulse.

Text Books

1. Practical Physics C.C Ouseph, V.J.Rao and V.Vijayendran
2. Practical Physics M.N.Srinivasan, Sultan son Pubs
3. D P Khandelwal, Laboratory Manual of Physics for UG classes (Vani Pub. House, New Delhi)
4. B Saraf et al, Physics through Experiments, Vol. 1, Mechanical Systems, (Vikas Publication House. New Delhi)
5. Verma, Ahluwalia, Sharma, Computational Physics, an Introduction (New Age Int. (P) Ltd.)

Reference Book

1. V Y Rajopadhye and V L Purohit, Text book of experimental Physics

CORE 8: (SUPPORTIVE 2) MATHEMATICS II

UNIT -1 (INTEGRAL CALCULUS)

Evaluation of $\int e^{ax}\cos(bx)dx$ and $\int e^{ax}\sin(bx)dx$, - Bernoulli's formula for integration by parts – Definite integrals – reduction formulae – Related definite integrals – properties – reduction formula for $\int e^{ax}x^n dx, \int \sin^n x dx$ and $\int \cos^n x dx (n$ is a positive integer) - Evaluation of $\int_0^\infty e^x x^n dx, \int_0^{\pi/2} \sin^n x dx, \int_0^{\pi/2} c\cos^n x dx$, - Rule of writing down $\int_0^{\pi/2} \sin^m x \cos^n x dx$ and illustrations

UNIT -2 (VECTOR INTEGRATION)

Gauss Divergence theorem and Stokes's theorem (Statement only) – Simple problems

UNIT-3 (FOURIER SERIES)

Definition – Finding Fourier co-efficient for a given period function with period 2π - Odd and Even functions – Half range series

UNIT-4 (ORDINAR DIFFERENTIAL EQUATIONS)

Equations of the first order but not of the first degree – Equations solvable for dy/dx, - equations solvable for y - Equations Solvable for x - Clairaut's form (simple cases) – Linear equations with constant coefficients – Evaluation of the particular integral of the equation – e^x, sin(ax), Cos(ax), x^k, $e^{ax}f(x)$

UNIT – 5 (LAPLACE TRANSFORM)

Definitions – Condition for the existence of Laplace transform – Laplace transform of 1, e^{at}, e^{-at}, cos(at), sin(at), sinh(at), cosh(at) and t^n - Simple problems – Laplace transform of the derivatives – Laplace transform of the integral – first shifting theorem – change of scale of property – Laplace transform of function multiplied by t, divisible by t – inverse Laplace transform – solution of ordinary differential equations using Laplace transforms

Text books:

1. S. Narayanan and T.K. Manicavachagom pillai, Calculus, S. Viswanathan Publishers
2. P. DuraiPandian, Vector Calculus, 1984
3. Vittal and Malini , Allied Mathematics, V.Margham Publishers, 1997

Reference Books:

1. George B.Thomas, Maurice D.Weir and Joel Hass, Thomas' Calculus 12th Edition, Pearson Education, 2015
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9th Edition, 2011

CORE 9: MODERN PHYSICS AND RELATIVITY

Unit I

Planck's quantum, Planck's constant and light as collection of photons; Photo – electric effect and Compton scattering. De Broglie wavelength and matter waves; Davission-Germer experiment Problems with Rutherford model – instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and Atomic stability; calculation of energy levels for hydrogen atoms and their spectra.

Unit II

Position measurement – gamma ray microscope thought experiment; Wave – particle duality, Heisenberg uncertainty principle – impossibility of a particle following a trajectory; estimating minimum energy; Energy – time uncertainty principle. Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; matter waves and wave amplitude;

Unit III

Schrodinger equation for non – relativistic particles; momentum and energy operators; stationary states; physical interpretation of wave equation, probabilities and normalization; probability and probability current densities in one dimension, simple one dimensional problems.

Unit IV

Special Theory of Relativity: Constancy of speed of light. Postulates of Special theory of Relativity. Length contraction. Relativistic addition of velocities.

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw – Hill.
2. Modern Physics, John R. Taylor, Chris D Zafiratos, Michael A Dubson, 2009, PHI
3. Modern Physics, R.A.Serway, C.J.Moses and C.A.Moyer, 2005, Cengage Learning.
4. Modern Physics, G.Kaur and G.R.Pickrell, 2014, McGraw – Hill.
5. Physics – Resnick, Halliday and Walker 9th edition, Wiley.

Text Books:

1. Quantum Mechanics, Gupta, Kumar, Sharma Jai Prakash Nath Pub. 31st Ed. 2012.
2. Essentials of Quantum Mechanics, B.N.Srivastava, Pragathi Prakasan, 2014.
3. Properties of Matter, Brijlal, S. Chand.

CORE 10: SOLID STATE PHYSICS

UNIT-I: Basics of Crystallography: Crystal geometry: Crystal lattice; crystal planes and Miller indices, unit cells. Typical crystal structures; coordination number, packing fraction. Symmetry elements; rotation, inversion and reflection, basics of point groups and crystal classes, space groups, reciprocal lattice Crystallography: Diffraction of X-rays by a crystal lattice. Laue's formulation of X- ray diffraction, Laue spots rotating crystal.

UNIT-II : Bonding and Lattice Vibrations Types of bonding in solids: Covalent, Ionic, metallic and Vander Waals bonding, hydrogen bond. Lattice Vibrations: Elastic and atomic force constants; Dynamics of chain of two types of atoms, optical and acoustic modes, interaction of light with ionic crystals. Einstein's and Debye's theories of specific heats of solids.

UNIT-III : Electrical Conduction in Solids: Conduction in metals: Drude's theory, DC conductivity, Hall effect and magneto resistance, AC conductivity, plasma frequency, thermal conductivity of metals, Fermi-Dirac distribution, thermal properties of free-electron gas. Conduction in semiconductor: Bands in solids; metals, insulators and semiconductor – electrons and holes-effective mass, donor and acceptor impurity levels.

UNIT –IV : Magnetic Properties of Solids: Magnetism: Diamagnetism, Paramagnetism due to free ions and conduction electron Curie's law, ferromagnetism, domains, hysteresis loop, outline of antiferro- and ferrimagnetism, ferrites. Superconductivity: Zero resistivity; critical temperature, critical B field. Meissner effect Type I and Type II super conductors, specific heat and thermal conductivity.

TEXTBOOKS

1. C Kittel, Introduction to Solid State Physics (Wiley Eastern , Ed., 1976)
2. S.O.Pillai, Solid State Physics (New Age International Ltd, New Delhi).
3. J.P.Srivastava, Elements of Solid State Physics,2nd Ed.(PHI, 2007)
4. J.S. Blackmore, Solid State Physics(Cambridge University Press, 1985)
5. L.V. Azaroff, Introduction to Solids, Tata McGraw Hill, 1987)
6. Saxena, Gupta and Saxena, Fundamentals of Solid State Physics, 12th Ed. (Pragathi Prakasan).

REFERENCEBOOKS

1. Mermin and Ashcroft, Solid State Physics (NewYork, Holt, RinehartandWinston)
2. W.A.Harrison, Electronic structure and the properties of solids(Freeman, 1980)
3. JP. Mc Kelvey, Solid state and semiconductor physics(Krieger, 1982)
4. HM Bosenberg, The Solid State"(Oxford University press, 1979)
5. SL Altmann, Band Theory of Metals, The Elements (Pergamon Press, 1970)
6. A J. Dekker, Solid State Physics(Prentice-Hall, 1957)

CORE 11: ATOMIC AND MOLECULAR SPECTROSCOPY

UNIT-I

Atomic and X-ray Spectra: Atomic spectra, Coupling schemes, L-S, J-J couplings, Spectral terms, s,p,d,f, notation, selection rules. Spectra of mono-and di-valent atoms: Doublet fine structure of hydrogen lines; screening constants for mono valent atoms, series limits, doublet structure of alkali spectrum. X-ray spectra: The continuum X-ray spectrum; Duane and Hunt limit. Characteristic X-rays; Moseley's law, doublet fine structure, X-ray absorption spectra, absorption edges.

UNIT –II

Effect of magnetic field on energy levels: Angular momentum and magnetic moment of electron due to orbital motion Gyromagetic ratios for orbital and spin motions; Bohr magneton, vector model, Lande g factor, Normal and anomalous Zeeman effects with reference to sodium D-lines

Unit III

Rotation and Vibration of Molecules: Classification of molecules as various tops, Rotational energy levels of diatomic molecules (no derivation), inter nuclear distance. Pure rotation spectra; selection rules, isotope effects on rotational energies. Vibrational energy levels, force constants, anharmonicity, dissociation energy, Spectra of diatomic molecules: Vibration-rotation spectra; selection rules, P, Q.and R branches.

Electronic levels, Raman Effect: Sharing of electrons; formation of molecular orbitals, molecular orbitals in H^+ ion, MO theory of H_2 molecule, diatomic molecular orbitals, molecular orbital energy level diagram. Electronic band systems, sequences and progressions, Franck-Condon principle. Raman effect: Stokes and anti-Stokes lines, quantum theory of Raman effect, selection rules in Raman and IR spectra.

UNIT-IV

Laser System, Types and Applications: Origin of spectral width, Schalow-Townes limit (only statement), Purity of a spectral line; Coherence: spatial and temporal, Einstein's A and B coefficients; Conditions for laser action; existence of a metastable state, population inversion by pumping and cavity resonance condition. Ruby Laser, He-Ne Laser, Dye laser; Applications of lasers: Laser communication, Medical applications and Material processing. Elementary idea of second harmonic generation.

TEXT BOOKS

1. J. B. Rajam, Atomic Physics(S. Chand & Co)
2. Beiser, Concepts of Modern Physics,(McGraw Hill International)
3. Richtmeyer etal, Introduction to Modem Physics(Tata Mc Graw Hill, India)
4. Murugesan, Modem Physics, (S.Chand & Co.)
5. C. N. Banwell, Fundamentals of molecular spectroscopy,(Tata-Mc-Graw Hill)
6. G.Aruldhas, Molecular Structure & Spectroscopy,(Prentice-Hall of India)
7. M. N. Avadhanulu, An Introduction to Lasers (S.Chand and Co)

REFERENCE BOOKS

1. Walker and Straughn; Spectroscopy-Vol 1,11,III,(Wiely)
2. G Herzberg; Atomic spectra and atomic structure,(Courier Dover Publication)
3. R C Johnson, Introduction to Molecular spectra,(Methuen)
4. S.P.Khare, Modem Physics,(Rastogi Publications).
5. BB Laud; Lasers and Non-linear Optics, (Wiley Eastern, 1985)
6. G Herzberg; Molecular spectra and Molecular structure, (prentice Hall, New York)
7. R C Johnson; An Introduction to Molecular spectra (Methuen).

CORE 12: (SUPPORTIVE 3) CHEMISTRY I

Unit 1

Intermolecular forces - Vanderwall and London forces. Liquid state theory and properties of liquids, liquid-crystal formation and applications. Solid state- forces in solids- covalent, ionic, metallic, and Vanderwall's, Lattice energy.

Unit 2

Theory of semi-conductors and its application. Bond properties- types of hybridization, bond length, bond order, bond strength. Resonance energy- resonance strength of multiple bonded species Carbon Monoxide, Nitrous Oxide, phenol, benzaldehyde, aniline.

Unit 3

Covalent bond- Orbital Overlap- hybridization, geometry of organic molecules- methane, ethylene, acetylene, benzene. Electron displacement effects, inductive, resonance, hyperconjugative and steric effects-their effect on properties of compounds. Stereoisomerism-Optical isomerism-optical activity, lactic acid, tartaric acid, racemization, resolution.

Unit 4:

Aromatic compounds-electrophilic substitution in benzene, mechanism of nitration, halogenation, Alkylation and Acylation. Preparation, properties and uses of Naphthalene, Furan, Thiophene, Pyrrole, Pyridine, Chloroform and Carbon Tetrachloride.

Unit5:

Keto-enoltautomerism. Geometric isomerization, maleic acid and fumaric acid. Rotation around single bond proffered rations, conformers of ethane, propane, n- butane and cyclohexane. Axial and equatorial bonds.

Text books:

1. P. W. Atkins Physical Chemistry, 6thed, 1998.
2. Wade, L.G. Organic Chemistry, Pearson Education, 5thed, 2003.
3. M. Ladd. Introduction to Physical Chemistry, Cambridge, 1998.

CHEMISTRY PRACTICALS I

1. Estimation of sodium hydroxide using sodium carbonate standard.
2. Estimation of hydrochloric acid using oxalic acid standard.
3. Estimation of borax using sodium carbonate standard.
4. Estimation of ferrous sulphate using Mohrs salt standard.
5. Estimation of oxalic acid using ferrous sulphate standard.
6. Preparation of the following inorganic compounds: ferrous ammonium sulphate, manganous sulphate, sodium thiosulphate.

CORE 13: ELECTRONICS

UNIT-I : Current density and current. Non-steady currents and continuity equation. Kirchoffs laws. Network theorems and their applications. Non-Ohmic circuitry, thermistor. Varying current: Rise and decay of currents in LR, CR circuits and LCR circuits - resonance. Time constant. Integrating and differentiating circuits.

Unit II: **Junction diode, special diodes, and their general uses**: Network theorems and their applications, Classification of Conductors, insulators and semi-conductors on the basis of energy band diagram-Intrinsic and extrinsic semiconductors. P-type and N-type semi-conductors. Formation of PN junction diode – Forward and reverse characteristics – Diode resistance-Effect of temperature on extrinsic semiconductors, Halfwave, Centre tap and Bridge rectifiers, Expression for average dc voltages, qualitative ideas of filters, clipping and clamping circuits-their general applications. Zener diode – Volt – ampere characteristics-Avalanche and Zener break down mechanisms - Zener voltage. Simple voltage regulator circuit using zener diode. LED, Photodiode.

UNIT-III: **Bipolar junction transistors, biasing and hybrid parameters:** Construction of NPN and PNP transistors – their operation modes-operation of NPN and PNP transistors-CB, CE and CC configurations and their biasing, Input, Output and transfer characteristics of BJTs in CB and CE modes

-Active, saturation and cut-off regions -Bias stability- Load line analysis- operating point.

The need of transistor biasing for faithful amplifications. Variations of transistor parameters – stability factor and stabilization – Thermal runaway-Methods of transistor biasing –Base bias with emitter feedback- Voltage divider bias, h-parameters of a transistor and their notations-hybrid equivalent circuits for CE, CB and CC mode transistors. Single stage RC coupled amplifier, calculation of mid frequency gain using h-parameters, frequency response curve (qualitative).

JFETS and MOSFETS: Construction of n-channel and p-channel JFETs-operation of n-channel JFET

– Drain characteristics of n-channel JFET-Transfer characteristics – parameters of JFET-comparison between BJT and JFET. JFET biasing circuits. MOSFETS, characteristics and parameters.

UNIT-IV: Operational amplifiers and oscillators: Principles of operational amplifiers, offset parameters, differential gain, CMRR, applications of op-amp: as inverting and non-inverting amplifiers, summing amplifier, difference amplifier, differentiator, integrator, and comparator. Concept of feedback mechanism, oscillators, Barkhausen criterion, RC oscillators (Wein-bridge & Phase-shift), Multivibrators.

TEXTBOOKS

1. R.S. Sedha, A textbook of applied electronics, 2005 (S. Chand & Co.,)
2. V.K.Metha, Principles of electronics, 2005 (S. Chand & Co.,)
3. Millmann & Halkias, Integrated Electronics (Tata McGraw Hill.)
4. M.K.Bagde, S.P. Singh, Element of Electronics(S.Chand & Co.)
5. D.Chathopadhyay & Rakshit, Electronic Fundamental and Applications (New Age International)
6. S. Salivahanan and N. Suresh Kumar, Electronic devices and electronic circuits, 2004 (TMH)
7. Malvino, Electronic principles, 6 Edition(TMH).

REFERENCEBOOKS

1. B.L.Theraja, Basic Electronics, 2005 (S. Chand & Co.,)
2. G.Nagarajan, Electronic devices, 2005 (Lakshmi Publications)
3. U.A.Bakshi and A.P.Godso, Electron devices, 2005 (Technical Publications, Pune).
4. Millman and Halkias, Electronic devices and Circuits, (McGraw Hill),
5. Horowitz and Hill, Art of Electronics(Cambridge University Press)

CORE 14: NUMERICAL METHODS AND COMPUTATIONAL PHYSICS

Unit I

Numerical Methods: Introduction-Straight line fitting (group average and least square methods)- fitting a parabola (least square methods) – successive approximation method – condition for the convergence- order of convergence – Regula – Falsi method – Newton Rapson method-criterion for the convergence
– order of convergence – Elimination method-Gauss – Jordan method

UNIT-II

Numerical Differentiation: Numerical Differentiation – forward and backward-Integration: - Trapezoidal – Interpolation – Lagrangian - unequal-Newton's forward interpolation formula (equal intervals) - Matrix: Solving the simultaneous equations – eigen value of a matrix by power methods.

UNIT-III

COMPUTER & FORTRAN: Computers: Introduction – input & output devices-CPU, Applications

– languages & packages (outline only). Fortran: Constants, variables, operators – mode of expressions

– arithmetic to FORTRAN expression – Hierarchy of operators, Statements – conditional and unconditional - i/p & o/p Statements – executable Statements-format and go to Statements – computed goto – arithmetic IF – logical IF, Built- in-functions, Do statement – simple Do loop-function subprogram Subroutine subprogram (Introduction)

UNIT -IV

Programming: Algorithm – Flow Chart-Simple programs using FORTRAN: Area and volume of geometrical structures, sum of series, product of 'n' numbers, Straight line, ellipse, parabola and their slope.

TEXT BOOKS:

1. M. K. Venkatraman, Numerical methods in Sci. & Eng.,(National Pub. Co.)
2. Santosh Kumar, Computer based Numerical & Statistical techniques,(S. Chand & Co, 2008)
3. Rajaraman, Computer Programming in Fortran 90and 95, (Prentice Hall of India)
4. Kandasamy, Thilagavathy & Gunavathy, Numerical methods,(S.Chand& Co., 2007)

REFERENCE BOOKS:

1. B.S.Grewal, Numerical methods in Engineering & Science with Programes in FORTRAN77, C & C++, (Khanna Pub. VIIedition, 2005)
2. Rajaraman, Computer Programing in FORTRAN77, (Prentice Hall of India, IV edition, 2002)
3. James B. Scarborough, Numerical Mathematical Analysis, (Oxford and IBH, New Delhi, 1971)
4. S.S.Sastry, Elementary Numerical Analysis,(PHI).

CORE 15: PHYSICS LABORATORY

PHYSICS LABORATORY – III

Choose any 8 experiments from the list given below

LIST OF EXPERIMENTS.

1. Young's modulus - Uniform bending - scale & telescope.
2. Rigidity modulus – Torsional pendulum with equal masses
3. Specific latent heat of fusion of ice.
4. Spectrometer- determination of wavelength - Minimum deviation method.
5. Spectrometer - i-d curve.
6. M and BH using deflection and vibration magnetometer Tan A and Tan B position.
7. Carry-Foster's bridge - Resistivity of the material of the coil of wire.
8. Potentiometer - Internal resistance of a cell.
9. B.G- Comparison of emf of two cells
10. Determining the focal length of high power microscope objective
11. Study of interference fringes bi-prism arrangements
12. Study of polarization of light by simple reflection
13. Study of the rise and decay of current in a RC circuit
14. Study of the impedance of an inductor at varying frequencies to measure R and L
15. Computer simulation circuit analysis using Kirchhoff's laws.
16. Computer simulation of double slit interference

TEXTBOOKS

1. Practical Physics C.C Ouseph, V.J.Rao and V.Vijayendran
2. Practical Physics M.N.Srinivasan, Sultan son Pubs
3. D P Khandelwal, A Laboratory Manual in Physics for Undergraduate Students (Vani Publication, New Delhi)
4. B Saraf et al. "Physics through Experiments, Vol. II., EMF constant and varying, (Vikas Publications, New Delhi)
5. V Y Rajopadhye and V L Purohit, Text book of experimental Physics
6. Verma, Ahluwalia, Sharma, Computational Physics, an Introduction (New Age Int. (P) Ltd.)

REFERENCE BOOKS

1. Olon, Experiments in Modern Physics.
2. Adrian C. & Melissinos, Experiments in Modern Physics (Academic Press)

PHYSICS LABORATORY – IV

Choose any 8 experiments from the list given below LIST OF EXPERIMENTS.

1. Young's modulus – Koenig's method (Non uniform bending)
2. Rigidity Modulus – Statistic Torsion
3. Specific latent heat of fusion of ice
4. Spectrometer- determination of N - normal incidence method
5. Field along the axis of the circular coil carrying current and determination of B
6. Carry-Foster's bridge - Temperature co-efficient of the material of a wire.
7. Potentiometer -Calibration of high range voltmeter
8. Figure of merit of a periodic moving coil galvanometer.
9. B.G. - Comparison of capacities.
10. Melde's string-Specific gravity of a solid and liquid.
11. Study of optical rotation by solutions.
12. Study of the rise and decay of current in a RL circuits
13. Junction and Zenor diode characteristics
14. Study of Half and full wave rectifier
15. Computer simulation of effect of magnetic field on charged particles
16. Computer simulation of propagation of electromagnetic waves.

TEXTBOOKS

1. Practical Physics C.C Ouseph, V.J.Rao and V.Vijayendran
2. Practical Physics M.N.Srinivasan, Sultan son Pubs
3. D P Khandelwal, A Laboratory Manual in Physics for Undergraduate Students (Vani Publication, New Delhi)
4. B Saraf et al. "Physics through Experiments, Vol. II., EMF constant and varying, (Vika Publications, New Delhi)
5. V Y Rajopadhye and V L Purohit, Text book of experimental Physics
6. Verma, Ahluwalia, Sharma, Computational Physics, an Introduction (New Age Int. (P) Ltd.)

REFERENCE BOOKS

1. Olon, Experiments in Modern Physics.
2. Adrian C. & Melissinos, Experiments in Modern Physics (Academic Press).

CORE 16: (SUPPORTIVE 4) CHEMISTRY II

Unit 1:

Co-ordination chemistry – definition of terms, classification of ligands, nomenclature. Chelation – examples, chelate effect explanation. Werner's theory- conductivity and precipitation studies. Sedgwick's theory- Effective atomic number concept. Pauling's theory- postulates, applications to octahedral, square, planar and tetrahedral complexes.

Unit 2:

Biological role of Hemoglobin and Chlorophyll. EDTA and its applications. Environmental chemistry- Green House Effect, global warming, Ozone depletion, BOD and COD – importance, rainwater harvesting-needs, methods, advantage. Pollution – types, strategies in its control.

Unit 3:

Carbohydrates-classification, preparation and properties of Glucose, Fructose and Sucrose. Discussion of ring structure and mutarotation. Properties of starch and cellulose. Interconversion of Glucose and Fructose. Amino-acids classification, preparation and properties of Glycine and Alanine, preparation of peptides by Bergman method. Classification of proteins according to composition, function and shape. Protein denaturation.

Unit 4:

Dyes and Drugs-Azo dyes-congo Red, Triphenylmethans, Malachite Green, Food colours. Sulpha drugs–sulphonamides and sulpha pyrimidine, preparation and uses. Antibiotics-penicillin and Chloromycetin-source, structure and uses. Vitamins- source and structure of vitamin A, B, C, D, E and F (structural elucidation not required).

Unit 5:

Electrochemistry- Kohlrauch law-measurement of conductance, pH determination, conductometric titrations, hydrolysis of salts, derivation of Kh. Galvanic cells, EMF standard electrode potentials, reference electrodes, electrochemical series and its application, electroplating and its application. Corrosion-methods of prevention. Bioenergetics-Chemical kinetics-order of reaction (zero and first order), half-life period. Chemical equilibrium-basic idea.

Text books:

1. P. W. Atkins Physical Chemistry, 6th edition, 1998.
2. Wade, L.G, Organic Chemistry, Pearson Education, 5th edition, 2003.
3. M. Ladd, introduction to Physical Chemistry, Cambridge, 1998.

CHEMISTRY II PRACTICAL

1. Detection of elements –nitrogen, sulphur and halogens.
2. Preliminary test and detection of carbohydrate, urea, benzamide and aromatic amines.
3. Detection of anions: carbonate, sulphide, sulphate, fluoride, chloride, bromide, nitrate, oxalate, phosphate.
4. Reaction of aldehyde (aromatic), ketone (aliphatic and aromatic), carbohydrate, carboxylic acid (mono-and dicarboxylic-), phenol, aromatic primary amine, amide and diamide.
5. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory tests or derivatives.

CORE 17: NUCLEAR PHYSICS

Unit I

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/Z plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

Unit II

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of various terms, condition of nuclear stability. Two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

Unit III

Radioactivity decay:(a) Alpha decay: basics of α-decay processes, theory of α- emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering).

Unit IV

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

Reference Books:

1. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
2. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
3. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP-Institute of Physics Publishing, 2004).
4. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
5. Theoretical Nuclear Physics, J.M. Blatt &V.F.Weisskopf (Dover Pub.Inc., 1991)

Text Books

1. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons

CORE 18: QUANTUM MECHANICS

Unit I : Time dependent Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigen functions. Position, momentum & Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle.

Unit II : Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wave function as a linear combination of energy eigen functions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to the spread of Gaussian wave packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wave function; Position-momentum uncertainty principle.

Unit III : General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigen functions.

Unit IV : Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers; Radial wavefunctions; Orbital angular momentum quantum numbers l and m; s, p, d,.. shells (idea only).

Reference Books:

1. Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
2. Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Education
3. Quantum Mechanics, Walter Greiner, 4^{th} Edn., 2001, Springer
4. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.

Text Books

1. P.M.Mathews & K.Venkatesan, A Text book of Quantum Mechanics, 2^{nd} Ed.2010, McGraw Hill
2. Robert Eisberg and Robert Resnick, Quantum Mechanics,2^{nd} Edn., 2002, Wiley.
3. Leonard I. Schiff, Quantum Mechanics, 3rdEdn. 2010, Tata McGraw Hill.
4. G. Aruldhas, Quantum Mechanics, 2ndEdn. 2002, PHI Learning of India.
5. Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge Uni. Press.

CORE 19: DIGITAL ELECTRONICS

UNIT-I

Digital Principles: Number system, binary arithmetic, Basic gates and universal gate operations. Boolean algebraic theorems and properties-Karnaugh map: two and four variable map, POS and SOP simplification, NAND and NOR implementation, don't care condition, Logic families: characteristics and parameters. TTL gates, TTL open collector gates, CMOS gates, TTL-CMOS interface. Combinational logic design: parity checker, half and full adders, demultiplexer, multiplexer, decoders, encoders, PAL.

UNIT-II

Flip Flops and Counters: RS flip - flops, clocked RS flip - flop, edge-triggering. JK flip - flop, D-type flip-flop, JK master slave flip-flop design procedure; serial –in – serial out. Serial – in –parallel out shift registers asynchronous counters; decade counter (Mod10 counter); NE 555 timer as astable mulitvibrator.

UNIT-III

A/D, D/A Converters: Principle of variable network and binary ladder type: four bit D/A converter, A/D converter, counter method and successive approximation, resolution and accuracy of D/A and A/D converter; frequency counters and digital voltmeters.

UNIT -IV

Microprocessors: Components of a micro-processor system, Architecture of 8085, Addressing modes, instruction set. Pin configuration, stack operation, memory stack and cascade stack, assembly language programming of Intel 8085. Software programmes involving addition and subtraction. Simple i/o operations using 8255 ports. Elementary introduction to 16 bit processor

TEXT BOOKS

1. Malvino&Leach, Digital Principles and Applications (Tata McGraw Hill)
2. R.P Jain, Modem Digital Electronics,(Tata McGraw-Hill. New Delhi)
3. Morris Mano.M Digital logic and computer design, (Prentice Hall of India)
4. Ramesh S.Gaonkar, Microprocessor Architecture-Programming and Applications with the 8085 (Prentice Hall)

REFERENCE BOOKS

1. Milliman & Halkias, Integrated Electronics(Tata McGraw-Hill)
2. Floyd L. Thomas; Digital fundamentals (Universal Book stall.)
3. Jacob Millman, Microelectronics (McGraw Hill)
4. Badri Ram, Fundamentals of Microprocessors and microcomputers, (Dhanpat Rai Publication)

CORE 20: PHYSICS LABORATORY

PHYSICS LABORATORY –V

Choose any 8 experiments from the list given below LIST OF GENERAL PHYSICS EXPERIMENTS:

1. Newton's Rings: determination of refractive index of the material of the lens.
2. Spectrometer: Hartmann's Interpolation Formula - Determination of wavelength
3. Spectrometer: i - i' curve and determination of refractive index.
4. Spectrometer Dispersive power of the material prism
5. Spectrometer: Grating – wavelength by normal incidence method
6. Young's modulus: Elliptical fringes method.
7. Ultrasonic velocity and compressibility of the liquids - Interferometer method.
8. Field along the axis of a circular coil - Determination of moment of a magnet
9. Temperature co-efficient of a Thermistor
10. Potentiometer: Verification of laws of resistance and resistivity of the material of a wire.
11. Potentiometer: Resistance of the potentiometer and measurement of emf of a thermocouple.
12. B.G Internal resistance of a cell
13. B.G: Current and voltage sensitivities.
14. B.G: Quantity or charge sensitivity.
15. Wien's bridge: Measurement of frequency.
16. Diode laser : characteristic study
17. Simulation of 3-D models of a given kind of crystal and their study
18. Computer simulation of growth of current in RL circuit.

TEXTBOOKS

1. Practical Physics C.C Ouseph, V.J.Rao and V.Vijayendran
2. Practical Physics M.N.Srinivasan, (Sultan son Pubs)
3. D P Khandelwal, A Laboratory Manual for Physics for Undergraduate Students (Vani Publications, New Delhi)
4. B Saraf et al, Physics through Expriments, Vol. II., EMF constant and varying (Vikas Publications, New Delhi)
5. Verma, Ahluwalia & Sharma, “Computational Physics, an Introduction” (New Age Int.)

REFERENCE BOOKS

1. Olon, "Experiments in Modern Physics"
2. Adrian C. & Melissinos, Experiments in Modern Physics, (Academic Press)

PHYSICS LABORATORY –VI

Choose any 8 experiments from the list given below LIST OF ELECTRONICS EXPERIMENTS:

1. Study of CRO.
2. Transistor characteristics - common emitter.
3. Tuned collector oscillator- Frequency measurement by CRO and Frequency counter.
4. Tuned base oscillator - Frequency measurement by CRO and Frequency counter.
5. Astablemultivibrator- Using 555 Timer- Frequency measurements
6. Emitter follower.
7. Phase shift oscillator - Frequency measurement by CRO and Frequency counter.
8. Basic Logic and Universal gates using diodes and transistors components.
9. NAND and NOR as universal gates using ICs
10. Transistor Amplitude modulator and measurement of percentage of modulation.
11. OP-AMP characteristics (741 IC) -parameter measurement
12. Implementation of logic expression and their simplification
13. Half-adder and full-adder
14. Parity generator / checker
15. Flip-flop circuits using gates
16. Asynchronous counters using ICs
17. Diode AM detection
18. Assembly language programming - microprocessor – addition.

TEXTBOOKS

1. Practical Physics C.C Ouseph, V.J.Rao and V.Vijayendran
2. Practical Physics M.N.Srinivasan, (Sultan son Pubs)
3. Jain R.P, Anand M.M.S, "Digital electronics Practice Using Integrated Circuits" (Tata McGraw-Hill, 1999, New Delhi).
4. Zbar&Malvino, Basic Electronics-A text Lab Manual (Tats McGraw-Hill, 1999)
5. Verma, Ahluwalia, Sharma, “Computational Physics, an Introduction” (New Age International)

REFERENCE BOOKS

1. Malvino, Electronic principles, 6th Ed. (Tata McGraw-Hill, 1999, New Delhi).
2. Takheim, Digital electronics, 3rd Ed (McGraw-Hill International).

CORE 21: RENEWABLE ENERGY AND ENERGY HARVESTING

Unit I

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Unit II

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Unit III

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.

Geothermal Energy: Geothermal Resources, Geothermal Technologies. (2 Lectures) Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Unit IV

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications Carbon captured technologies, cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability.

TEXT BOOKS:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi.
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.

REFERENCE BOOKS

1. Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004,
2. Oxford University Press, in association with The Open University.
3. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
4. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
5. http://en.wikipedia.org/wiki/Renewable_energy

CORE 22: PHYSICS LABORATORY

PHYSICS LABORATORY –VII

Choose any 8 experiments from the list given below LIST OF GENERAL PHYSICS EXPERIMENTS:

1. Air wedge: Determination of the thickness and insulation of the wire.
2. Spectrometer: i - i' curve for given angle of deviation II method
3. Spectrometer small angle prism
4. Spectrometer: Determination of Cauchy ‘s constants
5. Spectrometer: Dispersive power of a grating
6. Filed along the axis of acicular coil – Determination of BH using Searl’s vibration magnetometer
7. Potentiometer: Resistance of potentiometer and measurement of emf of a thermocouple.
8. Potentiometer: Temperature coefficient of resistance of the material of a coil of wire.
9. B.G: Comparison of mutual inductance of two pairs of coils.
10. B.G absolute capacity of a condenser
11. Study of divergence of a laser beam
12. Characteristics of a solar cell
13. Determination of refractive index: Abbe's refractometer.
14. Measurement of e by Milliken's method
15. Determination of Planck's constant
16. Hall probe in magnetic field measurement
17. Computer simulation of 1 -D and 2-D lattice vibrations
18. Computer simulation of nuclear chain reactions and nuclear energy.

TEXT BOOKS

1. Practical Physics C.C Ouseph, V.J.Rao and V.Vijayendran
2. Practical Physics M.N.Srinivasan, (Sultan son Pubs)
3. D P Khandelwal, A Laboratory Manual for Physics for Undergraduate Students (Vani Publications, New Delhi)
4. B Saraf et al, Physics through Expriments, Vol. II., EMF constant and varying (Vikas Publications, New Delhi)
5. Verma, Ahluwalia & Sharma, “Computational Physics, an Introduction” (New Age Int.)

REFERENCE BOOKS

1. Olon, "Experiments in Modern Physics"
2. Adrian C. & Melissinos, Experiments in Modern Physics, (Academic Press).

PHYSICS LABORATORY – VIII

Choose any 8 experiments from the list given below

LIST OF ELECTRONICS EXPERIMENTS:

1. Transistor characteristics - common base
2. Power pack - construction with Bridge rectifier and IC regulator.
3. Emitter follower
4. Single stage RC coupled CE amplifier - Frequency response curve.
5. Hartley oscillator - Frequency measurement by CRO and Frequency counter.
6. Colpitt's oscillator- Frequency measurement by CRO and Frequency counter.
7. Clipping and Clamping circuits using diodes
8. Astable –mutivibrater using transistor frequency measurement
9. Basic and Universal logic gates using ICs
10. JFET characteristics.
11. OP-AMP addition, subtraction, multiplication, Integration and differentiation.
12. Implementation of logic expression and the simplification
13. Arithmetic circuits using gates
14. Multiplexers, Demultiplexers
15. RS, D, JK and Master Slave

flip-flops 16 Shift Registers

17. Synchronous counters using ICs
18. Assembly language programming - microprocessor - subtraction

TEXTBOOKS

1. Practical Physics C.C Ouseph, V.J.Rao and V.Vijayendran
2. Practical Physics M.N.Srinivasan, (Sultan son Pubs)
3. Jain R.P, Anand M.M.S, "Digital electronics Practice Using Integrated Circuits" (Tata McGraw-Hill, 1999, New Delhi).
4. Zbar & Malvino, Basic Electronics-A text Lab Manual (Tats McGraw-Hill, 1999)
5. Verma, Ahluwalia, Sharma, “Computational Physics, an Introduction” (New Age International)

REFERENCE BOOKS

1. Malvino, Electronic principles, 6th Ed. (Tata McGraw-Hill, 1999, New Delhi).
2. Takheim, Digital electronics, 3rd Ed (McGraw-Hill International).