B.Sc. Semester - I
Optional Subject: Physics

PHY 1.1: Mechanics and properties of matter

UNIT 1:
Frames of References:
Inertial frames, Galilean transformation equations (derivation), Invariance of Newton's Laws under Galilean Transformations, Invariance of laws of conservation of momentum and energy under Galilean transformations, Non-inertial frames, fictitious force, rotating frame of reference, concept of Coriolis force.

	04 Hrs
Problems	01 Hrs

Linear Momentum:
Definition of Linear Momentum, Law of conservation of linear momentum for a system of particles, Centre of mass of a system of particles, Position coordinates of the Centre of Mass, Motion of center of mass, collision between two particles which stick together (inelastic collision) and do not stick together (elastic collision) in laboratory frame of reference (One Dimensional), Conservation of linear momentum in case of variable mass: examples i) Single stage rocket (expression for velocity neglecting the weight) ii) Double stage rocket

	05 Hrs
Problems	02 Hrs

UNIT 2:
Angular momentum
Definition of angular momentum and its relation to angular velocity, Definition of Torque and its relation to angular velocity, Relation between angular momentum and Torque, Law of conservation of angular momentum, Work done by a Torque, Central force, Kepler's second law of Planetary motion (derivation).

	05 Hrs
Problems	01 Hrs

Simple Harmonic Motion (SHM)
Definition of SHM, Expressions for displacement, velocity and acceleration of a particle executing SHM, Differential equation of linear SHM, Total energy of a particle executing SHM (Derivation), Expressions for the period of oscillation of flat spiral spring (Derivation), Composition of two linear SHM,s of equal periods acting at right angles to each other, Lissajous figures.

05 Hrs
Problems   01 Hrs

UNIT 3: Moment of Inertia

Kinetic Energy of a rotating body, Definition of M.I. and radius of gyration, Perpendicular and Parallel axis theorems (derivations), M.I of rectangular lamina, Annular ring and circular disc, (derivations), Hallow and Solid Cylinders (mention of expressions), M. I. of Flywheel (Theory and Experimental determination).
                                                                    07 Hrs
Problems   02 Hrs

Acceleration due to Gravity

Theory of Compound Pendulum, Interchangeability of Centres of suspension and oscillation, Four points collinear with the C.G. about which the time period is same, conditions for Maximum and Minimum time periods, Bar Pendulum, Experimental determination of "g" using Bar Pendulum, Bifilar Suspension with Parallel threads.
                                                                    05 Hrs
Problems   01 Hrs

UNIT 4: Elasticity

Stress, Strain, Elastic limit, Hook's law, Modulii of elasticity for isotropic materials, Relation between elastic constants (Derivation), Definition of Poisson's Ratio, Work done for unit Volume in stretching a wire, Bending of Beams-Neutral surface, Neutral axis, Plane of Bending, Bending Moment, Expression for bending moment (Derivation), uniform bending (mention formula), Theory of light cantilever (Derivation) and I-section girder (qualitative), Torsion expression for the couple per unit twist, Torsional pendulum, Experimental determination of "Y" by bending.
                                                                    07 Hrs
Problems   02 Hrs

UNIT 5:
Surface Tension.

Molecular forces, Molecular range, Surface energy, Pressure difference across a curved liquid surface, Excess pressure inside a spherical liquid drop, (or an air bubble inside a liquid), Excess pressure inside a soap Bubble, Difference of pressure across a curved surface, Angle of Contact, Rise of liquid in a capillary tube, Determination of surface tension by capillary rise method and Jeager's method with relevant theory.
                                                                    06 Hrs

Problems   01 Hrs

Viscosity
Viscosity of a liquid, Streamline and turbulent motion, Newton's law of viscous flow, Stoke's law of Viscosity, determination of co-efficient of viscosity of liquid by Stoke's method with theory, Derivation of Poiseuille's equation.

                                                                     04 Hrs
Problems   01 Hrs

Reference books:

1. Mechanics (VI-Edition) - J.C.Upadhyay –Ramprasad & Sons,Agra, 2005.
2. Mechanics (XX-Edition) – D.S.Mathur- S. Chand & Company Ltd., New-Delhi, 2007.
3. Mechanics & Electrodynamics (XVII-Edition, Course- 1 & 2) – Brijlal, Subramanyam & Jivan Seshan, S. Chand & Company Ltd., New-Delhi, 2008.
4. Properties of Matter (XIII-Edition) – Brijlal & Subramanyam, Eurasia Publishing House Pvt. Ltd., New-Delhi, 2001.
5. Elements of Properties of Matter (XXVIII-Edition), D.S.Mathur - S. Chand & Company Ltd., New-Delhi, 2005.
6. Physics , Vol. No.I (V-Edition)– Resnick, Halliday & Krane – John Wiley & Sons Inc., New-York, Singapore, 2005.
7. Berkely Physics, Vol. No.I – ABC Publications, Bangalore & New-Delhi.
8. University Physics (XI-Edition)- Young & Freedman – Pearson Education, 2004.

PHY 1.2: Physics Lab-1

List of Experiments:

1.   Bar Pendulum L vs. T and L^2 Vs. LT^2 graphs.
2.   M.I. of the Fly-Wheel
3.   Verification of Parallel axes theorem of Moment of Inertia using Bar Pendulum.
4.   Verification of Perpendicular axes theorem of Moment of Inertia using Tortional Pendulum.
5.   Bifilar Suspension.
6.   Young's Modulus of the material of a wire using Searls' Apparatus.
7.   Y- by Uniform bending- Load depression Graph.
8.   Torsion Pendulum – Rigidity of Modulus.
9.   Co-efficient of viscosity of liquid by Stoke's method.
10. Surface Tension by Jeager's Method / Quincke's method.
11. Radius of Capillary tube by mercury pellet method.

12. Use of CRO – Measurement of AC voltage and frequency for sine and square waves.
13. Use of multimeter (demonstration)

Note:
1. Experiments of four hours duration.
2. Minimum of Eight experiments to be performed.

Revised syllabus w.e.f. 2011-12
B.Sc. Semester - II
Optional Subject: Physics

PHY 2.1 : Kinetic theory of gasses, Thermodynamics, Radiation, Energy Sources and Sound,

UNIT 1: Kinetic theory of gases
Maxwell's law of distribution of velocities (qualitative) & its experimental verification. Average, r.m.s. & most probable velocity (derivation). Bose-Einstein & Fermi-Dirac distribution (qualitative), Mean free path, mention of Clausius-Maxwell's expressions for mean free path, Brownian motion, Einstein's expression (derivation), determination of Avogadro's number; Transport phenomena — Viscosity. thermal conductivity, diffusion, expression for η & κ (derivations)   **10 hrs**
Problems   **02 hrs**

UNIT 2: Thermodynamics
Heat engines: Otto engine, Otto cycle, expression for efficiency, Diesel engine, Diesel cycle, expression for efficiency & Carnot's theorem
Entropy: Concept of entropy, change in entropy in reversible & irreversible processes, entropy-temperature diagram, second law of thermodynamics.
Maxwell's relations-derivation of Maxwell's relations, applications to – 1) Clausius-Clapeyron's equation, 2) Clausius equations (specific heat of saturated vapours)   **10 hrs**
Problems   **02 hrs**

UNIT 3: Low temperature and pressure
Measurement of low temperature, exhaust pump & its characteristics, exhaust pressure, degree of vacuum attainable, speed of pump:
1) Diffusion pump-principle, construction & working
2) Ionisation gauge-principle,construction & working.
Production of low temperature - Joule Thomson effect, Porous plug experiment with theory, Thermodynamical analysis of Joule Thomson effect   **10 hrs**
Problems   **02 hrs**

UNIT 4: Radiation
Radiation pressure, (qualitative), Stefan's law & its derivation using radiation pressure. Laboratory method for determination of Stefan's constant. Wein's displacement law with derivation, Rayleigh-Jeans's law (qualitative), Planck's law of radiation & its derivation. Ferry's total radiation pyrometer.   **10 hrs**
Problems   **02 hrs**

UNIT 5:
Energy Sources
Introduction to energy Sources: Energy sources and their availability; conventional and non-conventional energy sources, Renewable energy sources; advantages and prospects.

Solar energy: Solar constant, solar radiation at earth's surface, attenuation of beam radiation.
Solar cell and its characteristics.   **05 hrs**

Sound
Free, forced and sustained vibrations, resonance with examples. Analytical treatment of damped and forced vibrations. Theory of Helmoltz resonator, condition for amplitude of resonance, phase of forced vibration, effect of damping on phase of forced vibration, effect of damping on phase, Fourier theorem and its applications to plucked strings.
                                                                       06 Hrs
Problems.   **02 Hrs**

Reference books:

1. Kinetic Theory of Gases(I-Edition) – V.N.Kelkar – Ideal Book Service, Pune, 1967.
2. Kinetic Theory of Gases(II-Edition) – R.S.Bhoosnurmath – IBH Prakashana, Bangalore, 1981.
3. Heat & Thermodynamics and Statistical Physics(XVIII-Edition) – Singhal, Agarwal & Satyaprakash – Pragati Prakashan, Meerut, 2006.
4. Heat & Thermodynamics and Statistical Physics(I-Edition) – Brijlal , Subramanyam & Hemne - S. Chand & Company Ltd., New-Delhi, 2008.
5. Heat and Thermodynamics (I-Edition) – D.S.Mathur - S. Chand & Company Ltd., New-Delhi, 1991.
6. A Treatise on Heat – Shaha and Srivatsava.
7. A text book of heat - J.B.Rajam.
8. Energy Sources – G.D.Rai
9. Text of sound (II-Edition) - Brijlal & Subramanyam - Vikas Publishing house, New-Delhi, 1977.
10. Text of sound (I-Edition) – Khanna & Bedi – Atmaram & Sons., Delhi, 1985.
11. Text of sound (III-Edition) – M.Ghosh - S. Chand & Company Ltd., New-Delhi, 1989.

PHY 2.2 : Physics Lab – II

List of experiments:

1. Volume Resonator
2. Frequency of AC using Sonometer
3. Velocity of sound through wire using sonometer
4. Use of CRO – study of Lissajous figures
5. Lee's method of determination of thermal conductivity of rubber

6. Thermal conductivity of poor conductor (perspex)
7. Specific heat by cooling
8. Verification of Stefan's Law.
9. Determination of Stefan's constant
10. 'J' by electrical method – radiation correction by graphical method
11. 'J' by continuous flow method
12. Velocity of sound using Kundt's tube

Note
1. Experiments are of four hours' duration
2. Minimum of eight experiments to be performed

B.Sc. Semester-III
(w.e.f. 2012-13)

Optional Subject: Physics

PHY 3.1 : Geometrical Optics and Electricity

UNIT 1:
Fermat's principle: Statement & explanation, derivation of laws of reflection & Snell's law. Sign convention, refraction at a spherical surface. Abbe's sign convention (derivation), Lagrange's law & Helmholtz relation (derivation). Aplanatic points & surfaces (qualitative). **04 hrs**

Cardinal points: Cardinal points of optical systems. Equivalent focal length of two thin lenses separated by a distance & location of cardinal points of a thick lens (derivation).
07 hrs

Problems **02 hrs**

Aberrations: Spherical & chromatic aberrations. Methods to reduce spherical aberrations (qualitative). Condition for achromatism of two thin lenses (1) in contact, (2) separated by a distance. **03 hrs**

Occulars : Ramsden & Huygen's eye piece (with discussion of their cardinal points).
02 hrs

Problems **01 hr**

UNIT 2: Electrostatics
Electric polarization, Gauss law in dielectrics and electric displacement. Boundary conditions at a surface separating the two dielectric media(with derivation). Derivation of relation between electric displacement 'D', electric field 'E' & polarization 'P'. D & P in terms of E. Atomic polarisability, electric susceptibility, relation between dielectric constant & electric suscebtibility. Mention of expression for force between two charges in a dielectric medium separated by a large distance. Expression for mechanical stress on surface of charged conductor – application to a electrified soap bubble. Expression for electrostatic energy in the medium surrounding charged conductors. Derivation of Clausius–Mosotti equations & its limitations. Electrical images, use to earthed conducting plane & a sphere **08 hrs**

Problems -   **02 hrs**

UNIT 3:
Current Electricity
Statement of Biot-Savart' law, derive the expression for magnetic field due to Straight conductor carrying current, mention the expression for the field along the axis of a circular coil & discuss the special cases. Helmholtz galvanometer-principle, construction & working. Ampere's ciruital law-statement, proof & its applications to derive the magnetic field due to Solenoid & Toroid.   **06 hrs**
Problems   **02 hrs**

Transient currents: Theory of growth & decay of current through RL circuit. Theory of charging & discharging of capacitor through RC circuit. Time constants of RL
& RC circuits. Measurement of high resistance by leakage method.   **05 hrs**
Problems   **02 hrs**

UNIT 4: Alternating current:
Operator j, Argand diagram. LCR series ciruit – Expression for current , impedence & phase (using j–operator method). Condition for resonance, resonant frequency, Band width, quality factor & their relation (qualitative)
LCR parallel circuit- Expression for admittance & condition for resonance (using j-operator method). Comparison between series & parallel resonant circuits.   **06 hrs**
Problems   **02 hrs**

UNIT 5: Electrical instruments & measurements :
Ballistic galvanometer: condition for moving coil galvanometer to be ballistic & dead beat. Theory of BG. Charge and current sensitivity and their relationship, correction for damping. Measurement of capacitance of capacitor using BG by absolute method. Determination of self inductance (L) by Rayleigh's method and mutual inductance by direct method with necessary theory. Theory of earth inductor, determination of B_H, B_V and Φ.   **07 hrs**
Problems   **02 hrs**

Reference books:

1. Principles of Optics (I-Edition) – B.K.Mathur – New Gopal Printing Press, 1962.
2. Fundamentals of Optics (V-Edition) – Khanna & Bedi – R. Chand & Co., New-Delhi, 1971.
3. A Text book of Optics (I-Edition) – Brijlal & Subramanyam - S. Chand & Company Ltd., New-Delhi, 2006.
4. Optics (IV-Edition) – Ajay Ghatak – Tata Mc Graw-Hill, New-Delhi, 2006
5. Fundamentals of Optics (III-Edition) – Jenkins & White - Mc Graw-Hill, 1957.
6. Geometrical Optics (I-Edition) – D.P.Acharya – Oxford & IBH Pub. Co., New-Delhi,1970.

7. Optics & Spectroscopy (VI-Edition) – Murugeshan, Kirutiga & Shivaprasath - S. Chand & Company Ltd., New-Delhi, 2006.
8. Geometrical Optics – A. Verstraeten.
9. Fundamentals of Electricity and Magnetism – Basudev Ghosh – Books & Allied New Central Book Agency, Calcutta, 2009.
10. Electricity and magnetism- D.N. Vasudev- S.Chand Publication, New Dehli.
11. Electricity and Magnetism- B.S.Agarwal- S.Chand Publication,New Dehli.
12. Electricity and magnetism- Brij lal &Subramasnyam.
13. Fundamentals of optics- Khanna and Gulati.
14. Electricity and magnetism and Atomic physics vol-I – John Yarwood.
15. Electricity and magnetism – A.N.Matveer-Mir publisher,Moscow 1986.
16. Introduction to electrodynamics- D.J.Griffith(3rd ed)Prentice Hall of India,New Dehli.
17. Vector Analysis-Hague
18. Electricity and Magnetism- D.Chattopadhya & Rakshit.
19. Electricity and magnetism- K.K.Tiwari
20. Fundamentals of electricity and magnetism- D.N.Vasudev.
21. Electricity and Magnetism- Segal and Chopra

PHY 3.2 : Physics Lab – III

List of experiments:

1. Calibration of spectromenter
2. Dispersive curve and dispersive power
3. Goniometer
4. Turn table
5. Total internal reflection
6. Determination of magnetic field along the axis of a coil
7. Helmholtz galvanometer
8. Determination of the constants of B.G.
9. Determination of high resistance by leakage method
10. Measurement of capacity by method of mixtures
11. Measurement of capacity by absolute method.
12. R-C time constant

Note
1. Experiments are of four hours' duration
2. Minimum of eight experiments to be performed

B.Sc. Semester-IV
(w.e.f. 2012-13)

Optional Subject: Physics

PHY 4.1 : Physical Optics, Thermoelectricity and Electromagnetic theory

Unit -1 : Interference :
Interference due to division of wave front: Fresnel's biprism. Detemination of wavelength of monochromatic light & thickness of a thin film using biprism.
Interference due to division of amplitude: Stokes' treatment of reflection & transmission at an interface.
Thin films – conditions for maxima & minima case of reflected light (derivation). Multiple reflections. Mention of conditions for maxima & minima in case of transimitted light. Exhibition of colours by thin films. Qualitative discussion of wedge shaped film with mention of expression for path difference. Theory of Newton's rings & determination of wavelength of monochromatic light using Newton's rings. Michelson interferometer. Formation of circular & straight fringes (qualitative). Determination of wavelength of monochromatic light using Michelson interferometer. Standardization of meter.   **15 hrs**
Problems   **03 hrs**

Unit -2 : Diffraction :
Fresnel class : Fresnel theory of half period zones considering plane waves, rectilinear propagation of light. Zone plate, construction . theory, expression for focal length and comparison with convex lens.   **04 hrs**
Problems   **01 hr**
Frounhoffer class : Composition of "n" numbers of SHM's of same amplitude & period and having their phases increasing in arithmetic progression. Diffraction at a single slit & at a double slit (qualitative). Plane transmission grating & its theory. Absent spectra & dispersive power of grating.
Resolving power: R.P. of prism & grating.   **09 hrs**
Problems   **02 hrs**

Unit -3 : Polarisation:
Malus law, Huygen's theory of double diffraction. Positive & negative crystals. Production of circularly & elliptically polarized light. Retardation plates -(i) quarter wave plate, (ii) half wave plate. Analysis of polarized lights: Optical activity, Fresnel's theory of rotatory polarization (qualitative)   **08 hrs**

Unit -4 : Thermoelectricity :
Seebeck effect & its explanation. Variation of e.m.f. with temperature, neutral temperature & temperature of inversion. Thermoelectric series. Laws of thermoelectric effect. Peltier effect- explanation, Peltier coefficient & thermodynamics of Peltier effect. Thomson coefficient - explanation, Thomson coefficient. Derivation of the relations $\pi = T \, de/dT$ and $\sigma_a - \sigma_b = T \, d^2e/dT^2$. Thermoelectric (Tait) diagram, its application to determine

1) total emf, 2) Peltier emf, 3) Thomson emf , 4) neutral temperature, and 5) temperature of inversion. **09 hrs**
Problems **02 hrs**

Unit -5 : Electromagnetic theory :
Mathematical background – gradient of scalar, divergence and curl of a vector, their physical significance, Gauss', Stoke's and Green's theorems (without proof).
Maxwell'sequations : derivation of Maxwell's equations in differential forms, mention of integral forms & their physical significance. Derivation of general plane wave equations in free space. Transverse nature of radiation. Poynting theorem (derivation) **08 hrs**

Reference books: Sem-4:
1. Principles of Optics (I-Edition) – B.K.Mathur – New Gopal Printing Press, 1962.
2. Fundamentals of Optics (V-Edition) – Khanna & Bedi – R. Chand & Co., New-Delhi, 1971.
3. A Text book of Optics (I-Edition) – Brijlal & Subramanyam - S. Chand & Company Ltd., New-Delhi, 2006.
4. Optics (IV-Edition) – Ajay Ghatak –Tata Mc Graw-Hill, New-Delhi, 2006
5. Fundamentals of Optics (III-Edition) – Jenkins & White - Mc Graw-Hill, 1957.
6. Geometrical Optics (I-Edition) – D.P.Acharya – Oxford & IBH Pub. Co., New-Delhi,1970.
7. Optics & Spectroscopy (VI-Edition) – Murugeshan, Kirutiga & Shivaprasath - S. Chand & Company Ltd., New-Delhi, 2006.
8. Geometrical Optics – A. Verstraeten.
9. Fundamentals of Electricity and Magnetism – Basudev Ghosh – Books & Allied New Central Book Agency, Calcutta, 2009.
10. Electricity and magnetism- D.N. Vasudev- S.Chand Publication, New Dehli.
11. Electricity and Magnetism- B.S.Agarwal- S.Chand Publication,New Dehli.
12. Electricity and magnetism- Brij lal &Subramasnyam.
13. Fundamentals of optics- Khanna and Gulati.
14. Electricity and magnetism and Atomic physics vol-I – John Yarwood.
15. Electricity and magnetism – A.N.Matveer-Mir publisher,Moscow 1986.
16. Introduction to electrodynamics- D.J.Griffith(3rd ed)Prentice Hall of India,New Dehli.
17. Vector Analysis- Hague
18. Electricity and Magnetism- D.Chattopadhya & Rakshit.
19. Electricity and magnetism- K.K.Tiwari
20. Fundamentals of electricity and magnetism- D.N.Vasudev.
21. Electricity and Magnetism-Segal and Chopra
22. University Physics (XI-Edition)- Young & Freedman – Pearson Education, 2004.
23. Heat & Thermodynamics and Statistical Physics(XVIII-Edition) – Singhal, Agarwal & Satyaprakash – Pragati Prakashan, Meerut, 2006.

24. Physics , Vol. No.II(VI-Edition)– Resnick, Halliday & Krane – John Wiley &
Sons Inc., New-York, Singapore, 2005.

PHY 4.2 : Physics Lab – IV

List of experiments:

1. Newton's rings
2. Biprism-Determination of wavelength of monochromatic light.
3. R.P. of a prism
4. R.P of telescope
5. R.P. of grating
6. Diffraction at a wire or aperture using laser
7. Polarimeter
8. Series/ Parallel Resonance (LCR Circuit)
9. Capacity by De Sauty's method (AC)
10. Determination of L & C by equal voltage method
11. Determination of dielectric constant of liquid
12. Measurement of emf of a thermocouple at various temperatures and verification of any one law of thermoelectric effect

Note
1. Experiments are of four hours' duration
2. Minimum of eight experiments to be performed

Books recommended for Practicals (for Physics Lab-III and Physics Lab-IV):

1. Advanced Practical Physics   - Worsnop and Flint
2. Practical Physics   - Rajopadhye and Purohit
3. Practical Physics   - Hipparagi M.A
4. Practical Physics   - Arora
5. Practical Physics   - Harnam Singh
6. Practical Physics   - Indukumar
7. Practical Physics   - Chowhan and singh
8. Advanced course in Practical Physics - D. Chatopadyay & P.C.Rakshit & B.Shaha

B.Sc. Semester-V
(w.e.f. 2013-14)

Optional Subject: Physics

PHY 5.1 : Classical mechanics, Quantum mechanics and Atomic spectra

Unit -1 : Classical Mechanics
Constraints- types, Holonomic, Nonholonomic, Scaleronomic, Rheonomic with examples. Degrees of freedom, space point and configuration space, principle of virtual displacement and virtual work.

Generalized co-ordinates , D 'Alemberts' Principle, Lagrange's equation, simple application to find equation of motion given a lagrangian.(For simple pendulum & Harmonic Oscillator)   **07 hrs.**
Problems: **02 hrs.**

Unit-2: Quantum Mechanics:
Introduction to Quantum theory, Compton scattering, expression for Compton shift(with derivation). de Broglie hypothesis, Davison and Germer's experiment.   **03hrs**
Problems: **01 hrs.**
Uncertainty principle: Statement, illustration by Gamma ray microscope and diffraction of electrons at a single slit.   **02 hrs**
Wave Mechanical Model of the Atom: Setting up of Schrodinger's equation (time independent only). Physical interpretation of wave function, Eigen function and Eigen values. Particle in one-dimensional box (with derivation of expression for energy). Expression for energy in three dimensions, degeneracy; Linear Harmonic oscillator (without derivation for energy); Concept of zero point energy.   **07 hrs**
Problems: **01 hrs.**
Statistical Physics
Statistics of identical particles – Maxwell-Boltzmann; Bose-Einstein and Fermi-Dirac statistics. Degenerate Fermi gas.   04 **hrs**

Unit-3: Atomic spectra:
Vector-model of Atom, Spin orbit interaction, Coupling schemes (LS and jj), The Pauli exclusion principle. Electron configuration of single valence electron atoms (Alkali metals) and two valence electron atoms and their spectra (Principal, Sharp, diffuse and fundamental series). , magnetic moment due to orbital and spin motion. Stern-Gerlach Experiment

07hrs
Magnetic field effect on light: Larmor precession, Normal and Anomalous Zeeman effect, Experimental method to study Zeeman effect Expression for Zeeman shift(using quantum theory). Energy level diagram for sodium D lines in a weak magnetic field..
04 hrs
Problems: **01 hrs.**

Reference books:

1. Classical Mechanics(X Ed)- Takwale and Puranik-Tata.McGraw Hill,Newdehli,1989
2. Classical Mechanics(XIV ed)- Gupta,Kumar & Sharma-
3. Classical Mechanics(XVII ed)- Goldstein-Narosa Publishing Newdehli,1998
4. Quantum Mechanics vol 1 and vol 2(I ed)- Shrivatsav-Pragati Prakashan, Meerat,1977
5. Quantum Mechanics- Gupta,Kumar & Sharma- Jayprakashnath &Co,Meerat,2004
6. Quantum Mechanics(I ed)- Powell-Oxford& IBH Publishing,NewDehli,Bombay,Culkatta,1961
7. Quantum Mechanics - Pauling& Wilson
8. Heat & Thermodynamics and Statistical Physics(XVIII-Edition) – Singhal, Agarwal & Satyaprakash – Pragati Prakashan, Meerut, 2006.
9. Modern physics- R. Murugeshan-- S.Chand Publication,New Dehli.
10. Modern physics(I ed)-Duggal and Chopra- Shobhanlal Nagin chand &Co,1989
11. Introduction to modern physics- Ritchmeyer,Kennerd & Lauritser-TMH Publishing NewDehli
12. Perspective of modern physics(VI ed)- A.Baiser- Tata McGraw Hill,Newdehli.2002
13. Modern physics- J.B.Rajam
14. Introduction to atomic spectra(IV ed)- H.E.White- McGraw Hill,Newdehli,2004

PHY 5.2 : Molecular Spectra, Lasers, Relativity and Electronics

Unit -1 : Molecular spectra:
Molecular Motions: different types motions in a molecule (electronic, vibration, rotation), molecular energy distribution in the electromagnetic spectrum, General features of band spectra compared to atomic spectra. The diatomic molecule as a rigid rotator, non rigid rotator, the rotational energy levels and their spectrum. Information about the moment of inertia and inter nuclear distances from the pure rotational spectrum.   **05 hrs.**
Lasers: Einsteins theory of spontaneous emission, stimulated emission and stimulated absorption, conditions for laser action, types of lasers : Gas lasers(He-Ne), Diode laser,. Applications of Lasers.   **04 hrs**
Raman effect: The Rayleigh's Scattering, the Raman Scattering. Quantum theory of Raman effect and Raman spectrum. Applications of Raman effect: Laser Raman Spectroscopy, SERS (Surface Enhanced Raman Spectroscopy), Comparision of IR and Raman Spectra.   **05 hrs**
Problems: **01 hrs.**

Unit-2: Relativity
Michelson-Morley experiment, Significance of negative result. Postulates of special theory of relativity. The Lorentz transformation –Relativity of length and time. Law of addition of velocities, variation of mass with velocity and mass-energy relation.   **08 hrs**
Problems: **01 hrs.**

Unit -3: Electronics-I
Network theorems: Current and voltage sources, Thevenin and Norton's Theorems.
            03 hrs
Power Supplies; Power Supplies with filters (C, L, LC and π-section), Qualitative idea of Peak inverse voltage, efficiency, Ripple factor, Zener diode: characteristics and its use in voltage regulation   **04hrs**
Transistors : DC h-parameters and their determination, performance of transistor as an amplifier (CE mode only) and its frequency response, Brief explanation of positive and negative feedback. Transistor as an oscillator, Hartley and Phase shift oscillators (Qualitative only); FET: Types, characteristics and parameters. FET as an amplifier (CS mode, qualitative). LDR characteristics.   **08 hrs**
Problems   **02 hrs**

Reference books:

1. Modern physics- R. Murugeshan-- S.Chand Publication,New Dehli.
2. Modern physics(I ed)-Duggal and Chopra- Shobhanlal Nagin chand &Co,1989
3. Introduction to modern physics- Ritchmeyer,Kennerd & Lauritser-TMH Publishing NewDehli
4. Perspective of modern physics(VI ed)- A.Baiser- Tata McGraw Hill,Newdehli.2002
5. Modern physics- J.B.Rajam
6. Introduction to atomic spectra(IV ed)- H.E.White- McGraw Hill,Newdehli,2004
7. LASERs and Non linear Optics- B.B.Laud
8. Introduction to Relativity- R.Resnik.
9. Relativistic Mechanics- Gupta and Kumar.
10. Basic electronics and solid state physics- B.L.Theraja- S.Chand Publication,New Dehli
11. Basic Electronics- B.L.Theraja- S.Chand Publication,New Dehli
12. Integrated Electroniics- Millmans Ans Halkias-McGraw Hill,Newdehli
13. Electronic devices and circuits- Allan Mottersed-.McGraw Hill,Newdehli
14. Basic Electronics linear circuits,TTTI- Bhargav&etal-Bharat Book Prakashan Dharwad

PHY 5.3 : Physics Lab –V

List of experiments:

1. Fraunhofer lines and determination of Rydberg constant
2. Ionisation potential of Xenon/Mercury
3. Thevenin and Norton's theorems using ladder circuits
4. Low pass filter
5. Characteristics of Zener diode
6. Voltage regulator using Zener diode
7. Battery charger
8. Battery eliminator
9. CE- amplifier
10. Hybrid parameters
11. FET characteristics

Note:

1. Experiments are of four hours' duration
2. Minimum of seven experiments to be performed

PHY 5.4 : Physics Lab –VI

List of experiments:

1. Analysis of molecular spectra (Rotational spectra)
2. Study of hydrogen spectrum - determination of Rydberg constant
3. Planck's constant using Photo cell
4. Thevenin and Norton's theorems using Wheatstone's net
5. High pass filter
6. Construction of multi range voltmeter
7. Full wave bridge rectifier with π-section filter
8. Hartely Oscillator
9. Colpits Oscillator.
10. FET Amplifier
11. Photoconductive cell (LDR)

Note:
1. Experiments are of four hours' duration
2. Minimum of seven experiments to be performed

B.Sc. Semester-VI
(w.e.f. 2012-13)

Optional Subject: Physics

PHY 6.1: Solid state physics, Nuclear physics, and Nanoscience

Unit -1 : Solid state Physics:
Crystal structure: Lattice, lattice translational vectors, basis of crystal structure, Types of unit cells, Co-ordination numbers, Bravais lattices, Seven crystal Systems, Miller indices, expression for inter-planar spacing, crystal structure of NaCl and CsCl.
03 hrs
Problems: **01 hrs.**
Crystal diffraction: X-ray spectrum(Continuous & Characteristic), Bragg's law, Bragg's X-ray spectrometer. **02hrs**

Problems: **01 hrs.**
Specific heat of solids: Experimental facts; classical theory, Einstein's and Debye's theory of lattice specific heats. **03 hrs**
Free electron theory of metals: Classical free electron model, expressions for electrical and thermal conductivity, Wiedemann-Franz law, failure of classical free electron theory.
02 hrs
Semiconductors :Expression for electrical conductivity in case of intrinsic semiconductors, experimental determination of energy gap, Hall effect, expressions for Hall co-efficient and applications. **03 hrs**

Unit-2:
Magnetic materials : Classification, classical Langevin's theory of diamagnetism and paramagnetism, determination of paramagnetic susceptibility by Gouy's method. Ferromagnetism, Domain and hystresis. **03 hrs**
Superconductivity : Experimental survey , Occurrence of superconductivity, destruction of superconductivity by magnetic field, Meissner effect, isotope effect and applications.
02 hrs

Nanoscience:
Introduction, size effect, correlation with quantum mechanical 'particle in a box' problem; quantum structures: quantum wells, wires and dots; nanomaterials; synthesis, characterization, properties and applications (qualitative). **05 hrs**

Unit- 3 : Nuclear Physics:
α-rays: Theory of α-decay, Range, ionization, specific ionization and Geiger-Nuttal relation, **03hrs.**
Problems: **01 hrs.**
β-rays: Fermi theory of β-ray spectrum. **02 hrs**

Nuclear models: Liquid-drop model — explanation of semi-emperical mass formula, explanation of nuclear fission on the basis of liquid-drop model. Shell model (qualitative), Magic numbers. **02 hrs**

Nuclear forces: Properties of nuclear forces, Meson Theory of nuclear forces. **01 hr**

Nuclear reaction: Q-value and Types of nuclear reactions. **01 hr**

Detectors and Accelerators: GM counter, Scintillation counter, linear accelerators, Cyclotron. **03 hrs**

Elementary particles: classification **01hrs**

Problems: **01 hrs.**

<u>**Reference books:**</u>

1. Solid State Physics- C.Kittel-Wishey Publishing
2. Solid state physics(I ed)- A.J.Dekkar-McMillan,NewDehli,2003
3. Solid state physics(I ed)- Keer-New age international Pvt. Limited.2002
4. Solid state physics- Kumar And Gupta
5. Solid state physics- Kumar and Gupta and Saxena
6. Nano: The Essentials- T.Pradeep(TMH,New Dehli,2007
7. Nanotechnology: Principles & practices- S.K.Kulkarni
8. Introduction to Nanotechnology- C.P.Poole&F.J.Owens
9. Nuclear Physics(XVIII ed)-I .Kaplan-Addison&Wesley Publishing Company.1977
10. Nuclear Physics(IV ed)- D.C.Tayal-Himalaya Publishing House,1982
11. Fundamentals of Nuclear Spectroscopy- Basswell- Tata McGraw Hill,Newdehli,2004
12. Nuclear physics- I.Kaplan

PHY 6.2: Astrophysics, Computational physics, Electronics and communication

Unit -1 : Astrophysics

Units of stellar distances: light year and parsec; luminosities of stars, apparent and absolute magnitudes, examples; stellar spectra, H-R diagram, binary stars, stellar masses, stellar temperatures, equations of stellar structure, linear density model for stars, formation and evolution of stars (qualitative); end stages of stars – white dwarfs, neutron stars and black holes (qualitative).

Different types of telescopes and their characteristics. **10 hrs**

Problems **01 hr**

Unit -2 : Computational Physics

C-Programming: Introduction; constants, variables and data types. Operators and expressions; I/O operations: scanf, printf; decision making: if-else statement, for and do-while looping. Application to simple pendulum **08 hrs**

Solving physical problems using matrix method: Refractive index, electrical conductivity and tunneling (α decay)   **02 hrs**

Unit -3 : Electronics-II
Integrated Circuits (ICs): types of ICs, operation of astable multivibrator using 555-timer (qualitative); Op-amp, characteristics.   **03 hrs**
Unit-4 Digital Electronics
Number systems: Decimal, Binary, Hexadecimal and their interconversion. Boolean algebra, truth tables, basic theorems, Basic and Universal gates. DTL gates; OR, AND, NOT, NAND and XOR gates.   **04 hrs**
Problems   **01 hr**
Electronics communication
Filters ;Low pass and high pass constant K–type filter , classification of radio waves; Types of radio wave propagation, radio waves propagation through ionosphere. Critical frequency, critical angle, MUF, virtual height, secant law.   **05 hrs**
Modulation and Demodulation : Need of modulation, types of modulation, significance of modulation index, Frequency spectrum of AM., AM modulator using BJT.
Frequency Modulation (FM) : FM spectrum, FM transmitter, applications of FM, Comparison between FM & AM **.**
Demodulation : Necessity, AM detection, square law detector (qualitative). Super heterodyne receiver (Block diagram).
                                                                         05 hrs.
Problems   **01 hr**

Reference books:

1. Introduction to Astrophysics(XV ed)- Baidyanath Basu-Prantice Hall of India-2006.
2. Astrophysics(III ed)- K.D.Abhyankar-Universities Press India Pvt. Ltd. 2009.
3. Introduction to Astrophysics and Astronomy- M. Zeilik, Gregory and Smith.
4. Basics of computer- Rajesh Hongal.
5. C Programming - E. Balguruswamy.
6. C programming- Kotur.
7. Modern Physics- Murugeshan.
8. Moden Physics- Duggal and Chabra.
9. Basic electronics and solid state physics- B.L.Theraja- S.Chand Publication,New Dehli
10. Basic Electronics- B.L.Theraja- S.Chand Publication,New Dehli
11. Integrated Electroniics- Millmans Ans Halkias-McGraw Hill,Newdehli
12. Electronic devices and circuits- Allan Mottersed-.McGraw Hill,Newdehli
13. Basic Electronics linear circuits,TTTI- Bhargav&etal-Bharat Book Prakashan Dharwad
14. Electronics communication system- Kennedy & Davis.

PHY 6.3 : Physics Lab –VII

List of experiments:

1. Analysis of x-ray diffraction spectra
2. Electrical and thermal conductivity of copper to determine Lorenz number.
3. Hall effect
4. Determination of resistivity of a semiconductor by four probe method.
5. Characteristics of GM counter.
6. GM tube (dead time).
7. Voltage Multipliers using diodes and capacitors.
8. V-I Characteristics of three LED's (emitting different colors).
9. Study of DTL gates.
10. Use of IC 7400 (basic gates)
11. Solar cell characteristics (a) Open circuit voltage (b) Short circuit current.

Note:
1. Experiments are of four hours' duration
2. Minimum of seven experiments to be performed

PHY 6.4 : Physics Lab –VIII

List of experiments:

1. Thermistor.
2. BH curve
3. Verification of inverse square law using GM tube
4. Attenuation of β- radiation (absorption coefficient of aluminium)
5. Spectral sensitivity of photovoltaic cell.
6. H.R. diagram : Physical Properties of stars
7. Use of IC 7400 (D'Morgan's theorems & verification of Boolean expressions).
8. Phase shift Oscillator using Op Amp.
9. Astable Multivibrator (using 555 timer).
10. Weins bridge oscillator using Op-amp.
11. Executing C Programs for period of a simple pendulum and range & height of a projectile.

Note:
1. Experiments are of four hours' duration
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