Syllabus for

B.Sc. Physics

(Semester system)

w.e.f. 2017

Rajiv Gandhi University

Rono Hills, Doimukh, Arunachal Pradesh

Course Structure of B.Sc. Physics, RGU

Year	Sem.	Paper code	Paper Name	Topics	Marks	Internal	Total marks
1st	I	PHY 111	Mechanics, Properties of Matter And Waves, Oscillation and sound	Mechanics	60	15	100
				Properties of Matter			
				Waves, Oscillation and sound			
		PHY111P	Physics Practical - 1	Physics Practical	20	05	
	II	PHY 121	Heat and Thermodynamics	Heat and Thermodynamics	60	15	100
		PHY 121P	Physics Practical - 2	Physics Practical	20	05	
2nd	III	PHY 231	Electricity and Magnetism and Geometrical optics	Electricity and Magnetism	60	15	100
				Geometrical optics			
		PHY 231P	Physics Practical - 3	Physics Practical	20	05	
		PHYSK 231	Electronics in Everyday life	Electronics in Everyday life	80	20	100
	IV	PHY 241	Physical Optics and Modern Physics	Physical Optics	60	15	100
				Modern Physics			
		PHY 241P	Physics Practical - 4	Physics Practical	20	5	
		PHYSK 241	Fundamental of Computers	Fundamental of Computers	80	20	100
3rd	V	PHY 351	Mathematical Physics	Mathematical Physics	80	20	100
		PHY 352	Classical Mechanics and Electromagnetic Theory	Classical Mechanics	60	20	100
				Electromagnetic Theory	20		
		PHY 353	Quantum Mechanics and Statistical Mechanics	Quantum Mechanics	60	20	100
				Statistical Mechanics	20		
		PHY 354	Physics Practical - 5	Physics Practical	80	20	100
	VI	PHY 361	Atomic Physics and Nuclear Physics	Atomic Physics	40	20	100
				Nuclear Physics	40		
		PHY 362	Solid state Physics	Solid state Physics	80	20	100
		PHY 363	Electronics and communications	Electronics and communications	80	20	100
		PHY 364P	Physics Practical - 6	Physics Practical	50	10	100
				Dissertation/seminar	30	10	

PHY-111: Mechanics, Properties of Mater, Wave oscillation and sound

Mechanics

Vector and its operations- Vector triple product, gradient, divergence and curl of vectors, Gauss's divergence theorem, Stokes's theorem, Green's theorem.

Rotational motion: KE of rotation, moment of inertia, theorems of moment of inertia, moment of inertia of rectangular plate, circular disc, cylinder, sphere (solid and hollow), body rolling without slip.

Gravitation: Kepler's law of planetary motion, Newton's law of gravitation from Kepler's law, Simple harmonic oscillator, Theory of compound pendulum (Katter's pendulum & Bar Pendulum, and their uses).

Properties of Matter

Elasticity: Hook's law, different kinds of elastic constants- relation among the elastic constants Bending of beam fixed at one end and loaded at the other end, torsion of a rod. Determination of elastic constants

Surface tensions, surface energy, excess pressure inside soap bubble and liquid drop, capillarity, Determination of surface tension by Jager's Method

Viscosity of fluids, Poiseuille's equation. Bernoulli's theorem and its applications, Meyer's formula, determination of viscosity by rotation viscometer.

Waves, Oscillation and sound

Simple harmonic motion, Theory of free, damped and forced oscillations, resonance, sharpness of resonance, equation of wave motion, principle of superposition of waves, beats, stationary wave-theory of plucked and struck strings .

Velocity of sound in a homogeneous medium, effect of temperature and pressure on velocity of sound in air, intensity level of sound and its unit, Ultrasonic waves – production of ultrasonic waves, application of ultrasonic waves, principle of SONAR system

Tentative Mark Distribution for end term examination		
Sections	**Compulsory Question**	**Choice based question**
Mechanics	15 Marks covering all sections (q. carry 1 or 2 marks)	15 marks Out of 5 Q. of 5 marks , 3 is to be answered
Properties of Matter		15 marks Out of 5 Q. of 5 marks , 3 is to be answered
Waves, Oscillation and sound		15 marks Out of 5 Q. of 5 marks , 3 is to be answered
Note: In each the choice based question may have objective or short questions also		

PHY-111P: Physics Practical-I

List of Experiments: (One experiment is to be performed in the examination by the candidate from this section)

1. Measurement of length or diameter using Calliper/Screw gauge/travelling microscope
2. Determination of the height of a building using sextants
3. Determination of moment of inertia of a flywheel
4. Determination of young modulus by using optical lever method.
5. Determination of modulus of rigidity of a wire by Maxwell's needle
6. Determination of elastic constant of a wire by Searle's method
7. Determination of g by bar pendulum
8. Determination of g by Kater's pendulum
9. Determination of g and velocity of a freely falling body by using digital timing technique
10. Study of motion of a spring and calibration of spring constant

Mark Distribution for the semester end examination:

1.	Theory	4 marks
2.	Experiment and results	6 marks
3.	Viva	6 marks
4.	Lab note book	4 marks

PHY-121: Heat and Thermodynamics

Heat and radiation

Kinetic theory of gases, Maxwell's law of velocity distribution, degree of freedom, law of equipartition of energy, mean free path, Brownian motion.

Andrew's and Amagat's experiment, equation of state, Van-der-Waals' equation of state, reduced equation of state, critical constants. Clausius-Clapeyron's equation ,Joule-Thomson effect, liquefaction of gases by Joule-Thomson effect. Phase, first order phase transitions, Gibbs' phase rule, triple point.

Platinum resistance thermometer and thermocouple thermometer. Thermal conductivity: Fourier equation for rectilinear flow of heat and its solution.

Laws of radiations –Kirchhoff's law; Stefan's laws; Newton's laws of cooling; Wien law; Rayleigh-Jean law & fundamental ideas of Planck's law.

Thermodynamics

First law of thermodynamics, specific heat of gases, isothermal and adiabatic process, reversal and irreversible process, conversion of heat into work, carnot cycle, Carnot's theorem. Second Law of thermodynamics-various statements, Kelvin's thermodynamical scale, Clausius formulation of entropy & principle of change of entropy in reversible and irreversible processes with examples; Clausius inequality.

Thermodynamic relationships: Maxwell's relations and derivation of fundamental thermodynamical relations form Maxwell's equation. Thermodynamic potentials and its relation to thermodynamic variables, Gibbs phase rule, triple point, adiabatic demagnetization contain

Tentative Mark Distribution		
Sections	**Compulsory Question**	**Choice based question**
Heat		30 marks Out of 5 Q. of 10 marks , 3 is to be answered
Thermodynamics		30 marks Out of 5 Q. of 10 marks , 3 is to be answered
Note: In each the choice based question may have objective or short questions also		

PHY-121P : Physics Practical-2

List of Experiments: (One experiment is to be performed in the examination by the candidate from this section)

1. Verification of vibration of laws of vibration of string using sonometer
2. Determination of viscosity of water by capillary tube
3. Verification of Newton's law of cooling
4. Determination of thermal conductivity of a disc by Lee's method
5. Determination of a specific heat of a solid by principle of mixture
6. Determination of Planck's constant using black body radiation
7. Determination of thermal conductivity of a copper by Charles' method
8. Determination of mechanical equivalent heat using Callender and Bame's method
9. Determination of unknown temperature by thermocouple
10. Determination of unknown temperature by platinum resistance thermometer

Mark Distribution for the semester end examination:

1.	Theory	4 marks
2.	Experiment and results	6 marks
3.	Viva	6 marks
4.	Lab note book	4 marks

PHY-231: Electricity and Magnetism and Geometrical Optics

Electricity and Magnetism

Electrostatics: Gauss's Law and its applications, electric potential and field due to an electric dipole. Poisson's & Laplace's equation; Electrical images and its applications, Capacitors and capacity of various types of condensers (parallel plate, spherical and cylindrical), dielectric- polarization and displacement vector, Clausius-Mosotti equation.

Current electricity: Moving coil Galvanometer, moving coil mirror ballistic galvanometer, dc bridges, Kelvin's double bridge, Thermoelectric effects, Seebeck effect, Peltier effect, Thomson effect, measurement of thermo emf, LR, CR and LCR circuit in DC current.

Magnetism: Biot Savart's Law and Ampere circuital law - **applications** (magnetic field due to a straight conductor, circular current loop and solenoid), Gauss' theorem in magnetism and its applications, Magnetic materials -dia-, para-, ferromagnetism, Hysteresis in ferromagnetic materials

Alternating Current: relation between maximum, average and virtual or effective (rms) values of ac current, L-R, C-R and LCR circuit in AC current, phasor diagrams, measurements of self-inductance by Anderson's bridge, measurements of mutual inductance by ballistic galvanometer, power in AC circuits.

Geometrical Optics

Fermat's principle: application to reflection and refraction at plane and curved boundaries, reflection through combination of two thin lenses, dispersion produced by lens, spherical and chromatic aberration and their remedies, achromatic combination of lenses, spectrometer. Convex lens - Optic Centre - Cardinal Points - Principal foci and principal points - Optic centre of a lens - Spherical aberration and lenses - Methods of minimizing spherical aberration - Condition for minimum spherical aberration in the case of two lenses separated by a distance - Chromatic aberration in lenses - Condition for achromatism of two thin lenses (in contact and out of contact) - coma - astigmatism Ramsden and Huygen's eyepieces - Constant deviation spectrometer - calculation of characteristic wave number of spectral lines, Telescope and microscopes

Tentative Mark Distribution for end term examination		
Sections	**Compulsory Question**	**Choice based question**
Electricity and Magnetism		40 marks Out of6 Q.of 10 marks, 4 is to be answered
Geometrical Optics		20 marks Out of 3 Q.of 10 marks, 2 is to be answered
Note: In each the choice based question may contained objective or short question		

PHY-231P : Physics Practical-3

List of Experiments: (One experiment is to be performed in the examination by the candidate from this section)

1. Use of multimeters
2. Determination of constant of ballistic galvanometer
3. Determination of the value of low resistance by carry foster's method
4. Finding the internal resistance of a cell using potentiometer
5. Finding out the value of current flowing through an external circuit by using potentiometer
6. Determination of the value of capacitance of an air condenser by De-Sauty's A.C Bridge
7. Determination of the capacity of a condenser by electrical vibrator
8. Determination of high resistance by method of leakage using a Ballistic Galvanometer
9. Determination of the value of specific resistance of a material of a wire by post office board.
10. Determination of the reduction of factor of a tangent galvanometer by using a meter
11. Determination of the value of M and H by magnetometer
12. Finding the value of horizontal component of earth's magnetic field using deflection and vibration magnetometer
13. Determination of J by Joule's calorimeter

Mark Distribution for the semester end examination:

1.	Theory	4 marks
2.	Experiment and results	6 marks
3.	Viva	6 marks
4.	Lab note book	4 marks

PHYSK-231: Electronics in everyday life

Electrical components: Electrical charge, field, current, potential, Ohm's law, electrical energy, power, watt; consumption of electrical power-kWh, resistance, capacitance, inductance and its units, measuring meters- Galvanometer, ammeter, voltmeter and millimeter. Electrification by friction - two kinds of electricity, capacitor, principle of condenser, types of condensers - fixed condenser, variable Condenser, electrolytic condenser, guard ring condenser, condenser in series, condensers in parallel. Types of resistance - fixed resistance, variable resistance. Resistance in series, resistance in parallel. Inductor- solenoid. Construction of inductor- standard wire gauge, Inductor in parallel and series, Code to represent the value of resistance, capacitor and inductors. Kirchhoff's law - application to Wheatstone's network.

Semiconductor devices in electronics and its applications Semiconductor diode, Zener diode, Transistor, Transistor configurations, diode rectifier, half wave, full wave and Bridge rectifier, Diode as voltage doublers and multiplier. Regulated power supply using Zener diode, transistor and IC. Fixed positive, fixed negative and adjustable power supply.

Alternating Current: Single phase and three phase connections - RMS and peak values, House wiring , Star and delta connection, overloading, Earthing – construction of proper earthing, short circuiting - Fuses - color code for insulation wires, Inverter, UPS – online UPS and offline UPS, generators and motor - circuit breaker. Electrical switches. Transformers and its construction – Core type, Shell type, classification of transformers. EMF equation – voltage ratio – current ratio – transformer on no load – auto transformer – applications.

Electrical appliances: Electrical bulbs, Fluorescent lamps, LED lamps, electrical fans, water heater, electrical iron, mixer-grinder, Air conditioner and refrezarators, microwave oven, Voltage Stabilizer, induction cooker.

Electronic Communication systems: Basic concepts of radio transmitter and receiver - Basic concepts of TV Transmitter and receiver, TV antennas: Resonance antennas and their characteristics - Dipole antenna - Folded dipole - Yagi antenna, Yagi antenna design, Dish antenna, DTH system, Mobile communication system, MODEM.

Tentative Mark Distribution for the semester end examination		
Sections	**Compulsory Question**	**Choice based question**
Electronics in everyday life *Total Marks :80*	10 marks (Q. carry 1 or 2 marks)	60 marks Out of 7 Q. of 15 marks , 4 is to be answered
Note: Each the choice based question may have objective or short questions.		

Head

PHY-241: Physical Optics and Modern Physics

Physical Optics

Interference: Stokes' law, Fresnel's biprism, and interference by a plane parallel film, wedge shaped film, colour of thin film, Newton's rings, Michelson interferometer and its applications, Interferometers, Febry Parrot interferometer.

***Diffraction*:** Fresnel and Fraunhofer diffraction, half-period zones and strips, Zone plate and its lensing property, diffraction at a straight edge, circular aperture, Fraunhofer diffraction due to a single slit, double slit and transmission gratng, wavelength measurement by the plane transmission grating,

Polarization: Double refraction, optic axis and $CaCO_3$ crystal, plane, circular and elliptically polarised light, Retarding plates and their uses for producing and analysing different polarized light, specific rotation of lane of polarisation and half-shade polarimeter.

Laser physics Lasers, Characteristics of laser light, absorption Spontaneous emission, Stimulated emission, Einstein coefficients, Population inversion and light amplification, Essential components of the laser, Ruby and He-Ne laser (principles only),

Modern Physics

Atomic Physics:

positive rays and its analysis, Aston and Bainbridege mass spectrograph, Thomson experiment for determination of e/m, Millkan oil drop experiment. Rutherford alpha scattering experiment, Bohr atom model – Frank and Hertz experiment.

Nuclear Physics:

Nuclear masses and binding energies - binding energy curve. Radioactive disintegration - - radioactive series, Geiger-Nuttal law, cabon dating, age of earth, -alpha particle disintegration energy - alpha particle spectra - theory of alpha decay (qualitative treatment). Types of beta decays, beta ray spectra - neutrino theory, gamma rays and their origin, interaction of gamma ray with matter.– nuclear reactors.

Tentative Mark Distribution for end term examination		
Sections	**Compulsory Question**	**Choice based question**
Physical Optics		30 marks Out of 5 Q. of 10 marks , 3 is to be answered
Modern Physics		30 marks Out of 5 Q. of 10 marks , 3 is to be answered
Note: each the choice based question may contained objective or short questions		

PHY-241P : Physics Practical-4

List of Experiments: (One experiment is to be performed in the examination by the candidate from this section)

1. Familiarization with Schuster's focussing; determination of angle of prism
2. Determination of dispersive power of the material of a given prism using mercury source
3. Determination of the equivalent focal length of the combination of two or more lens
4. Study of the variation in liquid column height with diameter of capillary tube and determination of the surface tension of the liquid
5. Determination the value of Planck's constant using LEDs of at least 4 different colours
6. Determination of the value of e/m by magnetic focussing
7. To set up the Millikan oil drop apparatus and determine the charge of an electron
8. Determination of e/m by Thomson method
9. Determination of specific rotation of sugar using polarimeter
10. To study Lissajous figure

Mark Distribution for the semester end examination:

1.	Theory	4 marks
2.	Experiment and results	6 marks
3.	Viva	6 marks
4.	Lab note book	4 marks

PHYSK-241: Fundamental of computers

Over view of computer system: Introduction, characteristics of computer, History of computer and generation of computer, Classification of computers, Anatomy of digital computer system, Input and output devices of computer, Primary and secondary memory Main Memory, static & dynamic RAM , Cache, ROM, Secondary Memory (hard disk, floppy, optical disk, pen drive), Input-Output devices (keyboard, monitor, mouse, OCR, MICR, Barcode Reader, Scanner, Joystick), Printer (DMP, Ink-jet, Laser Printer), Plotter, Use of Smart Card. Assembling of a computer. Desktop computer, notebook computer, Tablet, Smart phones- their applications and limitations.

Number system: Binary, Octal, Hexadecimal number system and their conversions, Binary arithmetic (Addition, subscription, Multiplication and division), Computer codes (BCD, EBCDIC and ASCII) Boolean algebra and Logic gates (AND, OR, NOT, NAND, NOR AND XOR) gates and their functions and truth tables.

Computer Software: Classification of software- System Software, Application Software. Operating System, Types Of Operating System & Its Uses, Application software- word processor, spreadsheet, slide presentation, database management, Programming languages, Machine language, Assembly language and high level language, Assembler compiler an Interpreter, Program planning and use of algorithms and Flow-charts in program developments. Fundamental of C programing and its use.

Programming in C: data types, variables and Constants, Operators and Expressions, Input and output, Control functions, Control statements, IF, IF-ELSE, Nested IF-ELSE statements, Switch and Break statement, GOTO statements, Looping - WHILE loop, Do-WHILE, FOR loop and nested loop, BREAK and Continue statements.

Data Communication and Computer Networks: Network topology, Multiplexer, Concentrator, Network types: LAN, WAN and MAN, Network devices, OSI model, Internet and its applications, WWW, websites and web pages, search engines E -mail and its features, VIRUS, Cyber Crime, Computer Ethics

Tentative Mark Distribution for the semester end examination		
Sections	**Compulsory Question**	**Choice based question**
Fundamental of computers *Total Marks :80*	10 marks (Q. carry 1 or 2 marks)	60 marks Out of 7 Q. of 15 marks , 4 is to be answered
Note: Each the choice based question may have objective or short questions.		

24/9/14

Head
Deptt. of Physics
R. G. U., Rono Hills, Doimukh

PHY-351: Mathematical Physics

Mathematical Physics,

Vectors: Gradient, divergence, and curl in curvilinear co-ordinate system. Laplacian in Cartesian, spherical and cylindrical coordinate system.

Matrices and Tensors: Various types of matrices, orthogonal, Hermitian and unitary matrices, characteristics equation - Eigen values, Eigen vectors; Caley Hamilton theorem, diagonalization of matrices. Concept of tensor and its importance, rank of tensors, covariant and contravariant tensors, Addition, subtraction, inner and outer products, contraction, symmetric and anti-symmetric tensors, quotient law,

Differential equations and special functions: Solution of differential equations of the first order and first degree and second order with constant coefficient, Series solutions (ordinary point, singular point), Frobenius method. Special functions: Legendre's polynomials, Bessel's function, beta and gamma functions and their inter relations,. Partial differential equations - Laplace equation in Cartesian, Spherical, and Cylindrical coordinates, Green's function for Laplace equation, wave equations, Helmholtz equation.

Fourier series and integral transformation: General properties of Fourier series, Fourier integrals and applications. Laplace transform, Fourier transform and their applications.

Computational Physics : C programming , – Algorithms, flow charts, input, output, control statement in C programming. Solving simple problems using C programming Language. Numerical analysis techniques - Bisection, Newton-Raphson, secant method. System of Nonlinear equations, approximating the derivative, numerical differentiation - trapezoidal and Simpson's rule,

Tentative Mark Distribution for end term examination		
Sections	**Compulsory Question**	**Choice based question**
Mathematical Physics	10 Marks	70 marks Out of 10 Q. of 10 marks , 7 is to be answered
Note: In each the choice based question may contained objective or short question		

PHY-352: Classical Mechanics and Electromagnetic theory

Classical Mechanics

Central Force motion: two body motion as a one body problem, general properties of central force motion, Energy and momentum as constants of motion in central fore, Energy equation involving only the radial motion, energy diagram and nature of orbits. Application of central force problem to motion under inverse square force field, solution of the equation of the path to find the nature of the orbits as hyperbolic, parabolic and elliptic.

Lagrangian and Hamiltonian formulation: Constraints and its Classification, Principal of Virtual Work, D'Alembert's principal and its applications, Lagrange's equations and its applications. Generalized co-ordinates, Generalized Momentum, cyclic coordinates, integrals of motion, Advantages of Lagrangian formalisms, Variational calculus and Least Action principle Hamilton's principle, derivation of Lagrange's equation from Hamilton's principle, Legendre transformations, Hamilton's function and Hamilton's equation of motion, Hamilton's equations from Lagranian equation ,

Special Theory of Relativity

Galilean transformation and invariance of Newton's laws of motion, non-invariance of Maxwell's equation. Michelson-Morley experiment, Concept of inertial frame. Postulates of special theory of relativity, simultaneity; Lorentz transformation– length contraction, time dilatation and velocity addition theorem, Relativistic dynamics: variation of mass with velocity; energy momentum relationship.

Electromagnetic Theory

Electromagnetic field equation in integral and differential form, displacement current, Maxwell's equations, Poynting theorem. Electromagnetic wave equation, velocity of electromagnetic wave, Monochromatic plane wave equation in free space and conducting medium. Reflection and Refraction of plane electromagnetic wave for normal and oblique incidence, Snell's law, reflection and transmission co-efficient, Fresnel's equations, Polarization of electromagnetic wave, linear, circular and elliptical polarization, Brewster's law. Propagation of electromagnetic waves in free space, isotropic, anisotropic dielectrics, in conducting media, Reflection and transmission, frequency dependence of permittivity, permeability and conductivity. Wave guides and transmission line.

Tentative Mark Distribution for end term examination		
Sections	**Compulsory Question**	**Choice based question**
Classical Mechanics		60 marks Out of 8 Q. of 10 marks , 6 is to be answered
Electromagnetic Theory		20 marks Out of 3 Q. of 10 marks , 2 is to be answered
Note: In each the choice based question may contained objective or short question		

PHY-353: Quantum Mechanics and Statistical Mechanics

Quantum Mechanics

Development of quantum mechanics –Origin of quantum theory (qualitative studies of black body radiation, Plank's quantum hypothesis, photoelectric effect and Compton Effect); Wave particle duality, de Broglie wave and its Experimental verification, Complimentary principle of Neils Bohr, Heisenberg's Uncertainty Principle, Gamma ray microscope experiment, application of Uncertainty Principle.

Wave function, Postulates of quantum Mechanics, probability density, probability current density - Continuity equation, normalised wave function and Normalisation condition, well-behaved wave function, Wave packets, Superposition of waves, phase velocity and group velocity and their relation. Schrodinger wave equation – (i) time dependent and (ii) time independent. Correspondence Principle.

Application of Schrodinger's wave equation – Free Particle, one dimensional step potential, one dimensional potential barrier- Reflection and transmission coefficients and tunneling effect, a particle in a one dimensional potential well of infinite depth, one dimensional harmonic oscillator. Theory of hydrogen atom- separation of variables, radial solution.

Concept of operator formalism in quantum Mechanics, Dynamical variable as operator (position, linear and angular momentum and Hamiltonian), Eigenvalues and eigen function; commutator and Commutation relation, Expectation value, Ehrenfest's theorem.

Statistical Mechanics

Phase space, trajectories and density of states, macroscopic and microscopic states, postulates of equal a priori probability, Liouville's theorem, Ensembles-microcannonical, canonical and grandcanonical ensembles (classical ideal gas, free energy, chemical potential, Boltzmann partition function and classical partition function, Gibb's paradox). Density matrix, statistics of ensembles, indistinguishable practices, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics, Ideal Fermi and Bose Gas, Bose-Einstein condensation.

Tentative Mark Distribution for end term examination		
Sections	**Compulsory Question**	**Choice based question**
Quantum Mechanics *Total mark 60*		60 marks Out of 8 Q. of 10 marks , 6 is to be answered
Statistical Mechanics Total mark 20		20 marks Out of 3 Q of 10 marks, 2 is to be answered
Note: In each the choice based question may contained objective or short question		

PHY-354P: Physics Practical - 5

Computational Skills and C programming

Total marks 20

1. Drawing and data analysis using computer
2. Problem solving using C Program
3. User of other Mathematical Packages for data analysis

Laboratory Experiment

Total marks 60

List of Experiment: (One experiment should be performed in five hours)

1. To determine the width of a single slit by the diffraction pattern of monochromatic light.
2. To determine the focal length of two lenses and their combination by displacement method.
3. To determine the wavelength of monochromatic light using Newton's ring arrangement.
4. To determine the magnifying power of a telescope by angular method and compare this value obtained by linear method.
5. To study the variation of optical rotation with concentration for sugar solution using polarimeter and Sodium light and hence determine the specific rotation of sugar.
6. To determine resolving power of a plane transmission grating.
7. To study the variation of absorption of light with the concentration of an organic solution using spectrophotometer
8. Execution of a program using I/O data in C-program
9. Writing and then execution of a given program using control statement in C-program
10. To solve numerical problems (Bisection method, Newton-Raphson methods etc..) using C-programming language

Mark Distribution for the semester end examination:

Laboratory Experiment: Total Marks 60

1.	Theory	10 marks
2.	Experiment and data	20 marks
3.	Viva	20 marks
4.	Result	05 marks
5.	Lab note book	04 marks

PHY-361: Atomic Physics and Nuclear Physics

Atomic Physics

Rutherford's nuclear atom model, alpha scattering experiment; deduction of the scattering formula. Bohr's theory of hydrogen spectra; Ritz combination principle; resonance, excitation, critical and ionization potentials; fine structures of the spectral lines; Sommerfeld's extension of the Bohr's theory. Vector atom model : Spectra of alkali atoms; Bohr magneton; spinning electron; quantum numbers; Pauli's exclusion principle; explanation of the periodic Classification of the elements; spectroscopic notations; normal Zeeman effect; anomalous Zeeman effect; Paschen-Back effect; Stark effect; Stern-Garlach experiment.

X-rays and its properties: Continuous and characteristic X-rays Mosley's law, Compton Effect, Scattering of light: Rayleigh scattering formula; colour of the sky; polarisation of the scattered light; Raman effect, experimental study of Raman effect, quantum theory of Raman effect, application of the effect.

Nuclear Physics

***Nuclear forces and Stability of Nuclei*:** Nucleon-nucleon forces – qualitative discussions on nuclear force. Brief outline of Yukawas meson theory, Nuclear stability, neutron proton ratio in stable nuclei, stability curve, odd-even rules of nuclear stability.

***Nuclear models*:** Liquid drop model - Bethe-Weizacker's mass formula - Applications of mass formula – estimation of fission energy application to alpha decay - Bohr - Wheeler theory - Shell model - evidences - theory - energy level diagram - spin orbit interaction - magic numbers - nuclear stability

Nuclear Reactions- fission and fusion, fusion barrier, fusion and thermonuclear reactions, nuclear reactors.

Accelerators and Detectors: Necessity of charge particle acceleration – construction and working principle of linear accelerator. Construction and working principle of a cyclotron. Principles of detection of charge particles. Construction and working principle of gas filled detectors. Ionization chamber (cloud chamber, bubble chamber) . GM counter.

Particle Physics : Elementary particles, Classification - types of interaction - symmetry and conservation laws - hadrons - leptons - baryons - mesons - strangeness - hyperons - antiparticles - basic ideas about quarks, Cosmic rays: Origin of cosmic rays, primary & secondary cosmic rays and their composition. The East West effect. Latitude, longitude & altitude effect, Extensive Air Shower (EAS)

Tentative Mark Distribution for end term examination		
Sections	**Compulsory Question**	**Choice based question**
Atomic Physics **Total mark 40**	Nil	40 marks Out of 6 Q. of 10 marks , 4 is to be answered
Nuclear Physics **Total mark 40**	Nil	40 marks Out of 6 Q. of 7 marks , 4 is to be answered
Note: In each the choice based question may contained objective or short question		

PHY-362: Solid State Physics

Solid State Physics

The idea of amorphous and crystalline solids, The crystal lattice and translation vectors, unit cell, types of crystal lattice, Miller indices, diffraction of X-rays, use of Bragg's law to the determination of lattice constants, Reciprocal lattice and Brillouin's Zone.

Bonding in solids: ionic, covalent, metallic, Van der Waal and hydrogen bonding, cohesive energy of ionic crystal, Madelung constant.

Free electron theory of metals; Fermi Dirac function, density of states in metal and semiconductors, Boltzmann's equation of state, electronic specific heat, electrical and thermal conductivity of metals, Wiedemann-Franz law (Quantum Mechanical treatment to be used); Bloch theorem in one dimension, Kronig-Penny model of energy bands of solids, distinction among metal, insulator and semiconductor, intrinsic and extrinsic semiconductors (qualitative discussion only).

Lattice vibration and thermal properties of solid, Einstein and Debye models; continuous solid; linear lattice; acoustic and optical modes; dispersion relation; phonon

Magnetic properties of solids: Magnetization, magnetic intensity, magnetic susceptibility, permeability, hysteresis, B-H curve and energy loss in hysteresis, different classes of magnetic material, Classical theory of paramagnetism (Langevin's theory and Curie law), Weiss theory (Quantum Mecanical treatment to be used), relation between para and ferromagnetism, Ferromagnetic domain.

Superconductivity and its historical perspective, critical temperature, type-I and type-II superconductors. Persistent current, effect of magnetic fields, Meissner effect, London equations; coherence length;

Tentative Mark Distribution for end term examination		
Sections	**Compulsory Question**	**Choice based question**
Solid State Physics	10 marks (Q. carry 1 or 2 marks)	70 marks Out of10 Q. of 10 marks , 7 is to be answered
Note: In each the choice based question may contained objective or short question		

PHY-363: Electronics and communications

Electronics and Communications

Electronic circuits: Passive and active components, voltage dividers. Superposition Theorem, Thevenin's Theorem, Norton's theorem, Maximum power transfer theorem.

Semiconductor devices: P-N junction diode (forward and reverse I-V characteristics), Breakdown voltage - zener diode. Applications of PN junction diode - half wave and full wave rectifier, filters- L-section and Π-section., Clipping and clamping circuits. Voltage regulation and regulated Power Supply. Transistor and its operation- CB,CE and CC configuration, Basic transistor amplifier - load line and operating point (Q point) of transistor, Stabilization and transistor biasing circuits, analysis of transistor amplifier with h parameters. Field effect Transistor and its applications.

Amplifiers and Oscillators Classification of amplifiers, cascade amplifiers, RC coupled amplifier, Push Pull Amplifier, Darlington connection. Feedback in amplifiers- positive and negative feedback, Barkhousen criterion, Oscillatiors and classification of oscillators, tuned collector oscillator, Phase shift(R-C) and Wein bridge oscillator, Differential amplifiers, Operational amplifier and applications.

Digital Electronics: Binary, hexadecimal and octal number systems, Binary addition and subtraction. Logic gates using PN junction diode and transistors, Boolean algebra, De Morgan's Theorem, Combinational circuit- Boolen equation , Basics of K – Maps, Half adder, full adder,

Electronic Communications: Fundamental of Electronic communication, Modulation, Amplitude modulation, Frequency modulation Angle modulation, Digital communication, Continuous wave modulation and Pulse modulation,.

Tentative Mark Distribution for end term examination		
Sections	**Compulsory Question**	**Choice based question**
Electronics and Communications	Nil	80 marks Out of 8 Q. of 16 marks , 5 is to be answered
Note: In each the choice based question may contained objective or short question		

PHY-364P: Physics Practical-6

In this semester most of the experiment is related to Electronics as of the theory paper

1. To study the characteristics of Diode
2. To study the voltage regulation of a Zener diode
3. User of Zener diode as voltage regulator
4. To draw the output characteristics of a transistor in common base(CB) configuration
5. To draw the output characteristics of a transistor in common emitter (CE) configuration.
6. To find the phase and frequency response characteristics of given LCR circuit.
7. To study the parallel resonant circuit and to measure the dynamic impedance of parallel tuned circuit
8. To study the frequency response for R-C coupled transistor amplifier
9. To determine the characteristics of p-n junction solar cell
10. To study the characteristics of a photodiode.
11. To study the characteristics of Hartley oscillator
12. Study of inverting and non-inverting amplifier using OP-AMP
13.

Mark Distribution for the semester end examination: (60 Marks)

1.	Theory	10 marks
2.	Experiment and data	15marks
3.	Viva-voice	15 marks
4.	Result	05 marks
5.	Lab note book	05 marks

Dissertation/Seminar: (30 Marks)

- One have to make a dissertation about a particular physics topic and give a seminar on that topic
- Mark distribution – Report : 20 marks , Seminar Presentation: 10 marks

List of recommended books

Mechanics

1. An Introduction to Mechanics by D. Kleppner and R. J. Kolenkow
2. Mechanics by D.S. Mathur
3. Mechanics by S. Hans, S.P. Puri
4. An introduction to Classical Mechanics by B. Bhattacharya

Properties of Matter

1. Properties of Matter- D.S. Mathur
2. General Properties of Matter- Newman and Searle
3. A Treaties on General Properties of Matter by Chatterjee and Sengupta

Waves, Oscillation and sound

1. Text book of Sound - K. Bhattacharjee
2. Sound - P.K.Chakraborty and S.B.Choudhury
3. Physics of vibrations and waves- H.J. Pain
4. A Text Book of Sound- N. Subramanyam and Brij Lal
5. Vibrations Waves and Acoustics Chattopadhay and Rakshit

Heat and Thermodynamics

1. A treatise on Heat - Saha and Srivastava
2. Advanced Textbook on Heat – P.K.Chakravarty
3. Heat and Thermodynamics- Zemansky and Dittman
4. Thermal Physics (Heat and Thermodynamics) by Gupta and Ray

Electricity and Magnetism and Electromagnetic Theory

1. Electricity and Magnetism by D.Chattopadhyay and P.C.Rakshit.
2. Electrostatics and Magnetostatics by B.B.Laud
3. Electrodynamics by Griffith

Modern Physics

1. Concept of Modern Physics – A. Beiser
2. Modern Physics - R.Murugeshan & Kirthiga Sivaprasath

Mathematical Physics

1. Introduction to Mathematical Physics, C. Harper (Prentice Hall, India)
2. Vector Analysis, Murray R. Spiegel (Schaum Series)
3. Mathematical methods of Physics by D Biswas
4. Mathematical Physics by B Bhattacharya
5. Methods of Mathematical Physics, Mechanics and General Properties of matter by C R Basu

Classical Mechanics

1. Classical Mechanics, S.N. Biswas (Books and Allied (P) Ltd).
2. Classical Mechanics, H. Goldstein (Narosa Publishing House).
3. An introduction to Classical Mechanics by B. Bhattacharya

Quantum Mechanics

1. Perspectives of Modern Physics - Beiser A. (1969)
2. Introduction to the Quantum Theory- Park D. (1974)
3. Introduction to the Quantum Mechanics- D.J. Griffiths
4. Quantum mechanics by Kuila

Optics

1. A Text book of Light- B Gosh and K G Mazumdar.
2. Geometrical and Physical optics – P.K. Chakraborty
3. Optics – A. Ghatak
4. Optics (Classical and Quantum) by R Kar

Statistical Mechanics

1. Statistical Mechanics- B.K Agrawal and M. Eisner
2. Statistical Mechanics- R.K.Pathria
3. Fundamentals of Statistical Mechanics by A K Dasgupta

Atomic Physics and Nuclear Phyics

1. Concept of Modern Physics – A. Beiser
2. Atomic and Nuclear Physics – S. N. Ghosal
3. Atomic & Nuclear Physics - A. B. Gupta & D. Ghosh
4. Atomic and Nuclear Physics C R basu
5. Introductory Nuclear Physics - K. S. Krane
6. Nuclear physics - I. Kaplan

Solid state Physics

1. Introduction to Solid State Physics by C.Kittel
2. Solid State Physics by S O Pillai
3. Solid State Physics(Essential) by S P Kuila

Electronics and communications

1. Basic Electronics – B.L. Thereja
2. Electronics fundamentals and applications –D. Chattopadhyay and P.C. Rakshit
3. A Text Book Of Electronics –S.L. Kakani & K.C. Bhandari
4. Electronic Principles and Applications by A B Bhattacharya
5. Electronics (Classical and Modern) by R Kar

Other recommended books

7. Fundamentals of Physics , Halliday, Resnick and Walker
8. Sears and Zemansky's University Physics, Hugh David Young, Roger A. Freedman
9. Physics for Scientists and Engineers, Raymond Serway, John Jewett
10. Undergraduate Physics (Voll I) by Bhattacharya and Bhattacharya
11. Undergraduate Physics (Voll II) by Bhattacharya and Bhattacharya
12. Undergraduate Physics (Voll III) by Bhattacharya and Bhattacharya