Year: 2023-24
Syllabus of B.Sc Programme: Subject: PHYSICS [UGPHS]

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits	Max. Marks
1	I	UGPHS -101N	VECTOR, MECHANICS AND GENERAL PHYSICS	Theory	2	100
		UGPHS -101P(N)	PRACTICAL WORK	Practical	2	100
	II	UGPHS -102N	OSCILLATION, WAVES AND ELECTRICAL CIRCUITS	Theory	2	100
		UGPHS -102P(N)	PRACTICAL WORK	Practical	2	100
2	III	UGPHS-103N	ELECTROMAGNETISM	Theory	2	100
		UGPHS-103P(N)	PRACTICAL WORK	Practical	2	100
	IV	UGPHS-104N	ANALOG AND DIGITAL ELECTRONICS	Theory	2	100
		UGPHS -104P(N)	PRACTICAL WORK	Practical	2	100
		SKILL ENHANCEMENT COURSE				
		SBSPHS-02	MODERN PHYSICS	Theory	4	100
3	V	**Discipline Centric Elective Course**				
		DCEPHS -105N	OPTICS	Theory	2	100
		DCEPHS-106N	THERMAL PHYSICS	Theory	2	100
		DCEPHS-107P(N)	PRACTICAL WORK	Practical	2	100
	VI	**Discipline Centric Elective Course**				
		DCEPHS -108N	QUANTUM MECHANICS AND SPECTROSCOPY	Theory	2	100
		DCEPHS -109N	SOLID STATE PHYSICS AND ADVANCED ELECTRONICS	Theory	2	100
		DCEPHS -110P(N)	PRACTICAL WORK	Practical	2	100
	Total Credit				**32**	**1500**

Programme: B.Sc.	Year: 1	Semester: I
Subject: Physics		
Course Code: UGPHS -101N	Course Title: Vector, Mechanics and General Physics	

Course Objectives:

- The course provides the students of core concepts of system of particles, motion, friction, work, energy, planetary and satellite motion.
- Some fundamental concept of vector calculus.
- The fundamental concepts make the students to find their interest so that they can explore in physics, and they can pursue their higher degree in physics.

Course Outcomes:

CO-1 Understand and illustrate various vector calculus method.
CO-2 Understand and define the laws involved in mechanics.
CO-3 Gain deeper understanding of mechanics and its fundamental concepts.
CO-4 Understand the fundamental ideas on conservation of laws.
CO-5 Understand objects in space as they are introduced to planetary and Satellite motions

Credits: 2	**Type of Course:** Core
Max. Marks: 100	Min. Passing Marks: 36

Block 1	Vector and mechanics
Unit 1	**Vector analysis** • Scalar and vector, polar and axial vectors, Concept of tensor. • Dot and cross product of two vectors, scalar and vector triple products • Gradient of scalar, divergence of vector, curl of vector, solenoidal and lamellar vector. • (Line, surface, volume) integral of vectors, Gauss, Stokes and Greens theorem (onlystatement). • Vector identities (only statement)
Unit 2	**. Dynamics of a particle** • Force, momentum, impulse. • Work, Power, energy. • Conservative and non-conservative forces. • Work-energy theorem, mechanical energy. • Conservation of momentum and conservation of mechanical energy. • Elastic and inelastic head on collision.
Unit 3	**Angular and rotational motion** • Equation of motion and fundamental definitions. • Angular momentum, torque, rotational K.E, angular impulse. • Conservation of angular momentum and its applications. • Moment of inertia, radius of gyration, theorem of parallel and perpendicular axes. • Expression for moment of inertia for ring and disc, hollow and solid spheres, hollow andsolid cylinder, thin rod and plates (derivation is not required). • Rolling without sliding and sliding without rolling motion, total kinetic

	energy. • Motion of body along inclined plane in both cases.
Unit 4	**Dynamics of many particles** • Centre of mass and centre of gravity of a system • Centre of mass and laboratory frame of reference. • Motion of centre of mass of a system. • Linear momentum, angular momentum, torque, kinetic energy, potential energy, mechanicalenergy for a system of particles. • Difference between conservation laws (linear momentum, angular momentum, mechanicalenergy) for a particle and system of particles
Unit 5	**Dynamics of rigid body** • Concept of rigid body and its characteristics. • Equations of rotational motion when the directions of angular momentum coincide and donot coincide with axis of rotation. • Relation between angular momentum, moment of inertia and angular velocity in tensor form. • Moment and product of inertia, inertia tensor. • Processional motion.
Block-II	**General Physics**
Unit 6	**Gravitation**
	• Gravity and gravitation, inertial and gravitational mass. • Variation of gravity with shape and rotation of earth, height and depth from surface of earth. • Gravitational field and potential due to spherical shell and solid sphere. • Gravitational self-energy. • Orbital motion of satellite. • Escape velocity of body. • Communication satellite and weightlessness condition.
Unit 7	**Motion under central force** • Central force and its characteristics. • Reduced mass. Reduction of two body central force problem to one body problem. • Expression for transverse and radial acceleration of a body moving under central force. • Acceleration of planet moving around sun. • Kepler's laws of planetary motion (statement, derivation and applications). • Expression for total energy of earth and condition to different paths. • Newton's law of gravitation from Kepler's law.
Unit 08	**Elasticity** • Kinetic model for solids (F-r and U-r graphs). • Behavior of loaded wire (graphs and definitions). • Poisson ratio, elastic constants and inter-relationship among them.

	• Angle of twist and shear. Torsion of cylinder. Torsional rigidity. • Bending of beam, bending moment, geometrical inertia and flexural rigidity. • Centiliver (negligible weight and finite weight), expression for depression. • Elastic potential energy of stressed and twisted wire
Unit 9	**Fluid mechanics and viscosity** • Ideal fluid, critical velocity, stream line and turbulent motion. • Compressible and incompressible fluid, lamellar and nonlamellar motion, steady andvariable motion. • Equation of continuity and its significance. • Euler's equation and its application to deduce Bernoulli's equation, Application ofBernoulli's theorem (velocity of efflux, spinning of ball). • Newton's formula for viscous force. Kinematical and dynamical viscosity (CGS, MKS andSI units). • Poiseuille's law (statement, derivation, limitations), Series and parallel combinations ofcapillaries. • Stokes's law for viscous force, terminal velocity.
Unit 10	**Surface tension** • Adhesive and cohesive force. Shape of meniscus. Angle of contact. • Surface tension, surface energy, unison of small drops and bubbles. • Effect of temperature and impurity on surface tension and angle of contact. • Excess pressure inside air bubble and soap bubble. • Rise and fall of liquid inside capillary. • Importance and application of capillarity.
Suggested Text Book Readings: • An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill. • Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill. • Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley. • Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning. • Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education • Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons. • University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.	
This course can be opted as an elective by the students of following subjects: NA	
Suggested equivalent online courses (MOOCs) for credit transfer: NA	
Electronic media and other digital components in the curriculum: **Choose any one or more than:** e-SLM/ Other electronic and digital contents	
Name of electronic media: e-SLM	Year of incorporation: 2020

Programme: B.Sc.	Year:1	Semester:2
Subject: **Physics**		
Course Code: UGPHS-102N	Course Title: **Oscillation, Waves and Electrical Circuits**	

Course Objectives:

- The course provides the students of core concepts of oscillations, waves and electrical circuits.
- The concepts make the students to find their personal interest, so that they can explore their key personal area in physics and pursue their masters in future.

Course Outcomes:

CO-1 Understand in detail the concepts of oscillations.

CO-2 Understand in detail the concepts of waves.

CO-3 Recognize basic terms in electrical circuits.

CO-4 Apply theorems to construct and solve electrical circuits.

CO-5 Ability to design and conduct experiments as well as to analyze and interpret data

CO-6 Buildup strong problem-solving skills by effectively formulate a circuit problem into a mathematical problem using circuit laws and theorems.

Credits:2	**Type of Course: Core**
Max. Marks: 100	Min. Passing Marks: 36

Block 1	**Mechanical oscillations**
Unit I	**Undamped oscillator** • Periodic motion and its classification. • Electrical analogous of mechanical quantities. • Undamped oscillations and its characteristics, kinematical and dynamical definition of SHM. • Derivation of differential equation using energy consideration and its definition. • Examples of SHM (mass-spring system, general pendulum compound pendulum, floatingcylinder, liquid column in U-tube), effective mass of spring.
Unit II	**Damped oscillator** • Damped oscillation and its characteristics, comparison with undamped oscillation. • Derivation of differential equation using energy consideration and its solution for heavy,critical and weak damping. • Condition for oscillation, frequency of damped oscillation. • Relaxation time, energy dissipation, logarithmic decrement, quality factor.
Unit III	**Forced oscillator** • Forced oscillations and its examples. • Differential equation and steady state solution. • Amplitude resonance and velocity resonance, mechanical impedance. • Amplitude and velocity resonance frequency, phase difference among position velocity andforce. • Power absorption and power dissipation. • Quality factor, band width, sharpness of resonance.

Unit IV	**Coupled oscillator** • Nature and condition of Lissajous figures (for 1:1 & 1:2 frequencies). • Normal co-ordinate, degree of freedom, normal modes of vibrations. • Oscillations of two coupled masses. • Oscillation of two coupled pendulums. • Energy of two coupled systems.
Block 2	**Waves**
Unit V	**Wave motion** • Basic definitions, types of propagation, concept of phase. • Expression and properties of plane progressive wave. • Differential equation of wave motions, wave front. • Plane progressive wave in fluid and stretched string. Displacement wave and pressure wave. • Plane progressive wave in stretched string. • Intensity and energy transportation in wave.
Unit VI	**Waves at boundaries of two media** • Free and bounded medium. • Specific acoustic impedance, characteristic impedance. • Reflection and transmission coefficient of amplitude at joints of two media/strings. • Reflection and transmission coefficient of energy at joints of two media/strings. • Discussion of results for various conditions of impedance of both media
Unit VII	**Superposition of waves** • Principles of superposition (statement, limitations, phenomenon observed). • Reflection of sound waves at free surface and rigid surface. • Stationary waves (formation and characteristics), SWR. • Mode of natural oscillations of stretched string and air column. • Fundamental frequency, harmonics and overtones. • Difference between interference and beats in sound.
Block III	**Electrical circuits**
Unit VIII	**Transient phenomenon and galvanometer** • Transient state and steady state, Time constant. • Transient response LR, CR, LC and LCR circuits. • Theory of moving coil galvanometer (dead beat and ballistic), critical resistance anddamping. • Sensitivity (current, charge and voltage) of moving coil galvanometer. • Applications to measurement of high resistance by leakage method.
Unit IX	**Alternating current** • J-Operator and phasor notations, reactance, impedance, susceptance, admittance. • Instantons, Peak, RMS and Average value of alternating voltage and current, Form factor. • Angle of lag and lead, wattful and wattless current, average power

	consumed (active,reactive and apparent), power factor. • Phasor and vector diagram of CR, LR, LCR series, LCR parallel, LR in series with C inparallel circuits. • Parallel and series resonance, sharpness of resonance, Quality factor, Bandwidth Resonancefrequency.
Unit X	**Network analysis (For both AC and DC)** • Circuit elements and various networks circuits. • T and π networks and their equivalence. • Kirchhoff's current and voltage laws. Mesh and nodal analysis of electrical circuits.(Matrices and determinant methods). • Concept of constant current and constant voltage source. Thevenin and Norton's theorem. • Maximum power transfer theorem, superposition theorem, reciprocity theorem.

Suggested Text Book Readings:

1. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
2. Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
3. Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
4. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
5. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
6. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill

This course can be opted as an elective by the students of following subjects: NA

Suggested equivalent online courses (MOOCs) for credit transfer: NA

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2020

Programme: B.Sc.	Year: 2nd	Semester: 3rd
Subject: **Physics**		
Course Code: UGPHS-103N	Course Title: Electromagnetism	

Course Objectives:

- To make students understand the electrostatic fields, potential, and capacitance, by applying Coulomb's law and Gauss's law.
- To make students understand the magnetostatic fields and inductance by applying Biot Savart's law and Ampere's law to find.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications
- To impart knowledge on the concepts of Faraday ‘s law, induced emf and Maxwell ‘s equation

Course Outcomes:

CO1- Understand the basic mathematical concepts related to electromagnetic vector fields.
CO2- Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.
CO3- Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.
CO4- Understand the concepts related to Faraday ‘s law, induced emf and Maxwell ‘s equations
CO5- Apply Maxwell ‘s equations to solutions of problems relating to transmission lines and uniform plane wave propagation.

Credits: 2	**Type of Course:** Core
Max. Marks: 100	Min. Passing Marks: 36

Block 1	**Electrostatics**
Unit I	**Electric charge, force and fields** • Concept of charge, Coulomb’s law, electric field, electric flux. • Gauss law (statement and derivation, integral and differential form). • Application of Gauss law for charge distribution (linear, cylindrical, spherical). • Coulomb’s law from Gauss law. • Electric field due to charged ring, charged infinite rod and charged disc from Coulomb’slaw. • Laws of electrostatics.
Unit II	**. Electric potential and dipole** • Electric potential and electrostatic potential energy. • Electric fields, potential gradient and their relationship. • Electrostatic self-energy (conducting and dielectric sphere). • Electric potential due to spherical charge distribution (hollow and solid), graphicalrepresentation. • Electric dipole and its behavior in uniform and non-uniform electric field. • Electric field and potential due to electric dipole at a point in Cartesian and polar coordinates. • Force between two electric dipoles.

Unit III	**Dielectrics** • Capacitor and its capacity, principle of capacitor, energy stored in field of capacitor. • Capacity of partially filled parallel plate capacitor, expression for induced charge. • Effect of dielectrics slab introduced inside plates of charged capacitor when its remainsconnected with battery and when it is disconnected from battery. • Spherical plates capacitor and cylindrical plates capacitor. • Change in electrical properties when N small charged drops coalesce to form a large drop. • Three electric vectors (**D, E, P**), dielectric constant, dielectric strength, electricalsusceptibility. • Polarization, surface and volume charge density, Gauss law in dielectrics. • Macroscopic and microscopic properties of dielectrics. Clausius – Mossotte formula.
Block 2	**Magnetostatics**
Unit IV	**Electric current and magnetic fields** • Electric current and current density. Ohm's law and Joule's law, drift velocity. • Magnetic field around stationary charge, moving charge and current carrying conductor. • Biot-Savart law and its application to straight conductor, circular loop, solenoid and toriodcarrying current. • Magnetic field due to moving charge, Lorentz force • Force between two current carrying conductor and two moving charges. • Cyclotron (principle, construction, working, limitations and modification), Betatron.
Unit V	**. Laws of magnetostatics** • Lines of forces, Gauss law in magnetostatics. • Ampere circuital law (statement and derivation), its applications to current carrying rod(hollow and solid). • Inconsistency of Ampere circuital law with equation of continuity. • Modification of Ampere circuital law by Maxwell with introducing concepts of displacement currents and its importance. Comparison of displacement current andconduction current. • Vector potential and its expression due to straight conductor and circular loop. • Derivation of magnetic flux density using vector potential for circular loop.
Unit VI	**Magnetic materials** • Magnetic properties (magnetic flux density B, magnetizing field H, intensity ofmagnetization Im, susceptibility, relative and absolute permeability). • Magnetization, cycle of magnetization, hysteresis loop, retentivity, residual magnetism. • Three magnetic vectors (B, H, Im), three magnetic currents (free, bound and

	total). • Curl of intensity of magnetization.
Block III	**Electromagnetic Phenomenon**
Unit VII	**Electromagnetic induction** • Faraday's law of electromagnetic induction (statement, integral form, differential form) andanalogy with Newton's laws of motion in mechanics. • Condition for existence and depending factors of induced charge, induced voltage, inducedcurrent and induced power. • Dynamic induced EMF and derivation of its expression, • Self and mutual induction and inductance, static induced EMF (self and mutual). • Reciprocity theorem and Neuman's relation. • Relation between self and mutual inductance of two coupled coils, energy of coupledcircuits. • Transformer and its equivalent circuit, condition for ideal transformer (expression forefficiency and voltage gain), transformer losses.
BLOCK IV	**Electromagnetic Theory**
Unit VIII	**Fundamental equations** • Four Maxwell's equations (statement and physical significance). • Maxwell's equations and features of their general plane wave solution in source free space. • Maxwell's equations and features of their general plane wave solution in simple dielectrics. • Differential equation and velocity for electromagnetic waves in source free space anddielectric medium. • Characteristics of electromagnetic waves, impedance, refractive index. • Skin depth and its importance.
Unit IX	**Energy and momentum of an electromagnetic wave** • Differential equation of plane electromagnetic waves in conducting media and its solution. • Behavior and property of electromagnetic waves for good dielectric and good conductors. • Poynting theorem (statement and derivation). • Expression for electromagnetic energy density. • Momentum density vector and its importance • Maxwell's stress tensor (statement and derivation).
Unit X	**Fresnel's equation** • Boundary conditions at discontinuity for D, E, B and H. • Reflection and refraction at normal and oblique incidence of electric vectors perpendicular toboundary. • Reflection and refraction at normal and oblique incidence of electric

	vectors parallel toboundary. • Total internal reflection, Brewster's law, degree of polarization. • Plane wave propagation in plasma and its properties (qualitative), metallic reflection. • Elementary theory of dispersion.
Suggested Text Book Readings: 1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education 2. Electricity & 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. 5. D.J.Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.	
This course can be opted as an elective by the students of following subjects: NA	
Suggested equivalent online courses (MOOCs) for credit transfer: NA	
Electronic media and other digital components in the curriculum: **Choose any one or more than:** e-SLM/ Other electronic and digital contents	
Name of electronic media: e-SLM	Year of incorporation: 2021

Programme: B.Sc.	Year:2nd	Semester:4th
Subject: **PHYSICS**		
Course Code: UGPHS -104N	Course Title: **Analog and Digital Electronics**	
Course Objectives: • This course helps the students to gain basic ideas of the construction and working of electronic devices and circuits. • The aim of this course is to make students acquire knowledge about Boolean algebra, logic Circuits.		
Course Outcomes: CO-1- Be familiar with the basic concepts of construction and working of electronic devices and Bipolar junction transistor. CO-2- Apply the knowledge to understand the working of amplifiers and oscillators CO-3- Apply the knowledge to understand the working of special types of Diodes CO-4- Apply the principles of feedback in amplifiers and oscillators CO-5- Understand the concepts and techniques in digital electronics. CO-6- Understand various number systems and their importance in digital designing. CO-7- Analyze and construct various digital circuits. CO-8- Design combination and sequential circuits.		
Credits:2		**Type of Course:** Core
Max. Marks: 100	Min. Passing Marks: 36	
(Syllabi framed block wise/unit wise)		

Block 1	**Electron devices**
Unit I	**Semi-conductor physics** • Band theory of solids and classification of solids on its basis. Intrinsic and extrinsic (n-type,p-type) semiconductors. • Conductivity, mobility, drifts motion and diffusion motion of free electron and holes. • p-n junction (formation of depletion region and potential barrier). • Forward and reverse biasing of p-n junction, forward and reverse current. • Diode equation and characteristics, static and dynamics resistance, knee voltage. • Breakdown mechanism (Zener and Avalanche), transition and storage capacitance. • Zener diode (statement, characteristics and comparison with p-n junction). • Zener diode as voltage regulation (circuit and analysis).
Unit II	**Power supply** • Non regulated and regulated power supply. • Circuit and mathematical analysis of rectifier (HWR, FWR and BR). • Ripple factor, rectification constant, voltage regulation and efficiency of rectifier. • Filtering by RL, RC and LC circuit (only qualitative). • Photonics device LED (principles and applications). • Photodiode and photo transistor, photoconductivity. • Solar cell (principle, construction, working and characteristics).
Unit III	**Bipolar junction transistor** • NPN and PNP transistor and their action. • Types of configurations, region of operation, thermal runaway. • Characteristics and parameters of CE, CB and CC configuration of transistor. • Emitter efficiency, base transport ratio and current gain in CB configuration. • Leakage current, hybrid parameters. • Transistor biasing and their merits & demerits, thermal stability. • DC and AC current gains in all three configurations of transistors and their inter-relationshipof transistors.
Unit IV	**Unipolar transistors** • FET (construction, classification, symbol, principle of operation). • Internal and external biasing of FET. Fundamental definition related with FET. • Characteristics and parameter of FET. • Comparison of FET with BJT. • MOSFET (enhancement and depletion mode), construction, symbol and working. • NMOS and PMOS, CMOS as switch, BJT as switch. • Storage and transition time (definition and importance). • Schottky diode and Schottky transistors (statement, symbol and importance).
Block 2	**Electronic circuits**
Unit V	**Amplification** • Introduction to different gains (impedance, current, voltage and power). • Small signal hybrid equivalent circuits of transistor in three configurations. • Inter-relationship among hybrid parameters in CE, CB, and CC configuration of transistors.

	• Importance of voltage divider biasing of transistor, operating points. • DC and AC load lines (statement and analysis). • Classification of amplifiers on the basis of coupling, range of operations, uses andfrequency.
Unit VI	**Voltage and power amplifier** • RC coupled amplifier (single and multistage), components and their functions. • Analysis of frequency (low, medium and high) response curve with the help of equivalentcircuits. • Push-pull amplifier (characteristics, advantages and disadvantages). • Single and double tuned amplifier (characteristics and importance). • Audio and radio frequency amplifier (characteristics and importance)
Unit VII	**Oscillator** • Feedback amplifier (positive and negative), open and closed loop gains. • Merits and demerits of negative feedback amplifier over positive amplifier. • Barkhausen criterion for sustained oscillation (statement and proof). • Component of oscillator and their functions • Tuned collector, Hartely and Colpit oscillator (circuit and working). • RC oscillator, phase shift oscillator and Wiens bridge oscillator. • Crystal oscillator.
Block III	**Digital Electronics**
Unit VIII	**Number system and codes** • Number system (decimal, binary octal and hexa-decimal), radix. • Rules for interconversion of one number system into other number systems. • 1s and 2s compliments of binary numbers. Binary arithmetic's. • Different types of codes (BCD code, Excess 3 codes, Grey code, ASCII code, EBICDICcode and error code).
Unit IX	**Boolean algebra and logic gates** • Boolean algebra and its features • Logic gates (Switching circuit, Truth table, Venn diagram, Boolean function). • Primary gates (AND, OR, NOT) and their representation using p-n diodes & transistors. • Universal gates (NAND, NOR) and realization of other gates using these. • Exclusive gates (XOR, XNOR), equivalent and non-equivalent gates, characteristics andXOR-laws, XNOR-laws. • AND-OR, OR-AND, NAND-NAND, NOR-NOR realization of Boolean expression.
Unit X	**Boolean Theorems and combinational logics** • De-Morgan's laws, commutative laws, associative laws, distributive laws, absorptive laws ofBoolean algebra. • Dual and compliment of Boolean function. • Minterms, maxterms, SOP form, POS form of Boolean functions. • Minterms and maxterms are conjugate to each other. • Karnaugh's mapping and its representation (for 2, 3 and 4 variables) in terms of

	minterms and maxterms. • Simplification and Boolean expression by Boolean laws and K-mapping. • Half and full adder, half and full subtractor.

Suggested Text Book Readings:

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
3. Solid State Electronic Devices, B.G.Streetman & S.K.Banerjee, 6th Edn.,2009, PHI Learning
4. Electronic Devices & circuits, S.Salivahanan & N.S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
5. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
6. Electronic circuits: Handbook of design & applications, U.Tietze, C.Schenk,2008, Springer
7. Semiconductor Devices: Physics and Technology, S.M. Sze, 2nd Ed., 2002, Wiley India
8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

This course can be opted as an elective by the students of following subjects:NA

Suggested equivalent online courses (MOOCs) for credit transfer: NA

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2021

Programme: B.Sc.	Year:2nd	Semester:4th
Subject: **PHYSICS**		
Course Code: SBSPHS-02	Course Title: **MODERN PHYSICS**	

Course Objectives:

The aim of this course is to make the students learn and discuss about the Modern Physics.

Course Outcomes:

CO-1 Understand the concept of Reference point.

CO-2 Understands the concept of Special and General theories of relativity.

CO-3 To establish a relationship between mass and energy.

CO-4 Describe the series of spectra and know Frank-Hertz experiment

Credits: 4	**Type of Course: Skill Enhancement Course**
Max. Marks: 100	Min. Passing Marks: 36

(Syllabi framed block wise/unit wise)

Block I	**Special Theory of Relativity**
Unit I	**Emergence of special relativity:** • Frame of reference (inertial and non-inertial), Events (simultaneous, colocal andcoincidence) • Centripetal force, centrifugal force, and Coriolis force. • Classical relativity, Galilean variant and Galilean in-variant. • Compatibility of electromagnetism with principle of relativity and mechanics. • Michel Jon-Morley experiment-significance of negative result. • Postulates of special theory of relativity.
Unit II	**Relativistic kinematics:** • Lorentz transformations (statements and derivation). • Relativity of simultaneity and length contraction. • Relativity of co locality and time dilation. • Experimental verification of length contraction and time dilation. • Relativistic transformation of velocity, resultant of two successive Lorentz transformations. • Relativistic velocity addition theorem (statement, derivations and applications). • Aberration of stars (statement, derivation and comparison with classical result). • Relativistic Doppler effect (statement, derivation and discussion of result).
Unit III	**Relativistic dynamics:** • Non-relativistic and relativistic particles. • Einstein's mass and energy equivalence relation, relativistic kinetics energy. • Variation of mass with velocity (only qualitative) and its importance. • Fundamental equations of relativistic motion, longitudinal and transverse mass. • Momentum and energy transformation equations. • Minkowski time space diagram and its applications.

Block II	**Atomic Physics**
Unit IV	**Atomic models:** • Bohr's theory of hydrogen likes atoms, Bohr radius, Sommerfeld fine structure constant,Rydberg & Rydberg Constant, Binding energy. • Spectral series of hydrogen atom, H_α, H_β, H_γ, H Balmer lines • Reduced mass, effect of nuclear motion, isotopic shift, • Ground, Excited and ionized state, emission and absorption spectra • Excitation, resonance and ionization potential, ionization energy of atom • Bohr's correspondence principle (statement, proof and importance) • Qualitative discussion of sommerfeld atom model.
Unit V	**X-Ray spectra** • Production of X-rays (qualitative discussion of Roentgen tube and Coolidge tube) • Properties and application of X-rays • Continuous and characteristic X-rays, Bremstrahlung radiation • Continuous and line X-ray spectra (K-series, L-series, M-series) • Duane-Hunt's law, cutoff frequency and cutoff wavelength, • Moseley's law (statement, derivation and applications), absorption edge • Comparison of optical and X-rays spectra
Unit VI	**Atomic structure:** • Vector atom model (need, statement and importance) • Space quantization, concept of electron spin and quantum numbers • Stern-Gerlach experiment (principal theory and importance of results) • Magnetic moment of atom, Bohr magneton, Gyro magnetic ratio,Larmor precession andfrequency • Intensity rules, selection rules, spectral terms, sodium D_1 and D_2 lines, Fine structure of Hαlines, • Coupling scheme (L-S and j-j), spectra of alkali and alkaline earth elements.
Unit VII	**Dualism nature:** • Planck's quantum theory and Einstein modifications, Photon and its characteristics • Photoelectric effect (statements laws and mathematical explanation), quantum efficiency • Compton effect (statement and explanation, expression for Compton shift and recoil energy), • Dualism in nature, de-Broglie hypothesis, matter waves and its importance. • Comparison of matter waves with electromagnetic waves and mechanical waves • Davisson-Germen experiment (principle, working and importance of result) • Wave packet, phase velocity and group velocity, wave and particle velocity, relation amongthem • Uncertainty principle (statement, significance and application)
Block III	**Nuclear physics**
Unit VIII	**Radioactivity:** • Natural and artificial radioactivity, emission of alpha particle, electron, positron and gammaparticles

	• Size of nucleus, classification of nuclei (isotopes, isobars, isotones, isomers andisodiapheres). • Radioactive series, successive radioactive decay, radioactive equilibrium • Earth dating and carbon dating, artificial nuclear transmutation • Discovery of neutrons and radioisotope in everyday life • Nuclear force and its Yukawa (Meson) theory.
Unit IX	**Nuclear energy:** • Mass defect, packing fraction, binding energy, specific binding energy, • Binding energy curve, explanation of nuclear fission, nuclear fusion and release of nuclearenergy, • Kinematics of nuclear reaction, Q-value of reactions • Bohr's-Wheeler model, activation and excitation energy, normal and enriched Uranium, • Liquid drop model, semi-empirical mass formula, • Shell model, magic number, collective model
Unit X	**Elementary particles** • Classification of elementary particles on the basis of mass, spin and interaction, • Particles and anti-particles. • Process of annihilation and process of production of matters, • Quantum number (Lepton number, Baryon number, iso-spin number, hyper charge number,strange number) • Conservation laws and concept of Quarks.

Suggested Text Book Readings:

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 the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
4. Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
5. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
6. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
7. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
8. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).

This course can be opted as an elective by the students of following subjects:NA

Suggested equivalent online courses (MOOCs) for credit transfer: NA

Name of electronic media: e-SLM	Year of incorporation: 2021

Programme: B.Sc.	Year:3rd	Semester:5th
Subject: **PHYSICS**		
Course Code: DCEPHS-105N	Course Title: OPTICS	
Course Objectives: • The aim of this course is to make the students learn and discuss about the Optics and their related experiments. • Students also correlate them with the corresponding theory, through the standard set of experiments .		
Course Outcomes: CO-1 Student will learn basics of Optics. CO-2. To impart basics knowledge of laser and holography CO-3. Student will familiar with nature of light.		
Credits:2	**Type of Course: ELECTIVE**	
Max. Marks: 100	Min. Passing Marks: 36	
(Syllabi should be framed block wise/unit wise; No of blocks and units may change)		
Block 1	**Geometrical and Quantum optics**	
Unit I	**Co-axial system of lenses** • Cardinal points (focal points, principal points and nodal points). • Analytical methods for analysis of cardinal points. • Matrix methods for analysis of cardinal points. • Equivalent lens, problems on combination of thin lenses. • Eye pieces (Ramsdon and Huygens), Ray diagram and characteristics, merits and demerits. • Aplanatic points and its importance	
Unit II	**Laser and holography:** • Coherence (Temporal and Spatial) • Stimulated and spontaneous emission, Einstein co-efficient and their inter-relationship • Basic idea about laser and its components, pumping and population inversion • Comparison of laser light and ordinary light • Ruby laser, Helium-Neon laser, semiconductor laser and their applications • Holography and hologram, comparison of hologram with photography. • Recording and reconstruction of hologram and its applications	
Unit III	**. Fiber optics** • Constructions and materials used in optical fibers, • Principle of fiber optics and propagation of light in optical fiber, • Advantages and disadvantages of optical fiber communication • Numerical aperture, acceptance angle, V-parameters, meridional and skew rays' analysis • Types of fibers (SIF, GIF, Single mode and multimode), fiber profile. • Phase index and group index in optical fiber, slowest and fastest mode of propagation inoptical fibers, • Attenuation and dispersion in optical fibers parameter (attenuation loss,	

	dispersion) • Qualitative discussion of coupler, splices and connecter.
Block 2	**CONCEPT OF LIGHT**
Unit IV	**Nature of light:** • Statement, merits and demerits of Newton's corpuscular theory, Huygens longitudinalwave's theory and Fresnel transverse wave theory. • Huygens principle and its explanation, laws of reflection and refraction. • Electromagnetic wave theory (statement, consequences and limitations) • Fermat's principles (statement and applications). • Perception of light (human vision, color vision and color receptor) • Scattering of light and its importance
Unit V	**Concept of polarization:** • Cause and concept of polarization, plane of vibration and plane of polarization • Un-polarized light and types of polarized light (linear, circular and elliptical). • Plane polarized light by reflection and refraction, Brewster's law, piles of plates • Plane polarized light by selective absorption (dichroism) and double reflection (E & Orays), birefringence. • Polarizer and analyzer, Nicol prism, law of Malus • Huygens theory of double reflection by uniaxial crystal, negative and positive crystal, optic axis • Superposition of two plane polarized lights along mutually perpendicular directions.
Unit VI	**Detection of polarized light**: • Retardation plates (quarter and half wave plates), features and applications. • Production and detection of elliptically and circularly polarized light • Analysis of different polarized light. • Babinet compensator (principle, theory, application). • Optical rotation and specific rotation, optical activity • Fresnal theory of optical rotation. • Polarimeters (Half Shade and Biquartz), their merits and demerits.
Block III	**Interference and diffraction**
Unit VII	**Concept of interference** • Statement and essential conditions for observation of interference • Constructive and destructive interference, shape of fringes, visibility of fringes • Youngs double slit experiment, shift in fringes pattern due to thin sheet of transparent material. • Fresnel biprism, Fresnel bimirror, non-localized fringes. • Lloyds single mirrors, achromatic fringes. • Formation of coherent sources due to division of wave front in above devices andcomparison of their fringe pattern. • Fringes pattern with white light.

Unit VIII	**Interference by division of amplitudes** • Stokes analysis of phase change on reflection • Color in thin films (parallel and Wedge shaped) due to white light. • Newton's rings (principle, theory and applications) • Haidenger fringes, localized fringes. • Michelson interferometer (principle and working), conditions for different shape of fringes,comparison with Newton's ring fringes • Febry-Perot interferometer, intensity distribution, coefficient of finesse, visibility of fringes,sharpness of fringes, superiority over Michelson interferometer fringes, • L-G plates
Unit IX	**Fresnel diffraction** • Difference between interference and diffraction. • Classification of diffraction and their conditions. • Fresnel construction of half period's zones, rectilinear propagation of light. • Diffraction at straight edge and circular aperture. • Zone plate and its comparison with convex lens • Cornu's spiral (theory, applications and merit)
Unit X	**Fraunhoffer diffraction**: • Single slit fraunhoffer diffraction (theory and graph for maxima and minima) • Double slit fraunhoffer diffraction (theory and importance), missing spectra. • Plane diffraction grating (principle and analysis), condition for absent spectra • Grating spectra and prism spectra. • Concave diffraction grating (theory and types), superiority over plane grating. • Rayleigh criterion of resolution, limits of resolution of eye. • Resolving power of Grating, Prism, Telescope, and Microscope.

Suggested Text Book Readings:

1. Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.71
2. LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010,
3. Tata McGraw Hill
4. Fibre optics through experiments, M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
5. Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
6. Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
7. Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
8. Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
9. Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press

Suggested equivalent online courses (MOOCs) for credit transfer: O**ptics nptel course** - https://youtu.be/U2Qhpa2Zmm4

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2022

Programme: B.Sc.	Year: 3rd	Semester:5th
Subject: **PHYSICS**		
Course Code: DCEPHS-106N	Course Title: **THERMAL PHYSICS**	
Course Objectives: The aim of this course is to make the students learn and discuss about the Thermodynamics.		
Course Outcomes: CO-1 Student will learn basics of Thermodynamics. CO-2. To impart basics knowledge of laws of Thermodynamics. CO-3. Student will be familiar with term Entropy. CO-4 Students will understand Thermodynamic relations.		
Credits: 2	**Type of Course: ELECTIVE**	
Max. Marks: 100	Min. Passing Marks: 36	
(Syllabi should be framed block wise/unit wise; No of blocks and units may change)		

Block 1	**Thermodynamics**
Unit I	**Fundamental of thermodynamics** • Thermodynamic systems, thermodynamic variables. • Thermodynamic equilibrium (thermal, mechanical and chemical). • Equation of state, equation of constraints. • Zeroth law of thermodynamics, concept of temperature. • Macroscopic and microscopic variables, extensive and intensive variables. • Quasi-static and non-quasi-static processes. reversible and irreversible processes. • Conditions for reversibility.
Unit II	**First law of thermodynamics** • Expression for thermal work done. Types of work done. • Point function and path function. • Internal energy and enthalpy both as point function. • First law of thermodynamics (statement, derivation, limitations and applications). • Degrees of freedom, atomic heat ratio, Mayer's relation. • Processes (cyclic, isobaric, isochoric, isothermal and adiabatic). • P-V indicator diagram and its importance.
Unit III	**Second law of thermodynamics** • Need of second law. • Carnot cycle (P-V and T-S diagram). • Carnot heat engine and Refrigerator. • Thermal efficiency and coefficient of performance. • Carnot theorems (statement, proof and significance). • Clausius & Kelvin statement of Second law and their equivalence. • Absolute scale of temperature and its comparison with perfect gas scale of temperature.
Unit IV	**Entropy** • Entropy (need, statement and characteristics). • Clausius theorem and Clausius inequality of entropy.

	• Change of entropy (in mixing, for change of state and for perfect gas). • Available and non-available energy, ordered and disordered state. • The principle of increase of entropy and degradation of energy. • Consistency of Clausius & Kelvin statement with definition of second law in terms ofentropy.
Block 2	**Thermodynamic relations**
Unit V	**Maxwell's relations** • Reciprocal theorem and reciprocity theorem in thermodynamics • Maxwell's relations (statement, significance and derivation from laws of thermodynamics). • Thermodynamic potentials (statement, significance and applications). • TdS equations (statement, proof and applications). • Heat capacity equations in different forms. • Atomic heat ratio.
Unit VI	**Phase Transition** • First order phase transitions and its characteristics. Clausius Clapeyron equations. • Second order phase transition and its characteristics. Ehrenfest equations. • First and second latent heat equations from Maxwell's relation, effect of pressure on meltingpoint of solids and boiling point of liquids. • Joule's expansion, Joule's coefficient, Energy equation. • Free expansion and conservation of internal energy in it. • Change of entropy in isothermal irreversible process.
Unit VII	**Third law of thermodynamics** • Joule's Thomson expansion, conservation of enthalpy. • Enthalpy equation, Joule-Kelvin coefficient, inversion curve. • Different methods of coolings, liquefaction of gas, adiabatic demagnetization. • Comparison of Joule-Thomson expansion with Joule expansion and adiabatic expansion. • Throttling process, change of entropy in an irreversible adiabatic process. • Third law of thermodynamics and its consequences. • Statistical Mechanics: Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Phase space - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.
Block III	**Heat**
Unit VIII	**Kinetic Theory of Gases** • Perfect gas equation and conditions for its validity to real gas. • Comparison of ideal gas and real gas. Vander Waal equation of state, Vander Waal constants. • Andrews experiment on CO_2, critical state, gas and vapors. • Critical constants (statement and inter-relationship). • Mean free path (qualitative) and its applications. • Transport phenomenon in gases (viscosity, thermal conductivity and self

	diffusion,derivation of expressions for each and their inter-relationship). • Brownian's motions and its features.
Unit IX	**Conduction and convection** • Modes of transfer of heat. • Steady and variable states.Thermal conductivity, Thermal diffusivity. • Temperature gradient, heat flow through combination of slabs, thermal resistance. • Formation of ice layer and its consequences. • Fourier equation of heat. Discussion of results for exposed and covered rods, Ingen-Hauseexperiment. • Periodic flow of heat (qualitative) and its applications. • Natural and forced convection (qualitative).
Unit X	**Radiation** • Radiant energy, black body radiation, white radiation. Reflectivity, absorptivity andtransmitivity. • Kirchoff's law for radiation, (statement, derivation, significance and applications). • Stefen-Boltzman law (statement and derivation), Stefan's constant, Newton's law of cooling. • Average energy of quantum oscillator and classical oscillator. Number of modes per unitvolume in frequency range. • Planck's law for radiations (need, statement and derivation), ultraviolet catastrophe. • Derivation of classical laws (Stefan's, Wien's displacement, Wien's fifth power, Rayleigh-Jean) from Planck's law. • Spectrum of black body radiations at different temperatures.

Suggested Text Book Readings:

1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
3. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
5. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
6. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press

This course can be opted as an elective by the students of following subjects:NA

Suggested equivalent online courses (MOOCs) for credit transfer: Thermal Physics: Nptel https://youtu.be/iSjKPeyoXYU

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2022

Programme: B.Sc.	Year:3rd	Semester:6th
Subject: **PHYSICS**		
Course Code: **DCEPHS-108N**	Course Title: QUANTUM MECHANICS AND SPECTROSCOPY	
Course Objectives: • To provide basics knowledge of Quantum mechanics. • To make the students familiar with the Schrodinger's equation.		
Course Outcomes: CO-1 Student will learn basics concepts of quantum mechanics. CO-2 students will be able to understand the various operators used to represents dynamic variables CO-3 The eigen values and eigen functions of linear harmonic oscillator CO-4 Hydrogen atom will help students to understand the behaviors of microscopic systems**.**		
Credits: 2	**Type of Course:** Elective	
Max. Marks: 100	Min. Passing Marks: 36	
(Syllabi should be framed block wise/unit wise; No of blocks and units may change)		
Block 1	**Wave mechanics**	
Unit I	**Basic concept:** • Need of quantum theory and quantum mechanics • Fundamental equation of wave mechanics and its representation in various forms • Wave function and its interpretation by Max-Born and Schrodinger • Separation of variables, stationary states • Probability density and probability current density • Equation of continuity	
Unit II	**Condition of wave function:** • Normalizable and unnormalizable wave function • Condition for normalized, orthogonal, ortho normal and complete wave function • Expectation values of thermo dynamical variables • Dirac-Delta function and Kronecker delta function • Non-degenerate states and degenerate state • Ehenfest theorem (statement, derivation and significance).	
Unit III	**Operator algebra** • Concept of operator, null operator, inverse operator, operator algebra • Operator in quantum mechanics (position, momentum, energy velocity, kinetic energy andangular momentum) • Physical operators (Linear, Hermitian, parity and their properties) • Commutator and non-commutator operators, simultaneous wave function and uncertaintyrelation • Eigen function, Eigen values and Eigen values equations • Commutator rules among components of orbital angular momentum, momentum, position,L^2. • Ladder operates (L+ and L^-), commutator rules amongst L+,L-, Lz and L^2.	

Block 2	**Applications of Schrodinger's equation**
Unit IV	**One- and three-dimensional problems** • Free particles, particle in box. • Potential steps, potential barrier(tunneling), • Potential well of infinite depth and finite depth. • Harmonic oscillator (classical and quantum), series solution. • Eigen values and Eigen function of harmonic oscillator,Hermite polynomial • Zero-point energy and parity of oscillator.
Unit V	**Spherically symmetric systems:** • Spherically symmetric potential, components of angular momentum in polar coordinate • Spherical harmonics and their orthogonality Legendre Polynomial, • Schrödinger equations for rotator with free axis and its series solutions • Schrödinger quatim for hydrogen atom, solution of r-equation, θ-equation, Ø equation, Eigenfunction and Eigen values of hydrogen atom, Bhoris radius • Degeneracy and quantum number of hydrogen atoms • Comparison of Schrödinger atomic model with Bohr's atomic models.
Block III	**Identical particles and perturbation**
Unit VI	**Identical particles** • Distinguishable and indistinguishable particles. • Symmetric and anti-symmetric wave functions • Concept of spin and spin angular momentum • Pauli spin matrices (definition, commutation, anti-commutation), spin wave function • Exchange operator, exchange degeneracy • Equation of motion, condition for constant motion. • Pauli exclusion principle (statement and importance)
Unit VII	**Approximation methods:** • Born-approximation (statement and application) • Variation methods (statement and application) • Perturbation method (time independent and time dependent) • Time independent perturbation (non-degenerate and degenerate, first order and second ordercorrection) • Application of perturbation theory to helium atom, ortho and para helium. • Application of perturbation theory to anharmonic oscillator, comparison of harmonic andanhormonic oscillator
Unit VIII	**Atomic spectra:** • Lande-g factor (statement and derivation) • Shift in energy of atom when placed in magnetic field • Zeeman effect (statement and classification) • Classical and quantum theory of normal and anomalous Zeeman effect, Paschen Back effect

	• Zeeman pattern for sodium lines and other various transitions Stark effect and its characteristics
Block IV	**Molecular spectroscopy Unit**
Unit IX	**Types of spectroscopies:** • Electronic, Rotational, Vibrational and Rotational-vibrational spectroscopy • Selection rules, energy and frequency of vibrational spectra • Selection rules, energy and frequency of Rotational spectra • Raman effect, stokes and anti-stokes lines (quantum and classical explanation) • Infrared spectroscopy • Fluorescence and phosphorescence spectroscopy
Unit X	**Techniques of spectroscopy:** • Electronic spectra, • Electronic transitions • Frank-Condon principle • Singlet and triplet states • Fine structure and hyper fine structure • NMR (principle and importance) • ESR (principle and importance)
Suggested Text Book Readings: 1. A Text book of Quantum Mechanics, P.M.Mathews and K.Venkatesan, 2nd Ed., 2010, McGraw Hill 2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley. 3. Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill. 4. Quantum Mechanics, G. Aruldhas, 2nd Edn. 2002, PHI Learning of India. 5. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning. 6. Quantum Mechanics: Foundations & Applications, Arno Bohm, 3rd Edn., 1993, Springer 7. Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press	
Suggested equivalent online courses (MOOCs) for credit transfer: NA	
Electronic media and other digital components in the curriculum: **Choose any one or more than:**e-SLM/Other electronic and digital contents	
Name of electronic media: e-SLM	Year of incorporation: 2022

Programme: B.Sc.	Year:3rd	Semester:6th
Subject: **PHYSICS**		
Course Code: DCEPHS-109N	Course Title: **SOLID STATE PHYSICS AND ADVANCED ELECTRONICS**	
Course Objectives: The aim of this course is to make the students learn and discuss about the basic's concepts of solids and Advanced electronics.		
Course Outcomes: CO-1: Understand the knowledge of Crystal and its structure. CO-2: Students will be able to understand Advanced analog electronics. CO-3: Students will be able to understand Advance digital electronics.		
Credits: 2	**Type of Course:** Elective	
Max. Marks: 100	Min. Passing Marks: 36	
(Syllabi should be framed block wise/unit wise; No of blocks and units may change)		

Block 1	**Basic concepts of solids**
Unit I	**Crystal and its structure** • Crystalline and amorphous state of solids, liquid crystal and its characteristics (qualitative). • Simple crystal structure (SC, FCC, BCC). • Unit cell and Bravais lattice. • Classification of lattices and types of crystals on the basis of Bravais lattice. • Direct and reciprocal lattice, Miller indices and planes. • X-ray diffraction, Bragg's law. • Generalized Hooke's law for Anisotropic body, elastic constants of cubic crystals
Unit II	**Band theory of solids** • Need of free electron quantum theory • Sommerfeld Fermi model band theory. • One dimensional motion of electron in periodic potential (Bloch theorem).\ • Kronning-Penny model (features and its importance). • Fermi surface, effective mass of charge carriers (electron and holes). • Concentration in semiconductors. • Hall effect (qualitative).
Unit III	**Lattice vibrations** • Interatomic force and classification of solids. • Lattice energy of ionic crystals. • Vibration of monoatomic and diatomic linear chain, acoustic and optical modes, phonon. • Thermal capacity of solids, classical theory of specific heats (Dulong and Petit's law). • Experimental results and need of quantum theory of specific heat of solids. • Einstein's theory of specific heats (need, statement, assumptions, derivations andlimitations). • Debye theory of specific heats (need, statement, assumptions, derivations and limitations).

	• Concept of Einstein's temperature and Debye temperature.
Unit IV	**Magnetism and superconductivity** • Comparison of features of diamagnetic and paramagnetic materials with examples. Curie lawand Curie Wiess law. • Classical and quantum theory of diamagnetism and paramagnetism. • Qualitative discussion of ferromagnetism, anti-ferromagnetism and ferrimagnetism. • Superconductivity and its characteristics, magnetic behavior of superconductor. • Meisner's effect, BCS theory (qualitative). • Types of superconductors (examples, properties and applications). • Josephson effect, quantum Hall effect.
Block 2	**Advanced analog electronics**
Unit V	**Different modes of operations.** • Eber's moll model for PNP and NPN transistors. • Expressions for various currents and voltage. • Saturation parameters and its importance. • Conditions for cut off mode, saturation mode, inverse mode and active mode. • Comparison among all modes of operations.
Unit VI	**Transmission and reception** • Basic elements of radio communication systems. • Requirements of transmitter, medium and receiver. • Modulation (need, types and statements). • Analysis of AM, FM and PM, modulation index. • Frequency spectrum and power in modulations. • Circuit of modulator. • Demodulation (need and statements). • Circuit for demodulator.
Unit VII	**Operational amplifier** • OP-amplifier (symbol, number code, power supply and characteristics). • Input-output relationship, input-offset and output offset voltage. • Differential input and output resistance. • Common mode rejection ratio, output current, power consumption, slew rate gain-bandwidth product. • Characteristics of OP- amplifier, comparators and detector. • Inverting and non-inverting amplifier. • Differentiator and basic integrator.
Block III	Advance digital electronics
Unit VIII	**Logic families** • Introduction and classification of logic families. • Input and output characteristics. • Fan-in and fan-out. • Noise margin and noise immunity. • Rise and fall time.

	• RTL (circuit, analysis and applications). • DTL (circuit, analysis and applications). • TTL (circuit, analysis and applications), totem-pol. • Comparison of RTL, DTL and TTL.
Unit IX	**Sequential circuits** • Difference from combinational circuit. • Flip-flops (RS, D, JK) master slave. • Register (function and types). • Counter (function and types). • Memory (function and types). • Convertors (A/D and D/A).
Unit X	**Integrated circuits and devices** • Introduction of integrated circuit and its comparison with discrete circuits. • Classification of IC on the basis of construction and operation. • Monolithic IC (basics structure and fabrication). • Cathode ray oscilloscope (principle, construction, block diagram, working and application). • Multimeter (principle, types, construction and function). • Ultrasonics (production, detection, velocity measurements and applications), Hypersonic and ultrasonics.

Suggested Text Book Readings:

1. Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.

2. Elements of Solid-State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India

3. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
4. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
5. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
6. Elementary Solid-State Physics, 1/e M. Ali Omar, 1999, Pearson India
7. Solid State Physics, M.A. Wahab, 2011, Narosa Publications
8. Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., 2011, Tata McGraw Hill
9. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
10. OP-AMP & Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

This course can be opted as an elective by the students of following subjects:NA

Suggested equivalent online courses (MOOCs) for credit transfer: NA

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2022