POPE'SCOLLEGE

(Autonomous)

(Accredited by NAAC-II with 'A' Grade (CGPA: 3.28)

C.S.I.-THOOTHUKUDI-NAZARETH DIOCESE

SAWYERPURAM-62825

(AFFILIATED TO MANONMANIAM SUNDARANAR UNIVERSITY)

PG & RESEARCH DEPARTMENT OF PHYSICS

B.Sc. PHYSICS - SYLLABUS

Learning Outcome Based Curriculum Framework (LOCF)

(2021 onwards)

Pope's College (Autonomous), Sawyerpuram – 628251
Accredited by NAAC – II Cycle with 'A' Grade (CGPA:3.28)
Learning Outcome based Curriculum Framework
Department of Physics and Research Centre
UG Syllabus
(with effect from the Academic Year 2021 - 2022 onwards)

LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

VISION

To promote and celebrate excellence of the students in the field of new horizons of Physics by inculcating critical thinking, engaging them to work out in vast areas of research by means of its benefit to the society.

MISSION

- To impart quality education in Physics to the rural and economically weaker students.
- To develop logical thinking and skills among the students in supporting them for a better career.
- To promote effective teaching for getting content knowledge and to explore more new inventions.
- To provide an environment promoting the students for research in the needy fields.

ELIGIBILITY FOR ADMISSION:

To pursue B.Sc degree course students must have qualify in higher secondary examination conducted by Board of Higher Secondary Examination, Tamilnadu with Physics, Mathematics and Chemistry as subjects in part III or any other examination recognized and approved by the syndicate of Manonmaniam Sundaranar University, Tirunelveli.

PROGRAMME OUTCOME (PO)

PO1	**Physics knowledge, Problem analysis and Design/development of solutions:** Understand the fundamental concepts and significance of various physical phenomena; identify, formulate and analyse problems in Physics and design solutions for complex problems using the knowledge of Physics.
PO2	D**evelopment of Practical Skill, Modern tool usage and Project management:** Develop abilities and practical skills that encourage research and development activities; employ critical thinking and emphasis on laboratory techniques and analyze the results of Physics experiments and demonstrate the knowledge of Physics and apply it to interdisciplinary environments.
PO3	**Ethics, Environment and sustainability:** Apply and commit to professional ethics of Physics and ensure that the development in Physics maintains and sustains the environment.
PO4	**Physics and society:** Produce graduates who excel in the competencies and values required for leadership to serve a rapidly evolving global community.
PO5	**Life-long learning:** Motivate the students to pursue higher education in Physics in social relevance and pollution free environment.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1	Acquire core knowledge in Physics, including the major areas of Properties of matter, Mechanics, Optics, Electricity and Magnetism, Electronics, Modern Physics, Nuclear Physics, Solid State Physics and Energy Physics.
PSO2	Plan and execute Physics related experiments and develop investigative skills
PSO3	Develop the proficiency in the acquisition of data using a variety of laboratory instruments and in the analysis and interpretation of such data.
PSO4	Discover Physics concepts in other disciplines such as Mathematics, Computer Science, Chemistry, etc.
PSO5	Realize and develop an understanding of the impact of Physics and Science on society.

Pope's College (Autonomous), Sawyerpuram – 628251

Accredited by NAAC – II Cycle with 'A' Grade (CGPA:3.28)

Learning Outcome based Curriculum Framework

Department of Physics and Research Centre

UG Syllabus

(with effect from the Academic Year 2021 - 2022 onwards)

Sl. No.	Parts of Curriculum	No. of courses	Hrs / week	credits	Total Marks
	Part-I: Language	04	6x4=24	16	400
	Part-II : English	04	6x4=24	16	400
	Part-III : Major				
	Core Theory	11	49	44	1100
	Core Practical	05	26	13	500
	Discipline Specific Elective (DSE)	02	09	08	200
	Skilled Based Core	02	02x02	04	200
	Allied (Chemistry &Botany)				
	Allied 1 Mathematics	03	12	10	300
	Allied 2 Chemistry	03	12	10	300
	Group Project/ **Discipline Specific Elective**	01	06	05	100
	Part-IV AECC				
	Environmental Studies	01	02	02	100
	Value Education	01	02	02	100
	Generic Elective (Non Major Elective)	02	04	04	200
	Skill Enhancement Course (SEC)	03	03x02=06	06	300
	Part-V : Extension Activities (NSS/NCC/YRC/YWF/Phy.Edu)	02		02	
	Certification in Professional English (I & II Semester)	01x2		02	
	Certificate/MOOCs Course I Year	01		01	
	MOOC/ Certificate Course II Year	01		01	
	Gender Studies Course V Semester	01		01	
	Extra Credit Course (III/IV/V/VI semester)	01x1		01	
			180	140+8	

POPE'S COLLEGE (AUTONOMOUS) Sawyerpuram -628 251

Accredited by NAAC – II Cycle with 'A' Grade (CGPA:3.28)

Department of Physics and Research Centre

Under Graduate Programmes

LOCF (Choice Based Credit System)

Course Structure for B.Sc. PHYSICS

(With effect from Academic Year 2021 - 2022 onwards)

Semester – I				
Part	**Sub Code**	**Paper**	**Hrs**	**Cr**
I	21ULTL11	Tamil	6	4
II	21ULEN11	English I	6	4
III	21UPHM11	Core -1 Properties of Matter	4	4
	21UPHM12	Core -2 Optics	4	4
	21UPHMP1	Major General Practical - I	2	-
	21UPHA11	Allied Physics/Maths - I	6	5
	21UPHAP1	Allied Physics Practical/Maths - I	-	-
IV	21UEVS11	AECC - Environmental Studies	2	2
V		Extension Activities NSS/NCC/Phy.Edu/YRC/Rotaract/AICUF/Eco Club	*	-
	21UPPS11	Professional English for Physical Science - I	2 *	+1
		Extra Credit Course: Certificate Course/MOOCS		+1
		Total	30	23 +2

Semester – II				
Part	**Sub Code**	**Paper**	**Hrs**	**Cr**
I	21ULTL21	Tamil - II	6	4
II	21ULEN21	English II	6	4
III	21UPHM21	Core -3 Mechanics and Relativity	4	4
	21UPHM22	Core -4 Thermal Physics	4	4
	21UPHMP1	Major General Practical - I	2	2
	21UPHA21	Allied Physics/Maths - II	6	5
	21UPHAP1	Allied Physics Practical/Maths - I	-	-
IV	21UVBE21	AECC - Social Value Education	2	2
V		Extension Activities NSS/NCC/Phy.Edu/YRC/Rotaract/AICUF/Eco Club		+1
	21UPPS21	Professional English for Physical Science - II	2 *	+1
		Extra Credit Course: Certificate Course/MOOCS		+1
		Total	30	25 + 3

Semester – III				
Part	**Sub Code**	**Paper**	**Hrs**	**Cr**
I	21ULTL31	Tamil - III	6	4
II	21ULEN21	English III	6	4
III	21UPHM31	Core -5 Electricity and Magnetism	4	4
	21UPHS3A	Skill Based Core – 1 Maintenance of Electrical Appliances	2	2
	21UPHMP2	Major General Practical - II	2	-
	21UPHA11	Allied Physics/Chemistry - I	4	4
	21UPHAP1	Allied Physics Practical/Chemistry - I	2	-
IV	21UPHN3A	Generic Elective -1 a) Basic Physics – I	2	2
	21UPHN3B	b) Energy Physics		
		Skill Enhancement Courses: Field Visit/Yoga/Soft Skills	2*	2
V		Extension Activities NSS/NCC/Phy.Edu/YRC/Rotaract/AICUF/Eco Club		-
		Self Learning Course : MOOCS/Certificate courses		+1
		Total	30	22 + 1

Semester - IV				
Part	**Sub Code**	**Paper**	**Hrs**	**Cr**
I	21ULTL41	Tamil IV	6	4
II	21ULEN41	English IV	6	4
III	21UPHM41	Core -6 Computer Programming in C^{++}	4	4
	21UPHS4A	Skill Based Core – 2 Maintenance of Electronic Equipments	2	2
	21UPHMP2	Major General Practical - II	2	2
	21UPHA21	Allied Physics/Chemistry - II	4	4
	21UPHAP1	Allied Physics Practical/Chemistry - I	2	2
IV	21UPHN4A	Generic Elective -2 a) Basic Physics-II/	2	2
	21UPHN4B	b) Space Physics		
	21USEC4A	Skill Enhancement Courses: Computer for Digital Era	2	2
V		Extension Activities NSS/NCC/Phy.Edu/YRC/Rotaract/AICUF/Eco Club		+1
		Self Learning Courses : MOOCS/Certificate Courses		+1
		Total	30	26 + 2

Semester - V				
Part	**Sub Code**	**Paper**	**Hrs**	**Cr**
III	21UPHM51	Core – 7 Atomic Physics	5	4
	21UPHM52	Core – 8 Basic Electronics	5	4
	21UPHM5A	Discipline Specific Elective – 1 a) Acoustics	5	4
	21UPHM5B	b) Statistical Mechanics		
	21UPHM5C	Discipline Specific Elective – 2 a) Solid State Physics	4	4
	21UPHM5D	b) Quantum Mechanics		
	21UPHMP3	Major Practical - III	3	-
	21UPHMP4	Major Practical - IV	3	-
	21UPHMP5	Major Practical - V	3	-
IV	21USEC5A	Skill Enhancement Course : a) Personality Development	2	2
	21USEC5B	b) Effective Communication		
	21USEC5C	c) Youth Leadership		
	21UEGS5A	Gender Studies		+1
		Total	30	18+1

Semester - VI				
Part	**Sub Code**	**Paper**	**Hrs**	**Cr**
III	21UPHM61	Core – 9 Nuclear Physics	5	4
	21UPHM62	Core – 10 Molecular Spectroscopy	5	4
	21UPHM63	Core – 11 Applied Electronics	5	4
	21UPHM6P	Specific Skill Elective Courses : Project/Numerical Methods	6	5
	21UPHMP3	Major Practical - III	3	3
	21UPHMP4	Major Practical - IV	3	3
	21UPHMP5	Major Practical - V	3	3
V		Extra Credit Course (Self Learning Course)		+ 1
		Total	30	26+1
		Total Credits		140 + 10

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – I

Core	Sub Code	PROPERTIES OF MATTER	Hrs./ Week	Credits:
01	21UPHM11		04	04

Objective	:	1. To acquire knowledge regarding elasticity and sound. 2. To understand the concept of bending of beams. 3. To analyze the viscous nature and surface force.
Unit I	:	**ELASTICITY** Stress-Strain diagram - Hook's law - Elastic moduli - Poisson's ratio - Experimental determination of Poisson's ratio of rubber - Relation among elastic constants - Twisting couple on a cylindrical wire - Expression for twist and couple - Work done in twisting -Torsional pendulum - Moment of Inertia of the disc with and without mass - Rigidity modulus of a wire (without mass).
Unit II	:	**BENDING OF BEAMS** Bending moment - Cantilever – Cantilever depression and oscillations (theory and experiment) – Non-Uniform bending - Uniform bending (theory & experiment) – I Shaped beam.
Unit III	:	**FLUIDS** Surface Tension and surface energy – Excess of pressure over curved surfaces – Angle of contact - Surface Tension determination by Jaeger's & Quincke's methods — Viscosity – coefficient of viscosity – Rate of flow of liquid in a capillary tube – Poiseuille's formula – Coefficient of viscosity of a highly viscous liquid – Stoke's method – Lubricants.
Unit IV	:	**ACOUSTICS** Simple Harmonic Motion – Free, damped and forced vibrations – Resonance – Melde's string Transverse and longitudinal mode – Loudness of sound – Decibel – Reverberation – Reverberation time – Sabine's formula – Acoustics of buildings – Doppler effect.
Unit V	:	**ULTRASONICS** Properties - Production – Magnetostriction and piezo electric methods – Detection – Applications -Velocity of ultrasonic waves (Acoustic grating) – SONAR – Ultrasonic flaw detector (NDT) – Industrial and medical applications.
Text Book	:	1. Properties of Matter – R. Murugesan, S. Chand & Co, Pvt Ltd, New Delhi, 1982. 2. A text book of Sound - Brijlal and Subramaniam, N. Vikas Publishing House, New Delhi, 1982.

References	**:**	1. Elements of Properties of Matter, D. S. Mathur, S. Chand & Co Pvt.Ltd, New Delhi, 1989. 2. Fundamentals of Physics – 6^{th} edn- D. Halliday, R. Resnick and J. Walker, Wiley NY, 2001. 3. A Text Book of Oscillations, Waves and Acoustics – M. Ghosh and D. Bhattacharya, S.Chand& Co, New Delhi, 2010. 4. Properties of Matter – Brijlal and Subramaniam, Eurasia Publishing Co, New Delhi 2002.

COURSE OUTCOME:

1. Understand the physical principles of elasticity and it types.
2. Apply the concept of elasticity while doing young's modulus experiment
3. Identify the properties of fluids.
4. Familiarize with general terms in acoustics like intensity, loudness and reverberation.
5. Determine in detail about production, detection, properties and uses of ultrasonic waves.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – I

Core	Sub Code	OPTICS	Hrs./ Week	Credits:
02	21UPHM12		04	04

Objective	**:**	1. To develop an understanding towards the properties of light, its nature and propagation. 2. To understand the principle of lasers and to acquire knowledge about fiber optic communication and its applications. 3. To learn about interference, diffraction and polarization of light.
Unit I	**:**	**GEOMETRICAL OPTICS** Introduction – Refraction through a thin prism – Dispersion of light – Dispersive power of a prism – Deviation without dispersion - Dispersion without deviation – Constant deviation spectrometer – Chromatic and spherical aberration in lenses and their removal – Eye pieces – Huygen and Ramsden eyepieces.
Unit II	**:**	**INTERFERENCE** Condition for interference – Fresnel's Biprism – Determination of wavelength of light (theory & experiment) – Air wedge – Determination of diameter of thin wire (theory & experiment) – Testing a surface for optical flatness – Newton's rings – Determination of wavelength of light (theory & experiment) – Michaelson's Interferometer – Applications of Michaelson's Interferometer.
Unit III	**:**	**DIFFRACTION** Fraunhofer and Fresnel diffraction – Diffraction by single slit and determination of intensity distribution by phasor method – Diffraction by circular aperture – Plane transmission grating – Oblique incidence – Wavelength determination – Resolving power of a grating – Theory of half period zones – Zone plate.
Unit IV	**:**	**POLARIZATION** Double refraction – Nicol prism – Quarter and Half wave plates – Production and detection of plane, elliptically and circularly polarized light – Optical activity –Polarimeter- Fresnel's theory of optical activity – Photo elasticity: Birefringence – Photo elastic effect – Applications of Photo elasticity.
Unit V	**:**	**FIBRE OPTICS AND LASERS** Principle and propagation of light in optical fibres – Numerical aperture and acceptance angle – Single mode and multimode fibres – Step index and graded index fibres – Fibre optic sensors: Pressure sensor - Displacement sensor. LASERS: Einstein coefficients (A & B) – Nd-YAG Laser – CO_2 laser – Semiconductor Laser (homo junction) – Applications.

Text Book	**:**	1. A Text book of Optics by Subramaniam N and Brijlal, S. Chand & Co. Pvt. Ltd., New Delhi, 1990 2. Laser and nonlinear optics by B . B. Laud 2nd edition Wiley Eastern Ltd., 1991 3. Optic Fiber and Fiber Optic Communication systems by Subir kumar sankar -. S Chand & Co. Pvt. Ltd., New Delhi,
References	**:**	1. Fundamentals of Optics, Jenkins A Francis and White E Harvey, McGRaw Hill Inc., New Delhi, 1976. 2. Optical Physics, Lipson. S G, Lipson H and Tannhauser D S, Cambridge University Press (1995) 3. Fundamentals of Optics, Raj M G, Anmol Publications Pvt. Ltd., New Delhi, 1996. 4. Fundamentals of Physics, 6th Edition, D Halliday, R Resnick and J Walker. Wiley NY 2001. 5. 5.Optics and Spectroscopy, Murugesan, S. Chand & Co. Pvt. Ltd., New Delhi,1997.

COURSE OUTCOME

1. Define the basic aspects of kinetic theory of gases.
2. Understand the basic laws of thermodynamics and their physical interpretations.
3. Apply Maxwell's relations to solve problems.
4. Perceive the fundamentals of the low temperature physics.
5. Develop their skills to perform some basic experiments in Thermal Physics.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – I

Allied	Sub Code	ALLIED PHYSICS – I / MATHS	Hrs./ Week	Credits:
01	21UPHA11		06	05

Objective	:	1. To acquire knowledge about elasticity and sound. 2. To study the viscous nature and surface force. 3. To understand about the concepts in thermal Physics and laws of electricity.
Unit I	:	**ELASTICITY AND BENDING MOMENT** Hooke's law – Elastic moduli – Relation between Elastic constants – Work done in stretching a wire – Expression for bending moment – Uniform bending – Experiment to determine Young's modulus using pin and microscope – Twisting couple of a wire – Expression for couple per unit twist – Workdone in twisting – Experimental determination of rigidity modulus of a wire using torsion pendulum with theory.
Unit II	:	**SURFACE TENSION AND VISCOSITY** Surface tension- Definition- examples- Molecular interpretation- Expression for excess of pressure inside a synclastic and anticlastic surface- application to spherical and cylindrical drops and bubbles- viscosity: coefficient of viscosity- rate of flow of liquid in a capillary tube (Poiseuille's Formula) – Anology between liquid flow and current flow-Stoke's formula for highly viscous liquids (Dimension method)-Experimental determination of viscosity of highly viscous liquid (Stoke's method)
Unit III	:	**SOUND** Simple harmonic motion - free, damped, forced vibration and resonance-composition of two SHMs along a straight line and in perpendicular direction- Melde's string experiment-Determination of frequency of Tuning fork (Both longitudinal and transverse modes).
Unit IV	:	**THERMAL PHYSICS** Mean free path - Expression for mean free path (Zero order approximation-Transport phenomena-Expression for viscosity and thermal conductivity-conduction in solids – coefficient of thermal conductivity-Lee's disc method to determine thermal conductivity of a bad conductor - Wiedemann-Franz's law - convection: Newton's law of cooling- Experimental verification-Radiation: Black body radiation - Distribution of energy in black body spectrum - Important features.
Unit V	:	**ELECTRICITY** Current and current density - Expression for current density - Ohm's law - resistors in series and in parallel - I-V characteristics of a resistor - color coding - Conversion of a galvanometer into an ammeter and voltmeter - Kirchoff's laws - Application of kirchoff's laws in Wheatstone network - sensitiveness of bridge.

Text Book	**:**	1. Properties of Matter, R. Murugesan , S. Chand&Co Pvt. Ltd., New Delhi, 1982. 2. Heat & Thermodynamics, Bruijal and Subramaniam, S. Chand & Co, New Delhi, 1993. 3. Electricity and Magnetism, R. Murugesan, S. Chand & Co, New Delhi, 2019.
References	**:**	1. Heat and Thermodynamics, D. S. Mathur, Shyamlal charitable trust, New Delhi,1993. 2. Elements of Properties of Matter, Mathur.D. S, Shyamlal Charitable Trust,New Delhi,1993. 3. Electricity and Magnetism, Arora, Saxena and Prakash, Pragathi Prakashan Publication, Meerut, 1998.

COURSE OUTCOME:

1. Understand the mechanical properties of materials
2. Determine the viscosity of different liquids.
3. Describe the nature of simple harmonic motion and its applications
4. Explain the basic aspects of thermal conductivity.
5. Apply Kirchhoff's laws in bridge circuits.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – II

Core	Sub Code	MECHANICS AND RELATIVITY	Hrs./ Week	Credits:
03	21UPHM21		04	04

Objective	**:**	1. To understand the basics of mechanics and relativity. 2. To learn about Laws of motion. 3. To impart knowledge about hydrostatics and hydrodynamics.
Unit I	**:**	**VECTORS** Vector analysis - components of a vector - gradient of a scalar point function - divergence and curl of vector point function - angular momentum as a vector - product of two vectors - work as a scalar product of two vectors - line, surface and volume integrals - Gauss divergence and Green's theorems - Stoke's theorem.
Unit II	**:**	**CONSERVATION LAWS** Equation of motion-Newton's law - Laws of conservation of linear momentum, angular momentum and energy - work energy theorem - work done by gravitational force - work done by spring force - potential energy - potential energy curve - conservative and non-conservative forces - Centre of mass - Two body problem and reduced mass - central field motion - motion of planets in elliptical orbits - proof of Kepler's second and third laws.
Unit III	**:**	**COLLISIONS AND PROJECTILES** Collisions and impulse as change of linear momentum - elastic and inelastic collisions-conservation principles on impact - direct and oblique impact of smooth spheres and loss of kinetic energy - Projectile motion on a horizontal and inclined plane, range, trajectory - Time of flight, height and range.
Unit IV	**:**	**HYDROSTATICS AND HYDRODYNAMICS** Pressure and thrust - Thrust on a plane surface immersed in a liquid - center of pressure - center of pressure on a rectangular lamina, a triangular lamina. Laws of floatation – Center of buoyancy determination of meta centric height of a ship - steady and streamline flow - equation of continuity - energy of a fluid - Bernoulli's theorem – proof - venturimeter.
Unit V	**:**	**RELATIVITY** Reference frames-inertial frames - Michelson Morley experiment - Postulates of special theory of relativity - Lorentz transformation equations - Lorentz Fitzgerald contraction - time dilation - relativistic addition of velocities - velocity addition theorem - simultaneity - relativistic mass - relativistic momentum - mass energy equivalence - relation between total energy, rest mass energy and momentum.

Text Book	**:**	1. Mechanics - D.S. Mathur - S Chand & Company Ltd, New Delhi, 1989. 2. Mechanics and Mathematical Physics - R.Murugesan -S Chand & Co. Pvt. Ltd., New Delhi.
References	**:**	1. Fundamentals of Physics, 6th Edn, D Halliday, R Resnick and J Walker. Wiley NY 2001. 2. Mathematical Physics, Satya Prakakash, S. Chand & Co. Pvt. Ltd., 3. Modern Physics, B. Murugesan, S. Chand&Co Pvt. Ltd, New Delhi.1998. 4. Elements of Mechanics, Agarwal and Prakash, Pragathi Prakashan, Meerut, 1982. 5. Hyperphysics: phy-astr.gsu.edu 6. swayam.gov.in

COURSE OUTCOME

1. Understand the role of vectors and coordinate systems in Physics.
2. Explain the conservation of energy, momentum, angular momentum and apply it to solving problem.
3. Understand laws of motion and their application to various dynamical situations
4. Develop the knowledge of special theory of relativity and its applications
5. Explain the dynamics of fluid motion and its applications.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – II

Core	Sub Code	THERMAL PHYSICS	Hrs./ Week	Credits:
04	21UPHM22		04	04

Objective	**:**	1. To understand the fundamental laws of thermodynamics and their applications. 2. To create a relationship between the macroscopic properties of physical systems in equilibrium. To impart knowledge on low temperature physics.
Unit I	**:**	**KINETIC THEORY OF GASES** Postulates - Ideal and real gas - Expression for pressure of a gas - Gas laws- Gas equation- Avogadro's hypothesis - Maxwell's law of equi-partition of energy - Maxwell's law of distribution of molecular velocities –experimental verification.
Unit II	**:**	**TRANSPORT PHENOMENA** Mean free path - transport of momentum, energy and matter - Diffusion, viscosity and thermal conductivity of gases - Vander walls equation of state - Determination of Vander walls constant - Relation among Vander-Wall's constants and critical constants - porous plug experiment.
Unit III	**:**	**THERMODYNAMICS I** Concepts of heat - Zeroth law, I and II law of thermodynamics - isothermal process-adiabatic process-gas equation and work done during adiabatic and isothermal process - Carnot's theorem - significance - thermodynamic scale of temperature - perfect gas scale of temperature - Carnot's engine - Otto engine and Diesel engine - working and efficiency – Coefficient of Performance.
Unit IV	**:**	**THERMODYNAMICS II** First latent heat equation (Clausius - Clapeyron equation) - effect of pressure on melting point and boiling point - second latent-heat equation - III law of thermodynamics - concept of entropy - T-S diagram - entropy of perfect gas - Maxwell's thermo dynamical relations - derivation - applications - Clausius - Clapeyron equation and specific heat relation.
Unit V	**:**	**LOW TEMPERATURE PHYSICS** Joule - Kelvin effect - liquefaction of hydrogen - liquefaction of helium - Kammerling - Onne's method - Helium I and II - Lambda point - adiabatic demagnetization - practical applications of low temperature - refrigerators and air - conditioning machines - super fluidity - application of super fluidity.

Text Book	**:**	1. Heat and thermodynamics by Brijlal and Subramaniyam, S. Chand & Co. 1993 2. Thermal Physics by R Murugesan and Kiruthiga Sivaprasad, S. Chand & Co., New Delhi, 2013.
References	**:**	1. Heat and Thermodynamics by D. S. Mathur, S Chand & Co., New Delhi, 1993 2. Thermal Physics by S C Garg, R. M. Bansal and C K Ghosh, Tata McGraw-Hill, 2012 3. Heat and thermodynamics by J. B. Rajam, S. Chand & Co., New Delhi, 1981.

COURSE OUTCOME

1. Define the basic aspects of kinetic theory of gases.
2. Understand the basic laws of thermodynamics and their physical interpretations.
3. Apply Maxwell's relations to solve problems.
4. Perceive the fundamentals of the low temperature physics.
5. Develop their skills to perform some basic experiments in Thermal Physics.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – II

Core Practical	Sub Code	MAJOR PRACTICAL - I	Hrs./ Week	Credits:
01	21UPHMP1		02	02

COURSE OBJECTIVES

1. To introduce different apparatus to demonstrate simple experiments.
2. To associate theoretical ideas with experimental skills.
3. To perform lab experiments for studying mechanical, thermal and optical parameters of materials.

COURSE OUTCOME

1. Know how to handle the instruments in laboratory
2. Determine the mechanical parameters such as young's modulus, rigidity modulus etc
3. Understand the properties of geometrical optics and explain the phenomena of reflection, refraction and dispersion.
4. Determine the AC frequency through experiments
5. Study the thermal conductivity of materials

EXPERIMENTS

1. Young's modulus - non uniform bending - pin and microscope
2. Young's modulus - uniform bending - optic lever and telescope
3. Young's modulus - cantilever – depression
4. Torsional pendulum - Rigidity modulus and moment of inertia (with & without masses)
5. Co-efficient of viscosity- Stoke's method
6. Sonometer – Verification of laws
7. Sonometer- determination of AC frequency
8. Compound pendulum - **g** and **I**
9. Melde's string – determination of frequency- transverse and longitudinal modes
10. Specific heat capacity of liquid – Newton's law of cooling
11. Thermal conductivity of a bad conductor - Lee's disc method.
12. Spectrometer – dispersive power of prism
13. Spectrometer - grating – oblique incidence
14. Air wedge - thickness of a wire and thickness of enamel coating.
15. Newton's rings - refractive index
16. Viscosity Determination – Poisulle's flow capillary method

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – II

Allied	Sub Code	ALLIED PHYSICS – II / MATHS	Hrs./ Week	Credits:
02	21UPHA21		06	05

Objective	**:**	1. To analyze the concept of interference and diffraction. 2. To understand about electromagnetism. 3. To acquire knowledge regarding nuclear and energy Physics.
Unit I	**:**	**OPTICS** Interference: Condition for interference - Air wedge - determination of thickness of a thin wire - Diffraction: Fresnel & Fraunhofer diffraction - Plane diffraction grating - theory and experiment to determine wavelength (normal incidence) Polarization: Double refraction - half wave and quarter wave plate – Production and detection of plane, elliptically and circularly polarized light.
Unit II	**:**	**ELECTROMAGNETISM** Definition of magnetic induction B, Magnetic field intensity H , Intensity of magnetization M – Relation connecting M, B and H – Magnetic permeability μ and magnetic susceptibility χ – Relation between μ and χ – Properties of Dia, Para and Ferro magnetic materials. Electromagnetism: Faraday's law of electromagnetic induction – Lenz's law – Expression for induced current and charge – Self inductance – Self inductance of a long solenoid – Determination of self inductance by Rayleigh's method –Mutual inductance – Coefficient of coupling – Determination of mutual inductance using BG.
Unit III	**:**	**ELECTRONICS** Junction diodes - forward and reverse bias - diode charecteristics - Zener diode – VI characteristic of a Zener diode – Transistors - Charecteristics of a transistor (common emitter mode only). Digital Electronics: Decimal and binary numbers – binary to decimal and decimal to binary - Binary addition – Binary subtraction by 1's and 2's complement method – Basic logic gates OR, AND, NOT (Symbol, Boolean equation, truth table, circuit and working) – NAND, NOR, EX – OR (Symbol, Boolean equation , truth table only) – De Morgan's theorem.
Unit IV	**:**	**NUCLEAR PHYSICS** Introduction – Classification of nuclei – General properties of nucleus – Nuclear size, Nuclear mass, Nuclear density, Nuclear charge, Nuclear spin & Nuclear magnetic dipole moments – Mass defect – Binding energy - Binding energy curve – Nuclear forces – Properties. Fundamental laws of radioactivity – Soddy Fajan's displacement law – Law of radioactive disintegration – Half life period – The mean life.

Unit V	**:**	**ENERGY PHYSICS** World's reserve of commercial Energy sources and their availability – Energy crisis and possible solutions –Various forms of Energy – Conventional and Non conventional Energy Sources – Solar Energy – Solar cells – Solar heaters – Wind Energy – Construction and Working of Windmills – Wind Farms –Global Warming.
Text Book	**:**	1. A Text book of Optics by Subramaniam N & Brij Lal, S Chand & Co. Pvt. Ltd., New Delhi, 1990 2. Modern physics – R. Murugesan, S. Chand & Co, New Delhi 3. Solar Energy Utilization - G.D. Raid. IV, Khanna Publications, New Delhi, 1995 . 4. Electricity and Magnetism – Arova, Saxena and Prakash, Pragathi Prakashan Publication, Meerut, 1998.
References	**:**	1. Principle of Electronics, V. K. Mehta, Rohit Mehta, S. Chand & Co, New Delhi 2008. 2. Digital principles and applications, Albert Paul Malvino & David J. Bates, 7th Edn, Tata McGraw Hill, New Delhi, 2007.

COURSE OUTCOME:

1. Apply the concepts of interference, diffraction and polarization.
2. Classify the magnetic materials and the phenomena of mutual and self inductance.
3. Design circuits using diodes, transistors, logic gates and understand the concepts of Boolean algebra and techniques to reduce / simplify Boolean expression.
4. Analyze the basic concepts of nuclear physics.
5. Explain about Energy Physics.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – II

Allied Practical	Sub Code	ALLIED PHYSICS PRACTICAL / MATHS - I	Hrs./ Week	Credits:
01	21UPHAP1			

COURSE OBJECTIVES:

1. To familiarize different instruments used in physics.
2. To impart necessary technical skills to understand and handle the experimental set-ups.
3. To verify Physics laws through experiments.

COURSE OUTCOME:

1. Identify the strength of a given material.
2. Determine the wavelengths of different lines in mercury spectrum
3. Calibrate a given voltmeter or ammeter.
4. Perform logical operation using logic gates.
5. Analyze the viscosity of different liquids.

EXPERIMENTS

1. Young's modulus - non uniform bending - pin and microscope
2. Young's modulus - uniform bending - optic lever and telescope
3. Torsional pendulum - Rigidity modulus
4. Co-efficient of viscosity - Stoke's method
5. Co-efficient of viscosity - variable pressure head
6. Thermal conductivity of a bad conductor - Lee's disc method.
7. Spectrometer – refractive index using prism
8. Spectrometer - grating - normal incidence method.
9. Air wedge - thickness of a wire
1. 10, Melde's string - frequency of tuning fork
10. Potentiometer - calibration of volt meter (low range)
11. Series resonance circuit
12. Basic logic gates using discrete components - AND, OR, NOT
13. Zener diode - Diode characteristics
14. Potentiometer – Calibration of Ammeter

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – III

Core	Sub Code		Hrs./ Week	Credits:
05	21UPHM31	ELECTRICITY AND MAGNETISM	04	04

Objective	:	1. To impart knowledge on the basic concepts of electromagnetic induction 2. To outline the charge transfer mechanisms. 3. To relate magnetic vectors with Maxwell's equations
Unit I	:	**ELECTROMAGNETIC INDUCTION** Laws of Electromagnetic Induction – Self-induction – Self-inductance of a long solenoid - Determination of L Rayleigh's method - Owens bridge – Mutual - induction - mutual induction between two co-axial solenoids - Experimental Determination of mutual inductance between a pair of coils - Coefficient of coupling - Energy stored in a coil
Unit II	:	**CHEMICAL EFFECT OF ELECTRICAL CURRENT** Introduction – Faradays laws of electrolysis – electrical conductivity of an electrolyte -specific conductivity - Kohlrausch's bridge method of determining the specific conductivity of an electrolyte – Arrhenius theory of electrolytic dissociation – mobility of ions - secondary cells – Gibbs – Helmholtz equation for a reversible cell.
Unit III	:	**ALTERNATING CURRENT** Alternating Current - j operator method - use of j operator in the study of AC circuits - resistance in an AC circuit - Inductance in an AC circuit - Capacitance in an AC circuit - AC through an inductance and resistance in series - AC through a capacitance and resistance in series - LCR in series resonance circuit - sharpness of resonance - parallel resonance circuit - power in an AC circuit - power factor.
Unit IV	:	**THERMO ELECTRICITY** Seebeck effect - thermo e.m.f - neutral temperature - temperature of inversion - Law of thermo electric effects - measurement of e.m.f of a thermocouple with potentiometer - Peltier effect - Thomson effect - Thermodynamics of a thermo couple - Thermo electric power diagram - Application of thermo electric power diagram - Types of Thermocouple.
Unit V	:	**MAGNETIC FIELDS AND MAXWELL'S EQUATION** The three magnetic vectors M, B, and H - Relation between them - Permeability and Susceptibility - relation between them - moving coil BG - construction - theory - correction for damping - measurement of charge sensitiveness - absolute capacity - De-Saughty's bridge. Displacement current - Maxwell's equations - Boundary conditions - Poynting vector - Electromagnetic waves in free space - Hertz experiment for production and detection of EM waves.

Text Book	**:**	1. Electricity and Magnetism, 7th edn- R. Murugesan, S. Chand & Co, New Delhi, 2011. 2. Electricity and Magnetism - K. K. Tiwari, S. Chand & Co, New Delhi,1995.
References	**:**	1. Introduction to Electrodynamics- David J Griffith, PHI publication, 2017. 2. Electricity and Magnetism, 12th revised edition - D. N. Vasudeva, 2017. 3. Fundamentals of Physics, 6th Edition- D. Halliday, R. Resnick and J Walker. Wiley NY 2001. 4. Electricity and Magnetism, 6th edn - E. M. Pourcel, Berkley Physics Course, Vol.2, McGraw - Hill, 2001.

COURSE OUTCOME

1. Understand the basic laws of electromagnetism and its applications
2. Discuss the concepts of Faraday's law of electrolysis
3. Explain the variation of alternating current in LCR circuits
4. Infer the thermo electric power diagram in thermocouple applications
5. Derive Maxwell's equations in material medium and electromagnetic waves

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – III

SBC	Sub Code	MAINTENANCE OF ELECTRICAL APPLIANCES	Hrs./ Week	Credits:
01	21UPHS3A		02	02

Objective	**:**	1. To impart knowledge on basic electrical instruments. 2. To recognize the importance and significance of maintenance of electrical appliances. 3. To learn about different types of house wiring and electrical safety devices.
Unit I	**:**	Resistance - capacitance - inductance and its units - Electrical charge - current - potential - units and measuring meters - Ohm's law - Galvanometer, ammeter, voltmeter and multimeter. Electrical energy - Power - Watt - KWh - consumption of electrical power.
Unit II	**:**	Transformer - principle and working - classification of transformers - testing of transformers - Core, Shell and Berry types, auto transformer - construction and uses. Cooling of transformers - Losses in transformer.
Unit III	**:**	Electrical bulbs – Fluorescent lamps - Street Lighting - Electrical Fans - Wet Grinder - Mixer - Water Heater - Storage and Instant types, electric iron box, microwave oven - Washing Machine - Stabilizer, fridge and Air conditioner.
Unit IV	**:**	AC and DC- Single phase and three phase connections - RMS and peak values, House wiring - Star and delta connection - overloading - earthing - short circuiting - colour code for insulation wires.
Unit V	**:**	Electrical protection - Relays - Fuses - Electrical switches - Circuit breakers, ELCB - overload devices - ground fault protection - Inverter - UPS - generator and motor
Text Book	**:**	1. A text book in Electrical Technology, B. L. Theraja and A. K. Theraja - S Chand & Co, 2012 2. Maintenance of electrical Appliance, G. Jose Robin, A. Ubaldraj - Indra publication, 2017.
References	**:**	1. Performance and design of AC machines, M. G. Say, ELBS Edn, CBS publishers Pvt. Ltd, 2002. 2. Semiconductor Physics and Opto Electronics, P. K. Palanichamy, Sci Tech publications, Pvt. Ltd, 2015. 3. Basic Electronics, B. L. Theraja – S. Chand & Co, 2005. 4. Principles of Communication Engineering, Arokh Singh and A. K. Chhabra, S. Chand & Co, 1984.

COURSE OUTCOME

1. Understand the importance of routine inspections, adequate maintenance of equipment and accurate record-keeping
2. Classify the different types of transformers and its maintenance.
3. Comprehend working principles of different household appliances
4. Identify the different house wiring methods
5. Gain knowledge on electrical safety.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – III

Core Practical	Sub Code	MAJOR PRACTICAL - II	Hrs./ Week	Credits:
02	21UPHMP2		02	

COURSE OBJECTIVES:

1. To impart practical knowledge on experiments related to electricity and magnetism.
2. To acquaint them in construction of basic electrical circuits.
3. To relate the respective theoretical concepts with experiments.

COURSE OUTCOME:

1. Understand the principle of potentiometer and to calibrate ammeter and voltmeter
2. Construct bridge circuits to verify balancing condition
3. Determine the sensitivity of ballistic galvanometer
4. Analyze frequency response of RLC circuit and characteristics of ac circuits.
5. Develop experimental skills and to interpret the significance of results

EXPERIMENTS

1. Field along the axis of a coil carrying current – deflection magnetometer
2. Potentiometer - calibration of volt meter (low range)
3. Potentiometer - calibration of ammeter
4. Potentiometer - thermo e.m.f
5. Potentiometer - comparison of resistances and specific resistivity
6. Series resonance circuit
7. Parallel resonance circuit
8. Figure of merit-Ballistic Galvanometer
9. Comparison of EMF's and Capacitances - Mirror Galvanometer
10. Owens bridge
11. De-Sauty's bridge
12. Carey foster's bridge-temperature co-efficient of resistance
13. Deflection & Vibration Magnetometer – M & B_H
14. Spectrometer – grating normal incidence
15. Zener diode Characteristics.
16. Bridge Rectifier.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – III

Allied	Sub Code	ALLIED PHYSICS / CHEMISTRY - I	Hrs./ Week	Credits:
01	21UPHA11		04	04

Objective	:	1. To acquire knowledge about elasticity and sound. 2. To study the viscous nature and surface force. 3. To understand about the concepts in thermal Physics and laws of electricity.
Unit I	:	**ELASTICITY AND BENDING MOMENT** Hooke's law – Elastic moduli – Relation between Elastic constants – Work done in stretching a wire – Expression for bending moment – Uniform bending – Experiment to determine Young's modulus using pin and microscope – Twisting couple of a wire – Expression for couple per unit twist – Work done in twisting – Experimental determination of rigidity modulus of a wire using torsion pendulum with theory.
Unit II	:	**SURFACE TENSION AND VISCOSITY** Surface tension- Definition - examples - Molecular interpretation - Expression for excess of pressure inside a synclastic and anticlastic surface-application to spherical and cylindrical drop and bubble - viscosity: coefficient of viscosity - rate of flow of liquid in a capillary tube (Poiseuille's Formula) – Anology between liquid flow and current flow - Stoke's formula for highly viscous liquids (Dimension method) - Experimental determination of viscosity of highly viscous liquid (Stoke's method)
Unit III	:	**SOUND** Simple harmonic motion - free, damped, forced vibration and resonance - composition of two SHMs along a straight line and in perpendicular direction - Melde's string experiment-Determination of frequency of Tuning fork (Both longitudinal and transverse modes).
Unit IV	:	**THERMAL PHYSICS** Mean free path - Expression for mean free path (Zero order approximation) - Transport phenomena - Expression for viscosity and Thermal conductivity - Conduction in solids – coefficient of Thermal conductivity - Lee's disc method to determine thermal conductivity of a bad conductor - Wiedemann - Franz's law – convection: Newton's law of cooling-Experimental verification - Radiation: Black body radiation - Distribution of energy in black body spectrum - Important features.
Unit V	:	**ELECTRICITY** Current and current density - Expression for current density - Ohm's law - resistors in series and in parallel - I-V characteristics of a resistor - color coding - Conversion of a galvanometer into an ammeter and voltmeter - Kirchoff's laws - Application of Kirchhoff's laws in Wheatstone network - sensitiveness of bridge.

Text Book	**:**	1. Properties of Matter, R. Murugesan, S. Chand & Co, 2009. 2. Heat & Thermodynamics, D. S. Mathur, S. Chand & Co, 2008. 3. Test Book of Sound, Brijlal & Subramaniam, N. Vikas Publishing house, New Delhi, 1982. 4. Electricity and Magnetism 7th Edn, R. Murugesan, S. Chand & Co, 2011.
References	**:**	1. Elements of Properties of Matter, Mathur D. S. Shyamlal Charitable Trust, New Delhi, 1993. 2. Heat and Thermodynamics, Brijlal & Subramaniam, S. Chand & Co., New Delhi, 2012. 3. Electricity and Magnetism Twelfth revised edition, D.N. Vasudeva, S. Chand Publishing. 2017.

COURSE OUTCOME:

1. Understand the mechanical properties of materials
2. Determine the viscosity of different liquids.
3. Describe the nature of simple harmonic motion and its applications
4. Explain the basic aspects of thermal conductivity.
5. Apply Kirchhoff's laws in bridge circuits.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – III

Allied Practical	Sub Code	ALLIED PHYSICS PRACTICAL / CHEMISTRY - I	Hrs./ Week	Credits:
01	21UPHAP1		02	

COURSE OBJECTIVES:

1. To familiarize different instruments used in physics.
2. To impart necessary technical skills to understand and handle the experimental set-ups.
3. To verify Physics laws through experiments.

COURSE OUTCOME:

1. Identify the strength of a given material.
2. Determine the wavelengths of different lines in mercury spectrum
3. Calibrate a given voltmeter and ammeter.
4. Perform logical operation using logic gates.
5. Analyze the viscosity of different liquids.

EXPERIMENTS

1. Young's modulus - non uniform bending - pin and microscope
2. Young's modulus - uniform bending - optic lever and telescope
3. Torsional pendulum - Rigidity modulus
4. Co-efficient of viscosity - Stoke's method
5. Co-efficient of viscosity - variable pressure head
6. Thermal conductivity of a bad conductor - Lee's disc method.
7. Spectrometer – refractive index using prism
8. Spectrometer - grating normal incidence method.
9. Air wedge - thickness of a wire
10. Melde's string - frequency of tuning fork
11. Potentiometer - calibration of volt meter (low range)
12. Series resonance circuit
13. Basic logic gates using discrete components – AND, OR, NOT
14. Zener diode Diode charecteristics
15. Potentiometer – Calibration of Ammeter

PC/ 2021-2022 / UG /Part - IV/ Physics / Semester – III

Generic Elective	Sub Code	BASIC PHYSICS - I	Hrs./ Week	Credits:
01	21UPHN3A		02	02

Objective	:	1. To explain the laws of motion, concept of conservation energy and their application to dynamics. 2. To describe the different phenomena of light in day- to- day applications 3. To impart knowledge on the concepts of heat, waves, sound and electricity
Unit I	:	**MECHANICS** Motion - speed, velocity, acceleration - force – equations of motion - Newton's laws - momentum - work, power and energy - energy – conservation of energy and momentum.
Unit II	:	**PROPERTIES OF MATTER** Three states of matter - binding forces - fluid pressure and thrust - applications - Pascal law - Archimedes principle – surface tension - capillary action - Bernoulli's principle – Viscosity-Venturimeter - Pitot's tube.
Unit III	:	**HEAT AND SOUND** Measurement of heat and temperature - Clinical thermometer - Heat transfer - Thermos flask - change of state - effect of pressure on boiling point and melting point - heat engines - steam engine and diesel engine. Sound and Music – reverberation - acoustics of building - recording and reproduction of sound in film.
Unit IV	:	**OPTICS** Reflection and refraction - Concave and convex mirrors and lenses – dispersion - spectra- rainbow - Interference – diffraction - polarization- concepts with examples – uses - double refraction - optical activity - quartz crystal
Unit V	:	**ELECTRICITY** Electric field - potential - Ohm's law - electrical energy and power - resistance - types of resistance - fixed resistance - variable resistance - resistance in series and parallel - Kirchoff's laws

Text Book	**:**	1. Properties of Matter, Murugesan. R, S. Chand & Co. Pvt. Ltd., New Delhi, 2009.
References	**:**	2. Text Book of Sound, Brijlal & Subramaniam, N. Vikas Publishing House, New Delhi, 1982. 3. Electricity and Magnetism, 7th edn, Murugesan. R., S. Chand & Co. Pvt. Ltd., New Delhi, 2011. 4. Heat and thermodynamics, Brijlal and Subramaniyam, S. Chand & Co. Pvt. Ltd., New Delhi, 2012. 5. Optics , Subramaniam. N & Brijlal, S Chand & Co. Pvt. Ltd., New Delhi, 2012.

COURSE OUTCOME

1. Describe the concept of laws of motion in mechanics.
2. Discuss the properties of fluid mechanics and its applications
3. Distinguish music and noise in acoustics
4. Differentiate diffraction and interference of light.
5. Explain the basic concepts of electric fields.

PC/ 2021-2022 / UG /Part - IV/ Physics / Semester – III

Generic Elective	Sub Code	ENERGY PHYSICS	Hrs./ Week	Credits:
01	21UPHN3B		02	02

Objective	:	1. To impart knowledge about alternate energy sources. 2. To harness renewable and non renewable energies. 3. To know about the working principles of energy harvesting systems in India.
Unit I	:	**CONVENTIONAL ENERGY SOURCES** Conventional energy sources – world's reserve of Conventional energy sources – various forms of energy - renewable and conventional energy systems-comparison
Unit II	:	**FOSSIL FUELS** Fossil fuels – coal, oil and natural gas – availability - statistical details – applications - merits and demerits
Unit III	:	**RENEWABLE ENERGY SOURCES** Renewable energy sources - Solar energy - importance - storage of solar energy - applications of solar energy - solar pond - solar water heater, solar crop dryers - solar cookers -advantages and disadvantages
Unit IV	:	**BIOMASS ENERGY** Biomass energy - biomass classification - biomass conversion process - biogas plants -Deenbandhu model gas plant - wood gasification - advantages and disadvantages of biomass
Unit V	:	**GEOTHERMAL ENERGY** Geothermal energy - Geothermal power plant - Wind energy and wind farms - Wind mills - types – Ocean thermal energy conversion - energy from tides - energy from waves
Text Book **References**	: :	1. Non-conventional energy sources by G.D Rai, Khanna Publishers, New Delhi, 2004. 2. Solar energy by M. P. Agarwal, S Chand & Co. Ltd, 1983. 3. Solar energy by Suhas P. Sukhatme, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2010.

COURSE OUTCOME

1. Analyse the demand and availability of conventional energy sources.
2. Explain the merits and demerits of fossil fuel usage.
3. Describe the solar energy importance and its applications.
4. Discuss the biomass – energy conversion
5. Compare the different types of

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – IV

Core	Sub Code	COMPUTER PROGRAMMING IN C^{++}	Hrs./ Week	Credits:
06	21UPHM41		04	04

Objective	**:**	1. To provide knowledge about the C^{++} programming language 2. To learn the various functions and operators in C^{++} 3. To write C^{++} programs for calculating physical quantities
Unit I	**:**	**WHAT IS C++** Introduction - tokens - keywords - identifiers and constants - declaration of variables - basic data types - user defined data types - derived data types - symbolic constants - operators in C^{++} - scope resolution operator - expressions and their types - special assignment operators - all control structures.
Unit II	**:**	**FUNCTIONS IN C++** Introduction - main function - function prototyping - inline functions - default arguments - function overloading - friendly functions - virtual functions - math library functions.
Unit III	**:**	**CLASSES AND OBJECTS** Introduction - specifying a class - defining member functions-a C^{++} program with class - nesting of member functions - private member functions - objects as function arguments - constructors - parameterized constructors - multiple constructors - constructors with default arguments - copy constructor.
Unit IV	**:**	**OPERATOR OVERLOADING** Introduction - defining operator overloading - operator overloading unary operators - overloading binary operators - inheritance - single inheritance - multiple inheritance - multi level inheritance - hybrid inheritance - hierarchical inheritance.
Unit V	**:**	**MANAGING CONSOLE I/O OPERATIONS** Introduction - C^{++} stream - C^{++} stream classes - unformatted I/O Operations - formatted console I/O operations - working with files - classes for file stream operations - opening and closing a file - file pointers and their manipulations.
Text Book	**:**	1. Object oriented Programming with C^{++} - E. Balagurusamy, Tata Mc Graw Hill publishing company Ltd. New Delhi, 2013. 2. Programming with C^{++} - D. Ravichandran, Tata McGraw Hill publishing company Ltd, New Delhi, 2002

References	**:**	1. Object oriented Programming in C^{++}, 4^{th} Edn, Robert Lafore, Macmillan publishing company Ltd, 2001. 2. Fundamentals of Programming with C^{++} , 7^{th} Edn, Richard L. Halterman, Sothern Adventist University, 2010.

COURSE OUTCOME:

1. Understand the basic concept of data types and operators in C^{++}
2. Identify the functions in C^{++}
3. Write C^{++} programs using classes and loops
4. Apply inheritance to write programs in C^{++}
5. Implement classes, I/O formatting using file stream operations

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – IV

SBC	Sub Code	MAINTENANCE OF ELECTRONIC EQUIPMENTS	Hrs./ Week	Credits:
02	21UPHS4A		02	02

Objective	**:**	1. To impart knowledge about different electronic components and electronic measuring instruments. 2. To classify the different types of transducers and its applications 3. To inculcate the knowledge of modern photography.
Unit I	**:**	**ELECTRONIC COMPONENTS** Study of Electronic components - Resistors - types - characteristics - colour coding – wattage rating - potential divider arrangement - capacitors - type - characteristics - working voltage -star and delta connection of resistors and capacitors - Soldering and disordering techniques -Groove board, bread board and printed circuit board
Unit II	**:**	**MEASURING INSTRUMENTS** Practical use of Multimeter (analog and digital) - CRO - Block Diagram - measurement of voltage, frequency and phase - waveforms and Lissajous figures. Digital Storage Oscilloscopes - LCD display for instruments - A/F and R/F oscillators.
Unit III	**:**	**TRANSDUCERS** Classification of transducers, Basic requirement / characteristics of transducers, Active and Passive transducers, Resistive (Potentiometer - Theory, temperature compensation & applications), Capacitive (variable air gap type), Inductive (LVDT) & piezoelectric transducers. Measurement of temperature (RTD, semiconductor IC sensors), Light transducers (photo resistors & photovoltaic cells).
Unit IV	**:**	**COMMUNICATION DEVICES** Basic concepts of radio 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. Telephone systems -cellular Telephone systems-mobile phone - principle of operation - integrated services - digital networks (ISDN)
Unit V	**:**	**PHOTOGRAPHY** Introduction to cameras - parts of camera and accessories - lens shutter – aperture - flash photography – filters – battery - tele and wide angle lens - Digital formats - data transfer to computer - ISO speed – resolution.

Text Book	**:**	1. Principles of Electronics, 5th Edn, V K Mehta, S. Chand & Co., 2001.
References		2. Functional Electronics, Ramanan, Tata McGraw Hill, 1984.
		3. Elements of Electronics, Bagde and Singh, S.Chand & Co, 2006.
		4. Basic Electronics, 6th Edn, B. Grob, McGraw Hill NY, 2009.
		5. Electronic principles, 7th Edn, Malvino, Tata McGraw Hill, 2012.
		6. Basic Electronics, 2nd Edn, B. Basavaraj, H. N. Shivasankar, Vikas Publishing, Universities press, India, 2011.

COURSE OUTCOME

1. Identify electronic circuits and components.
2. Understand various measuring electronic instruments.
3. Classify the types of transducers and its applications.
4. Explain TV transmission system , MODEM, DTH working, Mobile communication system and Internet ISDN.
5. Identify components of camera and explain the working of digital camera.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – IV

Allied	Sub Code	ALLIED PHYSICS / CHEMISTRY - II	Hrs./ Week	Credits:
02	21UPHA21		04	04

Objective	:	1. To analyze the concept of interference and diffraction. 2. To understand about electromagnetism. 3. To acquire knowledge regarding Nuclear and Energy Physics.
Unit I	:	**OPTICS** Interference: Condition for interference - Air wedge - determination of thickness of a thin wire - Diffraction: Fresnel & Fraunhofer diffraction - Plane diffraction grating - theory and experiment to determine wavelength (normal incidence) Polarization: Double refraction - half wave and quarter wave plate – Production and detection of plane, elliptically and circularly polarized light.
Unit II	:	**ELECTROMAGNETISM** Definition of magnetic induction B, Magnetic field intensity H , Intensity of magnetization M – Relation connecting M, B and H – Magnetic permeability μ and magnetic susceptibility χ – Relation between μ and χ – Properties of Dia, Para and Ferro magnetic materials. Electromagnetism: Faraday's law of electromagnetic induction – Lenz's law – Expression for induced current and charge – Self inductance – Self inductance of a long solenoid – Determination of self inductance by Rayleigh's method – Mutual inductance – Coefficient of coupling – Determination of mutual inductance using BG.
Unit III	:	**ELECTRONICS** Junction diodes - forward and reverse bias-diode charecteristics - Zener diode – V-I characteristic of a Zener diode – transistors - characteristics of a transistor (common emitter mode only). Digital Electronics: Decimal and binary numbers – binary to decimal and decimal to binary - Binary addition – Binary subtraction by 1's and 2's complement method – Basic logic gates OR, AND, NOT (Symbol, Boolean equation, truth table, circuit and working) – NAND, NOR, EX-OR (Symbol, Boolean equation, truth table only) – De Morgan's theorem.
Unit IV	:	**NUCLEAR PHYSICS** Introduction – Classification of nuclei – General properties of nucleus – Nuclear size, Nuclear mass, Nuclear density, Nuclear charge, Nuclear spin & Nuclear magnetic dipole moments – Mass defect – Binding energy - Binding energy curve – Nuclear forces – Properties. Fundamental laws of radioactivity – Soddy Fajan's displacement law – Law of radioactive disintegration – Half life period – Mean life.
Unit V	:	**ENERGY PHYSICS** World's reserve of commercial Energy sources and their availability – Energy crisis and possible solutions – Various forms of Energy – Conventional and Non Conventional Energy Sources – Solar Energy – Solar cells – Solar heaters – Wind Energy – Construction and Working of Windmills – Wind Farms – Global Warming.

Text Book	**:**	1. A Text book of Optics, Subramaniam. N & Brij Lal, S. Chand & Co. Pvt. Ltd., New Delhi, 1990 2. Modern physics – R. Murugesan, S. Chand & Co, New Delhi 3. Solar Energy Utilization, 4th Edn - G.D. Rai, Khanna Publications, New Delhi 1995 . 4. Electricity and Magnetism – Arova, Saxena and Prakash, Pragathi Prakashan Publication, Meerut, 1998.
References	**:**	1. Principle of Electronics, V.K. Mehta, Rohit Mehta, S. Chand & Co, New Delhi, 2008. 2. Digital principles and applications, 7th Edn, Albert Paul Malvino & David J. Bates, Tata McGraw Hill, New Delhi, 2007.

COURSE OUTCOME:

1. Apply the concepts of interference, diffraction and polarization.
2. Classify the magnetic materials and the phenomena of mutual and self inductance.
3. Design circuits using diodes, transistors, logic gates and understand the concepts of Boolean algebra and techniques to reduce/simplify Boolean expression
4. Analyze the basic concepts of Nuclear Physics.
5. Explain about Energy Physics.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – IV

Allied Practical	Sub Code	ALLIED PHYSICS PRACTICAL / CHEMISTRY - I	Hrs./ Week	Credits:
01	21UPHAP1		02	02

COURSE OBJECTIVES:

1. To familiarize different instruments used in physics.
2. To impart necessary technical skills to understand and handle the experimental set-ups.
3. To verify Physics laws through experiments.

COURSE OUTCOME:

1. Identify the strength of a given material.
2. Determine the wavelengths of different lines in mercury spectrum
3. Calibrate a given voltmeter and ammeter.
4. Perform logical operation using logic gates.
5. Analyze the viscosity of different liquids.

EXPERIMENTS

1. Young's modulus - non uniform bending - pin and microscope
2. Young's modulus - uniform bending - optic lever and telescope
3. Torsional pendulum - Rigidity modulus
4. Co-efficient of viscosity - Stoke's method
5. Co-efficient of viscosity - variable pressure head
6. Thermal conductivity of a bad conductor - Lee's disc method.
7. Spectrometer –refractive index using prism
8. Spectrometer - grating - normal incidence method.
9. Air wedge - thickness of a wire
10. 1.Melde's string - frequency of tuning fork
11. Potentiometer - calibration of voltmeter (low range)
12. Series resonance circuit
13. Basic logic gates using discrete components – AND, OR, NOT
14. Zener diode characteristics
15. Potentiometer – Calibration of Ammeter

PC/ 2021-2022 / UG /Part - IV/ Physics / Semester – IV

Generic Elective	Sub Code	BASIC PHYSICS - II	Hrs./ Week	Credits:
02	21UPHN4A		02	02

Objective	:	1. To impart knowledge on nuclear and semiconductor physics 2. To learn the laws of electricity and magnetism. 3. To understand the concepts in lasers and number systems in digital electronics.
Unit I	:	**NUCLEAR PHYSICS** Introduction - nuclear structure - properties of nucleus - binding energy - nuclear forces -nuclear fission - chain reaction - atom bomb - nuclear reactors - nuclear fusion - Hydrogen bomb
Unit II	:	**ELECTRICITY AND MAGNETISM** Coloumb's law - action of points, Ohm's law - electric power - electrical safety - electromagnetic induction - Faraday's Law - Lenz Law – transformers
Unit III	:	**SEMICONDUCTORS** Photo Diode - Photo Transistor - photo conductors - light emitting diode (LED) - liquid crystal display (LCD) - the solar cell
Unit IV	:	**LASER** Introduction – absorption - spontaneous emission - stimulated emission - population inversion - Ruby laser - He-Ne laser - applications
Unit V	:	**DIGITAL ELECTRONICS** Number systems in digital electronics - binary, decimal and hexadecimal numbers – inter conversions - binary addition and subtraction - Basic logic gates: AND, OR, NOT (Symbol, Boolean equation, Truth table).
Text Book **References**	: :	1. Modern Physics, R. Murugesan, S. Chand & Co. Pvt. Ltd., New Delhi, 2016. 2. Electricity and Magnetism, 7th Edn, R. Murugesan, S. Chand & Co. Pvt. Ltd., New Delhi, 2011 3. Mechanics and Mathematical Physics, R.Murugesan, S. Chand & Co. Pvt. Ltd., New Delhi, 2016. 4. Digital principles and applications - Albert Paul Malvino & Donald P. Leach, Tata McGraw Hill, 1994.

COURSE OUTCOME

1. Describe the applications of nuclear energy
2. Understand the laws of electricity and magnetism.
3. Explain the working principles of semiconductor devices
4. Describe the principle, types of lasers and its applications
5. Analyse basic logic gates and number systems in digital electronics.

PC/ 2021-2022 / UG /Part - IV/ Physics / Semester – IV

Generic Elective	Sub Code	SPACE PHYSICS	Hrs./ Week	Credits:
02	21UPHN4B		02	02

Objective	:	1. To provide knowledge about the universe and celestial bodies. 2. To learn about planets and stars. 3. To understand the theories of universe.
Unit I	:	**UNIVERSE** Planets - interior planets - exterior planets - crust, mantle and core of the earth - different - region of earth's atmosphere - rotation of the earth - magnetosphere - Van Allen belts - Aurora.
Unit II	:	**COMETS, METEORS, ASTEROIDS** Composition and structure of comets - periodic comets - salient features of asteroids, meteors
Unit III	:	**SUN** Structure of photosphere, chromo sphere, corona - sunspots - solar flares - solar prominences - solar piages - satellites of planets - structure, phases and their features of moon.
Unit IV	:	**STARS** Constellations - binary stars - their origin and types - star clusters – globular clusters - types of variable stars - types of galaxies.
Unit V	:	**ORIGIN OF UNIVERSE** Big bang theory - pulsating theory - steady state theory - composition of universe expansion
Text Book **References**	: :	1. Astrophysics of the solar system, K. D. Abyankar, University press, India, 2001. 2. An introduction to Astrophysics, 2nd Edn, Baidyanath Basu, Prentice Hall of India, New Delhi, 2013. 3. The fascinating Astronomy, Prof. P. Devadas, Devadas Telescoptics, Chennai, 2011. 4. Elements of Space Physics, R. P. Singhal, PHI, 2009.

COURSE OUTCOME

1. Acquire basic knowledge of morphology and classification of galaxies
2. Understand the atmosphere of earth and properties of stars, comets, meteors and asteroids.
3. Acquire basic knowledge of morphology and classification of galaxies.
4. Learn about the structure of sun.
5. Understanding basics of large scale structures and expanding the universe.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – V

Core	Sub Code	ATOMIC PHYSICS	Hrs./ Week	Credits:
07	21UPHM51		05	04

Objective	**:**	1. To develop basic understanding of physics of atoms and molecules. 2. To impart the knowledge of free electron theory of metals and classification of solids based on band theory. 3. To learn about X-rays and photoelectric effect.
Unit I	**:**	**THE ELECTRON, BAND THEORY OF SOLIDS AND POSITIVE RAYS** The free Electron Theory of metals – Expression for electrical conductivity – expressions for thermal conductivity – Determination of the electronic charge: Millikan‘s oil drop method - electron microscope – band theory of solids – classification of solids on the basis of band theory – optical properties of solids.
Unit II	**:**	**PROPERTIES OF POSITIVE RAYS** Positive ray analysis – Thomson‘s parabola method - Aston‘s mass spectrograph – Bainbridge‘s mass spectrograph – Dempster’s mass spectrograph – mass defect and packing fraction - Dunnington’s method of determining e/m.
Unit III	**:**	**STRUCTURE OF ATOM** The vector atom model – quantum numbers associated with the vector atom model – coupling schemes – the Pauli’s exclusion principle – the periodic classification of elements – magnetic dipole moment due to orbital motion of the electron - magnetic dipole moment due to spin - the Stern and Gerlach experiment - quantum mechanical explanation of normal and anamolous Zeeman effect.
Unit IV	**:**	**X-RAYS** Discovery of X-rays – Production of X-rays – Properties – measurement of intensity of X-rays – Origin of continuous X-rays – Fine Structure – Moseley‘s law – Absorption of X-rays – Scattering of X-rays – Thomson’s theory – X-ray spectra – Characteristic of X-ray Spectrum.
Unit V	**:**	**PHOTOELECTRIC EFFECT AND PLANCK‘S QUANTUM THEORY** Experimental investigations on the photoelectric effect – failure of electromagnetic theory -Einstein‘s photoelectric equation – photoelectric cells – Planck‘s quantum theory-the distribution of energy in the spectrum of a black body – Lenard’s experiment – Effect of temperature on Thermionic emission.

Text Book	**:**	1. Modern Physics, 14th Revised multicolour edn, R.Murugesan and Kiruthiga Sivaprasath, S. Chand & Company Ltd., New Delhi, 2016.
References	**:**	2. Fundamentals of Modern Physics, B. S. Agarwal, Kedarnath Ramnath, Meerut, Delhi, 2012. 3. Atomic and Nuclear Physics, N. Subrahmanyam Brijlal, S.Chand & Company Ltd., New Delhi, 2013. 4. Modern Physics, B.V.N. Rao, Wiley Eastern Ltd, New Delhi, 2016. 5. An Introduction to Modern Physics, P.Mahendru, New Rohtak road, Satyaprakashan , New Delhi, 2011. 6. Fundamentals of Physics by S.H. Ghosal, S. Chand & Company Ltd, Reprint 2012.

COURSE OUTCOME

1. Understand the band theory of solids.
2. Classify the different types of mass spectrograph and its usage.
3. Discuss the vector atom model and the arrangement of elements in periodic table.
4. Explain production, properties and applications of X-rays.
5. Describe the photoelectric effect and quantum theory.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – V

Core	Sub Code	BASIC ELECTRONICS	Hrs./ Week	Credits:
08	21UPHM52		05	04

Objective	**:**	1. To understand the circuits using Thevenin's and Norton's theorem 2. To acquire a pre requisite knowledge on electronic components, devices and their characteristics 3. To get insight about the functions of amplifiers, oscillators and applications of operational amplifiers.
Unit I	**:**	**LINEAR CIRCUITS AND SEMICONDUCTORS** Voltage source - Constant voltage source - Constant current source - Conversion of voltage source into current source - Maximum power transfer theorem - Thevenin's Theorem - Norton's Theorem – Semiconductor - Bonds in semiconductor - Commonly used semiconductor - Effect of temperature in semiconductor - Intrinsic and Extrinsic semiconductor - P and N type semiconductors.
Unit II	**:**	**SEMICONDUCTOR DIODE** Semiconductor diode - Characteristics - Crystal diode as a rectifier - Half wave rectifier - Full wave rectifier - Zener diode - Characteristics - Zener as voltage regulator - Special purpose Diodes - LED - Advantages and Applications - Photo diode - operation - characteristics - Applications of Photo diode.
Unit III	**:**	**TRANSISTOR AND FET** Transistor - Transistor Action - Three modes of connection - Common Emitter Characteristics - FET - Working - Importance - Difference between FET and Transistor - FET as amplifier - Output Characteristics - Important terms - Expression for drain current - Advantages - FET parameters - UJT - Equivalent circuit - Characteristics - Advantages - Applications.
Unit IV	**:**	**OSCILLATORS AND MULTIVIBRATORS** Feedback - Principle - gain - Advantages - Sinusoidal Oscillators - Tank circuit - Barkhausen Criterion - Colpitt's oscillator - Hartley Oscillator - Phase shift Oscillator - Wein bridge Oscillator - Multivibrators - Astable - Monostable - Bistable.
Unit V	**:**	**OPERATIONAL AMPLIFIER** Operational amplifier - Schematic symbol - Output voltage - AC analysis - Bandwidth - Slew rate - Frequency Response - Op-amp with negative feedback - Applications - Inverting amplifier - Noninverting amplifier - Voltage follower - Summing amplifier - Adder - Subtractor - Integrator - Differentiator - Comparator.

Text Book	**:**	1. Principles of Electronics, K. Mehta and Rohit Mehta, S. Chand and Company Ltd. New Delhi, 2001. 2. Electronic principles, 7th Edn, Malvino, Tata McGraw Hill, 2012.
References	**:**	1. Basic Electronics, 2nd Edn, B. Basavaraj, H.N. Shivasankar, Universities press, India, 2011. 2. Basic Electronics, Braphy, Tata McGraw Hill, 1989.

COURSE OUTCOME

1. Analyze the networks using Thevenin's and Norton's theorem.
2. Understand the types of semiconductor diode and its applications.
3. Explain the working principle of semiconductor transistors, FET and its characteristics.
4. Classify the different types of amplifiers, oscillators and multivibrators.
5. Design op amp circuits for arithmetic operations.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – V

DSE	Sub Code	ACOUSTICS	Hrs./ Week	Credits:
05	21UPHM5A		05	04

Objective	**:**	1. To understand the propagation of sound in vacuum and medium 2. To gain knowledge about Doppler Effect, quantitative measurement and acoustic in buildings. 3. To know Qualitative understanding of sound with applications.
Unit I	**:**	**VELOCITY OF SOUND** Velocity of longitudinal waves in gases – Newton's formula for velocity of sound – Laplace correction - Effect of temperature – Effect of pressure – Effect of density of the medium – Effect of humidity – Effect of wind – Velocity of sound in water – Velocity of sound in air – Velocity of sound in isotropic solids – Wave velocity and molecular velocity
Unit II	**:**	**VIBRATIONS IN STRINGS AND AIR COLUMNS** Velocity of transverse and longitudinal waves along a stretched string – Laws of transverse vibration of strings – Verification of the laws of transverse vibrations of strings using sonometer – Melde's experiment – Vibrations in rods – Kundt's tube – Helmholtz resonator – Theory of resonator
Unit III	**:**	**DOPPLER EFFECT AND BEATS** Doppler effect – Applications - Beats – Analytical treatment of beats – Characteristics of musical sound – Measurement of intensity of sound — decibel and Phon – Bel – Phon – Limits of audibility.
Unit IV	**:**	**ACOUSTICS OF BUILDINGS** Acoustics – Reverberation – Sabine's reverberation formula – Determination of absorption coefficient – Acoustic intensity – Acoustic measurements – Factors affecting the acoustics of buildings – Requisites for good acoustics.
Unit V	**:**	**PRACTICAL APPLICATIONS** Falling plate method – Determination of frequency of a tuning fork by stroboscopic method – Sound ranging – Locating the direction of aircraft – Wave front at supersonic speeds: Flight of the bullet – Production of ultrasonic waves – Detection of ultrasonic waves – Acoustic grating – Applications of ultrasonic waves.
Text Book	**:**	1. Waves and Oscillations by N. Subrahmanyam Brijlal, Vikas Publishing House Pvt. Ltd, Jangpura, New Delhi, 2010. 2. Text Book of Sound by Brijal & Subramaniam, N. Vikas Publishing house, 1982.

References	**:**	1. College Physics Vol. II by A. B. Gupta, Galgotia publications, Kolkat 1970. 2. Sound by M. Narayanamoorthy & N. Nagaratnam, The National Publishing & Co, Chennai, 2015.

COURSE OUTCOME

1. Explain about propagation of sound in vacuum under different conditions
2. Describe the propagation of sound in different medium and its velocity.
3. Identify relative effects of sound and its quantitative measurements.
4. Design good acoustics in buildings.
5. Apply ultrasonic effect on detection and ranging

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – V

DSE	Sub Code	STATISTICAL MECHANICS	Hrs./ Week	Credits:
05	21UPHM5B		05	04

Objective	:	1. To understand the fundamental postulates of statistical mechanics. 2. To learn about the ensembles and thermodynamic statistics. 3. To recognize the MB, FD and BE statistics and its applications.
Unit I	:	Statistical basis – probability - principle of equal a priori probability - microstate and macro state - thermodynamic probability - constrains on a system - static and dynamic systems -most probable state (equilibrium state) - concept of a cell in a compartment - ensemble and average properties
Unit II	:	Degrees of freedom - position space - momentum space - phase space - the μ space and gamma space - applications - fundamental postulates of statistical mechanics – density of quantum states of energy of a particle - statistical ensembles - comparison of ensembles - theories based on statistical mechanics - entropy and probability - Boltzmann‘s canonical distribution law - applications of Boltzmann‘s canonical distribution law.
Unit III	:	The law of equipartion of energy - statistical interpretation of second law of thermodynamics - partition function and its relation with thermodynamic quantities - entropy of an ideal gas - Gibbs paradox
Unit IV	:	Three kinds of particles - M.B statistics applicable to ideal gas - Maxwell Boltzmann energy distribution law - applications of M.B distribution law - mean RMS and most probable speeds - Maxwell‘s distribution law of velocities - experimental verification Maxwellian distribution of molecular speeds
Unit V	:	Need of quantum statistics - development of quantum statistics - Bose Einstein distribution law - photon gas – Planck’s radiation law - Fermi Dirac distribution law - free electrons in metal: electron gas - Fermi level and Fermi energy – EF for electrons in a metal - comparison of the three statistics - difference between classical and quantum statistics
Text Book **References**	: :	1. Heat thermodynamics and statistical physics, Brijlal N. Subramanium P. S. Hemne, S. Chand publications, 2012. 2. Fundamentals of Statistical Mechanics, B.B. Laud, New International Publishers, 2005. 3. An Introductory Course of Statistical Mechanics, First reprint, Palash. B. Pal, Narosa Publications, 2009.

COURSE OUTCOME

1. Correlate the statistics and thermodynamics
2. Understand the fundamentals of statistical physics and thermodynamics as logical consequences of the postulates
3. Explain Boltzmann‘s canonical distribution law and its applications
4. Describe statistical interpretation of second law of thermodynamics
5. Elaborate M-B, B-E and F-D statistics

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – V

DSE	Sub Code	SOLID STATE PHYSICS	Hrs./ Week	Credits:
05	21UPHM5C		04	04

Objective	**:**	1. To know about the types of crystal structures and X- ray diffraction analysis. 2. To understand the dielectric properties of materials and bonds in crystals. 3. To have an extended knowledge about magnetic properties like diamagnetic, paramagnetic, ferromagnetic, ferrites and superconductors.
Unit I	**:**	**CRYSTAL STRUCTURE** Crystal lattice – lattice translation vectors - primitive and unit cell – Bravais lattices, Miller indices - structure of crystals – Simple cubic, hexagonal close packed structures - Face centered cubic structures - Body centered cubic structure - Index system of crystal planes -Sodium chloride structure - Cesium chloride structure
Unit II	**:**	**X-RAY DIFFRACTION AND DEFECTS** Diffraction of x-rays by crystals – Bragg's law – experimental method in x-ray diffraction - Laue method - rotating crystal method - powder photograph method – von laue's equation – point defects - line defects - surface defects - volume defects - effects of crystal imperfection.
Unit III	**:**	**DIELECTRIC PROPERTIES** Electric polarization in a dielectric medium – electric displacement vector – dielectric constant – local field – Claussius - Mosotti relation-polarizability - electronic, ionic, oriental polarizability - frequency dependence of dielectric constant – Measurement of dielectric constant – ferro electricity – Hysteresis - Piezo electricity.
Unit IV	**:**	**BONDS IN CRYSTAL** Types of bond in crystal – Ionic, valence, metallic, Vanderwal's and Hydrogen bonding - phonons of mono atomic one dimensional lattice - specific heat of solids – Einstein's and Debye's theory – cohesive energy of cubic and Ionic crystals.
Unit V	**:**	**SUPERCONDUCTIVITY** Occurrence of superconductivity - Meissner effect – Type I SC – Type II SC – two fluid model of superconductivity - London equation – London penetration depth – BCS theory of super conductivity - Formation of Cooper pairs - Application of BCS theory - Josephson tunneling – DC Josephson effect - AC Josephson effect.

Text Book	**:**	1. Introduction to Solid State Physics, 8th Edn, Charles Kittel, John Wiley & Sons, 2012. 2. Solid State Physics, R.J. Singh, Pearson Education Publication, 2011.
References	**:**	1. Solid State Physics, P.K. Palanisamy, Scitech Publications Pvt. Ltd, India. 2. Solid State Physics, Ashcorft Mermin, 2003.

COURSE OUTCOME

1. Understand the fundamental features of crystalline solids, atomic packing, crystal lattice, and unit cell and translation vectors.
2. Describe Miller indices, reciprocal lattice, Brillouin Zones, Bragg's law, Diffraction methods.
3. Explain the dielectric properties of insulators.
4. Compare the types of bonding in solids and its properties.
5. Illustrate Superconductivity, its properties and applications

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – V

DSE	Sub Code	QUANTUM MECHANICS	Hrs./ Week	Credits:
05	21UPHM5D		04	04

Objective	:	1. To understand quantum theory and wave mechanics. 2. To impart knowledge on quantum mechanical operators and Eigen functions. 3. To solve simple problems in quantum mechanics using Schrödinger equation.
Unit I	:	**QUANTUM THEORY** Limitations of classical theory – Black body radiation – Max Planck's theory of quantum radiation – Einstein's theory of Photo electric effect – Compton effect – specific heat of solids – Bohr model of hydrogen atom – inadequacy of quantum theory – De Broglie's wave nature of particles – wave packet and its significance – wave packet and its motion.
Unit II	:	**WAVE MECHANICS** The uncertainty principle – single slit experiment – Uncertainty for other variables – Applications of Uncertainty principle – Schrodinger wave equation – Time dependent and Time independent forms – Interpretations of wave function – Probability current density – Expectation values – Ehrenfest's theorem.
Unit III	:	**EIGEN FUNCTION AND OPERATORS** Linear vector space – Orthogonal functions – Eigen functions and Eigen values – Orthonormality of Eigen functions – energy Eigen values are real – linear operator – Hermitian operator – Postulates of Quantum mechanics – Simultaneous measurements and commutating operators.
Unit IV	:	**SIMPLE APPLICATIONS** Particle in one dimensional Square well with infinite walls - Square well with finite walls – Potential step – Square potential barrier – barrier penetration – Alpha emission
Unit V	:	**SIMPLE APPLICATIONS** Bloch waves in periodic potential – Kronig – Penney square well periodic potential – linear Harmonic Oscillator – Schrodinger method – Operator method – The free particle.
Text Book	:	1. Quantum Mechanics, New edition, G. Aruldhas , PHI Pvt. Ltd, 2008 2. Quantum Mechanics, New edition, G.S. Chaddha, New Age International Publishers, 2016.
References	:	Fundamentals of Physics, 6th Edn by D. Halliday, R. Resnick and J. Walker, Wiley NY, 2001.

COURSE OUTCOME

1. Describe the aspects of the inadequacies of classical mechanics and understand the development of quantum mechanics.
2. Understand the theory of quantum mechanics, wave packets and uncertainty principle
3. Solve time-dependent and time-independent Schrodinger equation.
4. Analyze one dimensional and three dimensional potential well problems.
5. Apply different methods of quantum mechanics to solve potential well problems.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – VI

Core	Sub Code	NUCLEAR PHYSICS	Hrs./ Week	Credits:
09	21UPHM61		05	04

Objective	**:**	1. To impart knowledge about basic nuclear properties and nuclear models. 2. To acquire knowledge about radio activity, particle accelerators and detectors. 3. To learn about nuclear reactions and the basics of elementary particles
Unit I	**:**	**ATOMIC NUCLEUS** General properties of nucleus - Binding energy - Mass defect - Proton - proton hypothesis - proton neutron hypothesis - Nuclear forces - Characteristics of nuclear forces - Liquid drop model - Weizsacker semi - empirical mass formula - Shell model - Magic Numbers
Unit II	**:**	**RADIO ACTIVITY** Natural radioactivity - alpha, beta and gamma rays - properties - Radioactive series - Laws of radioactive disintegration - Radio - Carbon dating - Alpha decay - Beta decay - Neutrino and its properties - Gamma decay - Internal Conversion - Nuclear energy levels - Nuclear isomerism
Unit III	**:**	**PARTICLE ACCELERATORS & NUCLEAR REACTIONS** Cyclotron - Betatron – Synchrotron - Types of Nuclear reaction - Q value of Nuclear Reactions - The balance of mass and energy in Nuclear reactions - Nuclear transmutations.
Unit IV	**:**	**ENERGY FROM THE NUCLEUS** Nuclear fission - Types of fission - P-E Curve for fission - Bohr Wheeler‘s Theory of Nuclear fission - Nuclear fusion and Thermonuclear reactions - Controlled thermonuclear reactions - Nuclear chain reaction - critical size of a reactor - radiation hazards.
Unit V	**:**	**DETECTION AND MEASUREMENTS OF NUCLEAR RADIATIONS ELEMENTARY PARTICLES** G-M Counter - Scintillation Counter - Cloud Chamber Bubble Chamber - Cerenkov Counters - Classification of elementary particles - Particle interaction - Conservation Laws - Leptons - Hadrons - The Quark model
Text Book	**:**	1. Nuclear Physics, Irving Kaplan, Narosa Publishing House, 2002. 2. Nuclear Physics, D.C. Tayal, Himalaya publishing House, 2009.

References	**:**	1. Fundamentals of Physics, 6th Edition by D. Halliday, R. Resnick and J. Walker, Wiley NY, 2001. 2. Nuclear Physics, Anwar, Kamal, Naroasa Publishing house, 2014. 3. Nuclear Physics, 1st Edn, R. Prasad, Pearson Edn India, 2014.

COURSE OUTCOME

1. Understand the classification of the nuclei based on their properties.
2. Discuss Alpha, Beta and Gamma ray spectrum and Radio carbon dating.
3. Explain controlled and uncontrolled nuclear reactions.
4. Acquire knowledge about the particle accelerators.
5. Learn about the detectors of nuclear radiations and classification of elementary particles.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – VI

Core	Sub Code	MOLECULAR SPECTROSCOPY	Hrs./ Week	Credits:
10	21UPHM62		05	04

Objective	:	1. To impart knowledge of different types of molecular spectroscopy. 2. To examine the electronic spectra of diatomic molecules and Raman, resonance spectroscopy. 3. To learn the instrumental techniques in molecular spectroscopy.
Unit I	:	**MICROWAVE SPECTROSCOPY** The rotation of molecules - diatomic molecules – rigid diatomic molecule – intensities of spectral lines - effect of isotopic substitute, Non - rigid rotator Polyatomic molecules – linear, symmetric top - asymmetric top molecules - Techniques and instrumentation, chemical analysis by microwave spectroscopy.
Unit II	:	**INFRARED SPECTROSCOPY** Vibrating diatomic molecule – energy of diatomic molecule - harmonic and inharmonic oscillator - vibrating rotator – CO rotational vibration spectrum - interaction of rotations and vibrations – vibrations of polyatomic molecules – fundamental vibrations and their symmetry – overtones and combination frequencies - Analysis by IR techniques.
Unit III	:	**RAMAN SPECTROSCOPY** Theory of Raman Effect - Pure rotational Raman spectra – linear - symmetric top - spherical top, asymmetric top molecules. Pure vibrational Raman spectra – Raman activity of vibration rule of mutual exclusion - overtones and combination vibrational spectra - nature of light polarized - vibration of spherical top molecules and other type of molecules. Structural determinations from Raman and IR spectroscopy.
Unit IV	:	**ELECTRONIC SPECTROSCOPY** Born – Oppenheimer approximation vibrational coarse structure (Progression), intensity of vibrational electronic spectra, (Franck – Condon principle), dissociation energy and dissociation products. Vibrational spectra Vibrational fine structure (Rotation), fortart diagram - pre dissociation - diatomic molecular electronic spectra.
Unit V	:	**INSTRUMENTATION** Techniques and instrumentation – Microwave Spectrometer - Outline, single and double beam arrangement in IR spectroscopy - Raman Spectrometer.
Text Book	:	1. Fundamentals of Molecular Spectroscopy, 3rd Edn, C.N. Banwell, Tata McGraw Hill Publishing Co. Ltd., 1972. 2. Lasers and Non Linear Optics, B.B. Laud, Wiley Eastern Ltd., 1985.

References	**:**	1. Molecular structure and Spectroscopy, G. Aruldhas, PHI, New Delhi, 2001. 2. Fundamentals of Molecular Spectroscopy, Siddhu, New Age International Pvt. Ltd, 2011.

COURSE OUTCOME

1. Understand the principles of microwave spectroscopy
2. Identify some of the molecular structures using infra red spectroscopy
3. Distinguish the structure using Raman Spectrum.
4. Describe the techniques and principles of electronic spectra of molecules.
5. Explain instrumentation techniques of different molecular spectrum.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – VI

Core	Sub Code	APPLIED ELECTRONICS	Hrs./ Week	Credits:
11	21UPHM63		05	04

Objective	:	1. To introduce circuit design and to provide in depth the theoretical knowledge of Digital electronics-Number systems and Boolean Algebra 2. To impart knowledge on digital circuit minimization techniques. 3. To understand combinational circuits, flip flops and registers.
Unit I	:	**NUMBER SYSTEMS** Introduction to Decimal – Binary – Octal - Hexadecimal Number Systems and their inter –conversions - BCD codes - Excess-3 codes - Gray codes - Cyclic codes - code conversions; parity - binary arithmetic - 1‘s and 2‘s complements.
Unit II	:	**BOOLEAN ALGEBRA** Postulates and theorems of Boolean algebra - De-Morgan‘s Theorem - Reducing Boolean expressions - Logic Gates: Positive and Negative Logic - Basic Logic Gates: AND, OR, NOT (symbol, truth-table, circuit diagram, working) NAND – NOR - EX-OR - EX- NOR (symbol, truth-table).
Unit III	:	**MINIMIZATION TECHNIQUES** Introduction - SOP and POS form of Boolean functions - Karnaugh Map simplifications (upto 4 variables) - Don’t care condition - Parity generator - Parity checker - implementations of SOP and POS form using NAND and NOR gates.
Unit IV	:	**COMBINATIONAL CIRCUITS AND DECODERS** Half adder - full adder - 8421 adders - 1‘s & 2‘s complement adder / Subtractor - Parallel binary adder – parallel Subtractor - Excess-3 adder, multiplexer – demultiplexer - encoders and decoders - Seven segment decoder
Unit V	:	**FLIP FLOP, REGISTER AND COUNTER** Integrated circuits - Flip-Flop (RS, JK, Master-Slave JK,) - Shift Register - serial in - serial out resister - serial in - parallel out register - parallel in - serial out shift register - parallel in parallel out register - Counters - Ripple counters - Ring counter - up-down counter.
Text Book	:	1. Modern Digital Electronics, R.P. Jain, Tata McGraw Hill Publication, 2003. 2. Digital Electronics Circuits and Systems, V.K. Puri, Tata McGraw Hill Publication, 1997.

References	**:**	1. Digital Principles and Applications by A.P. Malvino & D.P Leach, Tata McGraw Hill.1994. 2. Digital Electronics by M. Morris Mano, Prentice Hall Publication, 1984.

COURSE OUTCOME

1. Understand number systems and its conversion in digital electronics
2. Classify the basic logic gates and generalize the concepts of Boolean Algebra.
3. Apply Karnaugh map for simplification of Boolean expressions.
4. Design combinational and sequential circuits.
5. Elucidate the working principles of various flip flops, registers and counters.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – VI

Core Practical	Sub Code	MAJOR PRACTICAL - III	Hrs./ Week	Credits:
03	21UPHMP3		03	03

COURSE OBJECTIVES

1. To understand the theoretical concepts through experiments.
2. To develop experimental skills using general physics experiments.
3. To perform lab experiments for studying mechanical, thermal and various physical parameters of materials.

COURSE OUTCOME

1. Develop experimentation skills and get hands-on experience in the measurements
2. Construct experiments on optics and electricity and demonstrate the related theoretical concepts.
3. Examine the measurements to draw valid conclusions.
4. Analyze the network theorems in circuits.
5. Develop analytical skills for interpreting data and present it in the form of a report.

EXPERIMENTS

1. Newton's Rings – refractive index and radii of curvature R_1 & R_2.
2. Spectrometer - Grating - Oblique incidence.
3. Thermo e.m.f - M.G.
4. Network theorem – Verification - Thevenin's & Norton's theorem.
5. Absolute determination of mutual inductance – M.G.
6. Potentiometer - Calibration of High Range Voltmeter.
7. Anderson's Bridge – self inductance of a coil.
8. Spectrometer - Hartmann's formula.
9. Absolute determination of capacity of condenser - M.G
10. Potentiometer - Temperature coefficient of resistance.
11. Spectrometer - (i-d) curve.
12. Comparison - of mutual inductances - M.G.
13. Conversion of Galvanometer into Ammeter and Voltmeter.
14. Young's Modulus of the given material – Elliptic Fringes.
15. Spectrometer – (i_1-i_2) curve.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – VI

Core Practical	Sub Code	MAJOR PRACTICAL - IV	Hrs./ Week	Credits:
04	21UPHMP4		03	03

COURSE OBJECTIVES

1. To transform the principles of basic electronics into experiments.
2. To gain knowledge about different electronic equipments.
3. To motivate the students to design digital circuits using Boolean expressions.

COURSE OUTCOME

1. Design different types of oscillators, multi vibrators and power supplies.
2. Acquire knowledge on characteristics and arithmetic operations using operational amplifier.
3. Troubleshoot electronic circuits.
4. Design circuits for basic logic gates and universal gates.
5. Explain the applications of operational amplifier.

EXPERIMENTS

1. Dual power Supply Using IC 78--, 79--.
2. FET Characteristics.
3. NAND and NOR as universal building block.
4. Single Stage amplifier with and without feedback.
5. Wein's bridge Oscillator.
6. Colpitt's Oscillator
7. Astable multi vibrator using timer.
8. Monostable multi vibrator using timer.
9. OP - AMP adder and Subtractor.
10. OP - AMP differentiator and Integrator.
11. OP - AMP low pass and high pass filters.
12. Half and Full Adder - IC.
13. Hartley oscillator.
14. Code Converter – Gray to Binary & Binary to Gray.
15. Voltage Follower – OP-amp

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – VI

Core Practical	Sub Code	MAJOR PRACTICAL - V	Hrs./ Week	Credits:
05	21UPHMP5		03	03

COURSE OBJECTIVES.

1. To learn the C^{++} programming language .
2. To write programs using object oriented program.
3. To execute C^{++} programs and to solve problems in physics.

COURSE OUTCOME.

1. Gain knowledge about the usage of C^{++} program.
2. Draw the flow chart for every task and execute good program in turbo C^{++} software.
3. Apply the concepts of object oriented programming
4. Construct C^{++} programs for solving simple numerical problems.
5. Practice the use of C^{++} classes and class libraries, arrays, inheritance and file I/O stream concepts

EXPERIMENTS

1. To read any two numbers through the key board and to perform simple arithmetic operations (i.e. addition, subtraction, multiplication and division) and display the results using C_{in} and C_{out} functions. Use do-while loop.
2. To test the validity of any entered character whether it belongs to the alphabetical set or a number or a special character.
3. To find the sum of series using for loop.

b. Sum = 1+3+5+.....n.

c. Sum= x-x^3/3! +x^5/5!-x^7/7!+.....x^n/n! c. Sum= 1+2^2+4^2+.....n^2.

4. To find the factorial of a number by using function declaration with/without using the return statement.
5. To read a set of numbers from a standard input device and to find out the largest number in the given array using function declaration. Also sort them in the ascending or the descending order.
6. To read the elements of the given two matrices of order m*n and to perform the matrix addition and display the transpose of the result.
7. a) To display the content of an array using pointer arithmetic.

   b) To read the data variables (Such as Day, Month and Year) of the class by the member function and display the contents of class objects on the screen in the format DD/MM/YYYY.

8. To generate a series of Fibonacci numbers using constructor.
9. To read the following information from the keyboard in which basic class consists of Name, Roll No. and Sex. The derived class contain the data members Height and weight. Display the contents of the class. Use inheritance concept.
10. An OOP to find the period of a pendulum of given length L, in a gravitation field. Accept the required values using the keyboard. Also display the results.
11. Develop a program in C++ to calculate the Young's modulus of a material from the data obtained from uniform bending method.
12. Solve Quadratic equation.
13. Multiplication of two matrices.

PC/ 2021-2022 / UG /Part - III/ Physics / Semester – VI

Project	Sub Code	MAJOR PROJECT	Hrs./ Week	Credits:
01	21UPHM6P		06	05

GROUP PROJECT CAN BE ALLOTED FOR STUDENTS (FOUR MAXIMUM)

Must be subject oriented or applied or interdisciplinary or can be carried out in research institutes / Universities / facilitated colleges / in collaboration with leading institutes.

COURSE OBJECTIVE

1. To select a suitable problem to work as a project for his relevance.
2. To solve with a sharing to overcome complicated things as a group
3. To attain knowledge of designing instruments, devices and softwares

COURSE OUTCOME

1. Define problems, analyse, interpret and draw conclusions from data.
2. Identify the complications in work and solve in groups.
3. Familiarize with software / instruments required for the project.
4. Present the work in seminars/conferences and to update in their relevant field of interest.
5. Develop confidence over facing any challenge in the respective field.