Semester II
Course Name : PROPERTIES OF MATTER AND SOUND
Course code: PC2021

No. of Hours per Week	Credits	Total No. of Hours	Marks
4	4	60	100

Objective

To expose students to the fundamentals of properties of matter and sound.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO- 1	identify the materials suitable for construction of buildings, based on the moduli of elasticity.	PSO-4	Ap
CO- 2	paraphrase the properties of liquids and its determination.	PSO-1	U
CO- 3	analyze the physics of sound and its applications	PSO-2	An
CO- 4	integrate the concepts of acoustic comfort and better understanding of the theories used in building acoustics	PSO-3	Ap

Modules

Credits: 4 **Total contact hours: 60 (Including assignments and tests)**

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Elasticity**					
	1	Elasticity –- Hooke's law – Elastic moduli – Poisson's ratio –	2	To understand the concept elasticity and	Lecture	Evaluation through short test

		Beams – Bending of beams – Expression for bending moment –		bending of beams	Discussion with PPT illustration	Multiple choice questions Formative assessment I
	2	Cantilever- Theory of uniform and non – Uniform bending - Determination of Young‘s modulus	2	To be able to determine the Young’s modulus of the material	Lecture discussion with illustration	
	3	Koenig's method – Torsion of a body – Expression for couple per unit twist – Work done in twisting a wire	3	To acquire knowledge on Work done in twisting a wire	Lecture discussion	
	4	Torsional oscillations of a body - Rigidity modulus by dynamic torsion method (Torsional pendulum) and static torsion method	2	To be able to distinguish between dynamic torsion method and static torsion method	Lecture discussion	
II	**Surface Tension**					
	1	Surface tension – definition – Molecular forces – Explanation of surface tension on kinetic theory – Surface energy	3	To understand the concept of surface tension according to kinetic theory	Lecture Illustration	Short test Quiz Assignment Formative assessment I
	2	Work done in increasing the area of a surface – Excess pressure inside a curved liquid surface – Excess pressure inside a spherical	3	To determine the excess pressure inside a spherical and cylindrical drops and bubbles	Lecture discussion	

		and cylindrical drops and bubbles				
	3	Drop weight method - Angle of contact- Quincke's method- variation of surface tension with temperature- Experimental determination- Jaegar's method	3	To evaluate the principle of surface tension in liquids and understand it by practical experiments.	Lecture Illustration	
III	**Viscosity**					
	1	Viscosity – Co efficient of viscosity – Streamlined and turbulent motion – Critical velocity	3	To have practical knowledge on determining the coefficient of viscosity of a liquid.	Lecture with PPT Illustration	Class test Quiz Formative assessment II
	2	Rate of flow of liquid in a capillary tube – Poiseuille's formula – Viscosity of highly viscous liquid	4	To understand the concept of pressure and thrust.	Question-answer session Lecture	
	3	Terminal velocity - Stoke's method - Ostwald Viscometer - Viscosity of gas- Mayer's formula- Rankine 's method	3	To evaluate Stoke's formula and apply it in experiment to understand the viscous force of a liquid.		
IV	**Sound**					
	1	Simple harmonic motion – Differential equation of motion	3	To derive the solution of the differential	Lecture Discussion	Short test

		executing S.H.M. – Solution of the differential equation of motion		equation for a simple harmonic motion		Quiz Formative assessment II
	2	Composition of two S.H.M. along the same direction and at right angles – Lissajous figure – Free, damped and forced vibration	3	To distinguish between Free, damped and forced vibration	Lecture Discussion	
	3	Frequency of vibrating string- Melde's experiment and verification of the laws of transverse vibration of a string- Sonometer – Loudness level- Sound Intensity measurement	3	To acquire skills to do experiments by sonometer and Melde's string.		
V	**Ultrasonics and Acoustics**					
	1	Ultrasonics – Production – Piezoelectric crystal method – Magnetostriction method – Properties and Applications	3	To compare the methods of ultrasonic production.	Lecture with PPT	Class test Formative assessment III
	2	Acoustics of building – Reverberation- Sabine's Reverberation formula (No derivation) - Factors affecting acoustics	5	To classify sound and to examine the architectural acoustics	Brain storming session. Lecture Illustration	

		of building- Sound distribution in an auditorium- Requisites for good acoustics				

PO- Program outcome; LO – Learning outcome; Cognitive Level U – Understand; Ap- Apply, An- Analyze;

Course instructors: Dr.A.Lesly Fathima and Sr.S.Sebastiammal

Semester II

Name of the Course : Allied Physics II

Subject code : AP2021

No. of hours per week	No. of credits	Total no. of hours	Marks
4	4	60	100

Objectives

To understand the concept of strength of materials, viscous properties of liquids, heat transformation from one place to another, converting heat to do mechanical work and basic properties of light such as interference and diffraction.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO 1	Acquire knowledge on elementary ideas of electricity and magnetism, electronics, optics and nuclear physics.	PSO-1	U
CO 2	Analyze the concepts and study their applications in the field of electricity and magnetism, electronics, optics and nuclear physics.	PSO-2	An
CO 3	Apply their depth knowledge of Physics in day today life.	PSO-3	Ap
CO 4	Develop their knowledge and carry out the practical by applying these concepts	PSO-5	Ap

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment / Evaluation
I	**Quantum Mechanics and Relativity**					
	1	Wave mechanics – expression for group velocity – Davison Germer's experiment – Heisenberg's uncertainty principle – basic postulates of wave mechanics – time dependent form of Schrodinger equation – properties of wave function.	2	To understand the basic concepts of wave mechanics	Illustration and lecture	Evaluation through: quiz, short questions Multiple choice, questions , Deriving theoretical Formulas Problem solving Formative assessment
	2	Heisenberg's uncertainty principle – basic postulates of wave mechanics – time dependent form of Schrodinger equation – properties of wave function.	2	To study the basic postulates of wave mechanics and derive Schrodinger equation	Illustration and theoretical derivation	
	3	Relativity – frame of reference – Newtonian relativity – Galilean transformation equations.	2	To understand Relativity and frame of reference	Illustration, theoretical derivation and Practical	
	4	Special theory of relativity – Lorentz transformation equations.	3	To derive Lorentz transformation equations.	Lecture and theoretical derivation	
II	**Nuclear Physics**					
	1	Nuclear constituents - size - mass - spin and charge - binding energy - binding energy curve	3	To understand the basic concepts of nuclear physics and study its units	Illustration, Theoretical formulation, Problem Solving	Evaluation through: quiz, short test Assignment on applications.
	2	Nuclear fission - chain reaction - nuclear reactor - radioactive disintegration	3	To determine nuclear fission	Lecture, Theoretical formulation	

				and radioactive disintegration		Formative assessment
	3	Half life period - radiation hazards.	2	To understand the causes of radiation hazards	Lecture, Illustration,	
III	Electricity & Magnetism					
	1	Electric curent - current density - Ohm's law - Electrical conductivity - Kirchhoff's law	2	To understand the basic concepts of current and laws	Illustration and lecture	Evaluation through: quiz, short questions, Multiple choice, questions, Deriving theoretical formulas Formative assessment
	2	Wheatstone's bridge - condition for balance - potentiometer - calibration of voltmeter and ammeter.	2	To study the basic of potentiometer , voltmeter and ammeter	Illustration and theoretical derivation. Practical	
	3	Electromagnetic induction - laws of electromagnetic induction - Faraday's law - Lenz law	2	To understand the basic concepts of electromagnetic induction through experiment	Illustration, theoretical derivation and Demonstration	
	4	Flemings right hand rule - self-inductance - mutual induction - coefficient of coupling.	2	To define convection mode of heat transfer and study its application	Illustration and lecture	
IV	**Electronics**					
	1	Formation of p-n junction diode – forward and reverse biasing of a junction diode	2	To understand the basic concepts of electronics	Lecture, Demonstration, theoretical formulation	Evaluation through: quiz, short questions Multiple choice, questions, Deriving theoretical
	2	Zener diode - characteristics of the Zener diode – diode as a half wave and full wave rectifiers.	2	To analyse the various aspects of zener diode	Lecture, Demonstration, theoretical formulation	
	3	Bipolar junction transistor –	2	To understand the concept of	Lecture, Demonstration,	

		junction transistor – CE characteristics of a transistor		Bipolar junction transistor	theoretical formulation	formulas Formative assessment
	4	Field effect transistor – drain characteristics of an n channel JFET.	2	To understand the concept of Field effect transistor	Lecture, Demonstration, theoretical formulation	
V	**Digital Electronics**					
	1	Digital logic gates – AND – OR – NOT gate – NAND and NOR as universal gates – integrated circuit – EX-OR gate	3	To understand the basic concepts of logic gates	Illustration, Theoretical formulation, Demonstration	Evaluation through: quiz, Deriving theoretical formulas Assignment on applications Formative assessment
	2	Boolean algebra– half adder – full adder – half subtractor.	2	To understand the basic concepts of Boolean Algebra	Lecture, Demonstration, Theoretical formulation	
	3	Decimal system – Binary system –conversion – binary addition – binary subtraction using 2s complement – binary multiplication – binary division.	3	To understand the number system and binary operations	Lecture, Demonstration, Theoretical formulation	

PO- Program outcome; LO – Learning outcome; Cognitive Level U – Understand; Ap- Apply, An- Analyze;

Course Instructor: Ms.P. Aji Udhaya &Sr.S.Sebastiammal

Semester II

Course Name : Physics in Everyday life – II

Course Code: PNM202

No. of hours per week	No. of credits	Total no of hours	Marks
2	2	30	100

Objectives

1. To provide basic knowledge on the concepts of light, Electromagnetism and Electronics along with some applications.
2. To explain the wonders in universe using the principles of physics

. Course Outcomes

CO	Upon completion of this course, students will be able to:	CL
CO - 1	understand the principle and working of simple devices used in day to day life.	U
CO – 2	identify the symbols used for various electronic components and infer the electronic tools.	R
CO – 3	distinguish different heavenly bodies (star, planet, comets, galaxies)	R
CO - 4	recall various applications of physics concepts in everyday life	K

Teaching Plan

Total contact hours: 30 (Including lectures, assignments and tests)

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Light**					
	1	Introduction - Nature and properties of light - Reflection - Colours of light - Colours of objects- Reflection in everyday life	1	To understand the fundamental concepts of light	Lecture, PPT	Quiz test, Formative assessment
	2	Refraction - Dispersion – Rainbow formation- Refraction in everyday life	2	To understand the fundamental phenomenon of light	Lecture, Demonstration	
	3	Laser: principle and applications - Fiber optics and its applications - Applications of light in day to day life	1	To understand the principles and applications of	Lecture	

				Laser and fiber optics in day to day life		
II	**Electromagnetic Radiation**					
	1	Introduction- Properties of Electromagnetic waves - EM Spectrum- Radio sub spectrum	1	To understand the basic properties of electromagnetic radiation	Lecture, Demonstration	Quiz test, Formative assessment
	2	Cell phones, Microwaves - Microwave oven and sensor, Terahertz radiation and its applications	2	To apply electromagnetic radiations in electrical and electronic appliances	Lecture, Demonstration	
	3	Infra red rays in everyday life – Infra Red and microwaves - comparison - visible light waves - UV rays and its applications	1	To understand and apply the uses of microwave, infrared and visible light in day to day lie	Lecture	
III	**Electromagnetism**					
	1	Introduction - Magnetic materials - Magnetic Field in and around a bar Magnet, Magnetic Fields in and around Horseshoe magnet, Magnetic lines of force	2	To understand Magnetic Field and magnetic force	Lecture	Quiz test, Formative assessment (II)
	2	Electric charge - Ohm's Law - Practical Applications of Ohm's Law in Daily Life	1	To understand Ohm's Law and the applications of Ohm's law	Lecture, PPT	
	3	Electromagnetism- Applications of electricity and magnetism: Credit card machine, Use of electromagnetism in daily life.	1	To apply the applications of electricity and magnetism in digital technology		
IV	**Basic Electronics**					
	1	Introduction - Electronic components - Electronic tools	1	To understand and apply the basic electronic components	Lecture	Quiz test, Formative assessme

				and electronic tools		nt (II)
	2	Semiconductors and integrated circuits - Application of electronic devices	1	To understand Ohm's Law and the applications of Ohm's law	Lecture, PPT	
	3	Electromagnetism- Applications of electricity and magnetism: Credit card machine, Use of electromagnetism in daily life.	2	To apply the applications of electricity and magnetism in digital technology		
V	**Space Physics**					
	1	Introduction - The big bang theory - Stars-Star system, multiple star, supernova, black hole - solar system	1	To understand the stars and the solar system	Lecture	Quiz test, Formative assessment (II)
	2	Terrestrial and Jovian planets - Asteroids- Meteoroids - Meteors - Comets	2	To understand the planets, comets and asteroids	Lecture	
	3	Galaxy - Eclipse: solar and lunar - seasons	1	To understand the seasonal changes	Lecture	

Semester IV

Course Name: Optics and Spectroscopy

Course Code : PC2041

No. of hours per week	No. of credits	Total No. of hours	Marks
4	4	60	100

Learning Objectives

1. To provide knowledge on the concept of aberrations in lenses, prisms and Spectroscopy.
2. To understand the phenomenon like interference, diffraction, polarization through wave nature of light and itsapplications.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO- 1	gain knowledge of geometric optics, helps in the practical design of many optical systems and instruments including aberrations in lens system.	**PSO - 2**	**U**
CO- 2	determine the behavior of a ray and wave at any optical surface.	**PSO - 1**	**R**
CO- 3	analyze the intensity variation oflight due to polarization, interference and diffraction.	**PSO - 4**	**An**
CO- 4	study the phenomena: interference, diffraction, and polarization lays the foundation for an understanding of concepts such as as holograms, interferometers.	**PSO -5**	**E**
CO- 5	gain knowledge on spectroscopy helps to extract the dynamic information about the molecule.	**PSO - 3**	**Ap**

Modules

Total contact hours: 60 (Including lectures, assignments and Tests)

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Geometrical optics**					
	1	Lens – Spherical aberration in lenses – Methods of minimizing spherical aberration	3	To understand the spherical aberrations in lenses	Illustration and lecture	Evaluation through: quiz, short questions Multiple choice, questions, Formative assessment
	2	Dispersion – Angular and Chromatic dispersion – combination of prisms to produce i)dispersion without deviation ii) deviation without dispersion	3	To define and understand angular and Chromatic dispersion	Illustration and lecture	
	3	Direct vision spectroscope – Eyepieces – Ramsden's and Huygens's eyepieces	2	To explain spectroscopes and various eyepieces	Illustration and lecture	
	4	Simple microscope (magnifying glass)– compound microscope	1	To compareSimple and compound microscope	Group discussion and lecture	
II	**Interference**					
	1	Conditions for interference – Theory of interference fringes – interference due to reflectedlight (thin films)	3	To understand the basic concepts of interference and its condition	Illustration, demonstration and lecture	Evaluation through: quiz, Multiple choice, questions, Exhibiting Models, Formative assessment
	2	Colours of thin films – wedge shaped thin film – theory – determination of diameter of a thin wire by Air wedge	2	To determine the diameter of any thin wire using air-wedge method	Demonstration and lecture	
	3	Test for optical flatness – Newton's rings by reflected light	2	To test the optical flatness	Group discussion	
	4	Determination of wavelength of light - Michelson's Interferometer – theory and its Application (Measurement of wavelength)	2	To determine the wavelength of light source	lecture and Demonstration	
III	**Diffraction**					
	1	Fresnel's diffraction – Rectilinear propagation of light – zone plate – action of zone plate - Fraunhofer diffraction at single slit – Double slit	3	Differentiate Fresnel's and Fraunhoffer diffraction	Lecture discussion, PPT	Evaluation through: quiz, Assignments

	2	Plane diffraction grating –theory of plane transmission grating - experiment to determine wavelength (Normal incidence method) –resolving power	3	Discuss the theory of plane transmission gratig	Lecture discussion &Demonstration, PPT	Multiple choice questions
	3	Rayleigh's criterion for resolution – resolving power of a telescope – resolving power of a microscope – resolving power of a prism - resolving power ofgrating.	3	Evaluate the resolving power of various optical devices	Lecture demonstration	Descriptive answers Formative assessment
IV	**Polarisation**					
	1	Double refraction –Nicol Prism – Nicol Prism as polarizer and analyzer – Huygens's explanation of double refraction in uniaxial crystals	3	To explain the basic principles & phenomena of polarisation	Lecture discussion, PPT	Evaluation through: quiz Assignments
	2	Plane, elliptically and circularly polarized light– Quarter wave plates and Half wave plates – Production and detection of plane, circularly and elliptically polarized light	3	To analyze different types of polarization	Lecture Illustration	Short questions Descriptive answers
	3	Optical activity– Fresnel's explanation of optical activity	3	Determine the various optical parameters by using optical components	Lecture discussion PPT	Formative assessment
V	**Spectroscopy**					
	1	Infrared spectroscopy – sources and detector – uses – ultraviolet spectroscopy – sources – quartz spectrograph - applications -	4	Explain UV & IR spectroscopy and its applications	Lecture discussion, PPT	Evaluation through: quiz, Assignments on applications
	2	Raman Spectroscopy Nuclear magnetic resonance –Nuclear quadrupole resonance	2	Discuss the principles of NMR spectroscopy	Lecture discussion, PPT	Formative assessment
	3	Electron spin resonance		Analyze and study the	Group discussion,	

		spectroscopies- (Qualitative study)	3	applications of ESR spectroscopy.	PPT	

CO-Course Outcome; CL-Cognitive Level; R- Remember; U- Understand; Ap- Apply; An-Analyze; C - Create.

Course Instructors: Dr. M. Abila Jeba Queen & Dr. R. Krishna Priya

Semester IV

Course Name: Computer Programming in C++

Course code: PC2042

No. of hours per week	No. of Credits	Total No. of hours	Marks
4	**4**	**60**	**100**

Objectives

1. To provide knowledge about the basics of Computer programming in C++ and to solve problems by writing programs.
2. To enable the students developing their own applications using C++.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	understand the different types of operators and expressions in C++ language.	**PSO - 4**	**U**
CO-2	implement different operation an arrays and use function to solve the given problem	**PSO - 4**	**Ap**
CO-3	understand member functions and constructors	**PSO - 4**	**U**
CO-4	analyze pointers, operator overloading and inheritance.	**PSO - 4**	**An**
CO-5	analyze input/output operations	**PSO- 4**	**An**

Modules

Credit: 5 **Total Hours: 60**

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assesment/ Evaluation

I	**C++ An Introduction**					
	1	Introduction - tokens - keywords - identifiers and constants - declaration of variables - basic data types - user defined data types-derived data types	2	To understand the basics of C++ language	Illustration and PPT	Evaluation through: quiz
	2	Symbolic constants - operators in C++ -expressions and their type-hierarchy of arithmetic operators	3	To understand the types of operators	Illustration, PPT	Formative assessment
	3	Scope resolution operator – declaring, initializing and modifying variables-special assignment operators -	2	To understand the applications of different operators	Lecture Discussion	Evaluation through short test
	4	Control structures- Structure of a simple C ++ program	2	To understand and apply them to solve simple physical problems	Writing simple programme	
II	**Arrays and Functions in C++**					
	1	Introduction - one dimensional and two dimensional arrays - initialization of arrays-array of strings -	1	To understand the declaration of arrays	Illustration	Evaluation through: quiz
	2	Functions-introduction-function with no argument and no return values -function with no argument but return value - function with argument and no return values	3	To understand function and types of function	Lecture, Writing simple programmes	Class test
	3	Function with argument and return values- call by reference return by reference	2	To understand the use of arguments in function	Lecture Illustration , Writing simple programmes	
	4	Function prototyping - inline functions - local, -global and static variables	2	To acquire knowledge on function prototyping	Illustration , Writing simple programmes	

	5	Function overloading - virtual functions-main function-math library functions.	1	To acquire knowledge on library functions	Illustration and PPT	
III	**Classes and Objects**					
	1	Introduction - specifying a class - defining member functions- C++ program with class	2	To understand the basic concepts of object oriented programming	Lecture and Discussion	Evaluation through: quiz Formative assessment Evaluation through short test Multiple choice questions
	2	Nesting of member functions - private member functions - objects as function arguments	2	To understand the access of member functions	Lecture Illustration , Writing simple programmes	
	3	Arrays within a class-array of objects-static class members-friend functions	2	To understand and remember the array declaration and apply	Lecture Illustration , Writing simple programmes	
	4	Constructors - parameterized constructors-multiple constructors - constructors with default arguments - copy constructor.	3	To understand and remember the use of constructors	Lecture Illustration , Writing simple programmes	
IV	**Operator Overloading, Inheritance and Pointers**					
	1	Introduction -defining operator overloading - overloading unary operators -binary operators	2	To understand and remember the operators	Lecture Illustration , Writing simple programmes	Evaluation through: quiz, Problem solving Theoretical derivation Formative assessment
	2	Inheritance - single inheritance – multipleinheritance- multilevel inheritance- hybrid inheritance-hierarchial inheritance	4	To understand and apply the concept of inheritance in solving problems	Lecture Illustration , Writing simple programmes	
	3	virtual base class-abstract class	1	To understand and analyse	Lecture Illustration , Writing simple programmes	
	4	Pointers-definition-declaration-arithmetic operations	2	To understand and apply the concept of inheritance in	Lecture Illustration , Writing simple programmes	

				solving problems		
V	**Managing Console I/O Operations**					
	1	Introduction - C++ stream - C++ stream classes -	2	To understand and remember the stream classes in C++	Lecture Illustration , Writing simple programmes	Eva thro
	2	unformatted I/O Operations - formatted console I/O operations	2	To understand ,analyse and apply in solving problems	Lecture Illustration , Writing simple programmes	Prob solv For Ass
	3	Working with files - classes for file steam operations	2	To understand ,analyse and apply in solving problems	Lecture Illustration , Writing simple programmes	Ass
	4	Opening and closing a file - file pointers and their manipulations.	3	To understand ,analyse and apply in solving problems	Lecture Illustration , Writing simple programmes	

PO- Program outcome; LO – Learning outcome;
Cognitive Level R – Remember; U –Understand; Ap-Apply, An- Analyze; E-Evaluate; C- Create

B.Sc Physics
Semester VI
Elective – IV (a): Nanomaterials and its Applications
Subject Code: PC1764

No of hours per week	No of credits	Total no of hours	Marks
5	4	75	100

Objectives : 1. To gain knowledge on synthesis and characterization of nanomaterials.
2. To understand the advancements and applications of nanostructures.

CO No	Course outcomes Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	Infer the history of nanotechnology and explain the various dimensions of nanostructures	PSO-1	U
CO-2	Apply the characterization techniques of nanomaterials (XRD,SEM,TEM and Analytical Electron Microscope)	PSO-3	Ap
CO-3	Explain the synthesis of nanomaterials and categorize their properties	PSO-2	An
CO-4	Interpret quantum well, quantum wires and quantum dots	PSO-5	E
CO-5	Explain the carbon nanotubes and its applications.	PSO-6	E
CO-6	Discuss the applications of nanotechnology in various fields	PSO-4	C

Modules

Credits: 4 **Total contact hours: 75 (Including assignments and tests)**

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Introduction to nanotechnology**					
	1	History of nanotechnology – Inorganic nanomaterials - Organic nanomaterials - Techniques in nanotechnology	3	To understand the history of nanotechnology and its techniques	Lecture Discussion with PPT illustration	Evaluation through short test Multiple choice

	2	Dimensions of nanostructures – One dimensional nanoscale – Two dimensional nanoscale– Three dimensional nanoscale	3	To be able to distinguish the dimensions of nanoscale	Lecture discussion with illustration	questions Formative assessment I
	3	Nanocrystals. Synthesis of nanomaterials: sol-gel method, ball milling, colloidal growth	3	To know the principles of nanomaterials and their synrhesis.	Lecture discussion	
	4	Characterization of nanomaterials – X-ray diffraction (XRD) – Scanning Electron Microscope (SEM) – Transmission Electron Microscope (TEM) – Analytical Electron Microscope – Significance of nanoparticles	3	To distinguish between nanorings, nanorods, nanoshells and to acquire knowledge on the properties of nanoparticles	Lecture discussion	
II	Quantum wells, Quantum wires and Quantum Dots					
	1	Introduction – Potential well – Quantum well – Particle in a box – One-dimensional box – Two-dimensional box – Three-dimensional box	5	To acquire knowledge on Potential ,Quantum well and Particle in a box	Lecture with PPT Illustration	Formative assessment I
	2	Superlattices– Types of Superlattices	3	To understand the concept of Superlattices and its types	Question-answer session Lecture	
	3	Applications of quantum wells –Quantum wire – Density of States (3D, 2D, 1D, 0D) –Quantum dots – Electrons in mesoscopic structures.	4	To know the density of States, Quantum dots and electron in mesoscopic structure	Lecture with PPT Illustration	
III	Carbon Nanotubes					
	1	Discovery of nanotubes –	3	To acquire	Lecture	

		Allotropes of carbon – Structure of carbon nanotubes		knowledge on discovery, Allotropes of carbon and structure of carbon nanotubes	Discussion videos ppt	Formative assessment II
	2	Categories of carbon nanotubes : Tours – Buckminster fullerene – Carbon nanohorns – Fullerite – Nanobud	3	To categorize carbon nanotubes	Lecture Discussion videos	
	3	Synthesis of carbon nanotubes: Laser method – Electrolysis – Chemical Vapour Deposition (CVD)	3	To have a knowledge on synthesis of carbon nanotubes	Lecture with PPT Illustration	
	4	Purification of carbon nanotubes and fullerene – Applications of carbon nanotubes.	3	To acquire knowledge on purification and applications of carbon nanotubes	Lecture Discussion videos	
IV Bionanotechnology						
	1	Biomachinery- DNA Nanotechnology	3	To understand the human body system and DNA	Lecture with PPT Illustration	Evaluation through short test
	2	Coding- Polymerisation	3	To acquire the Knowledge on Coding and polymerization	Lecture with PPT Illustration	Formative assessment II
	3	DNA computing – Electronic properties	3	To have a knowledge on DNA computing and electronic properties	Lecture with Discussion	
	4	Biocomputers –DNA sensing- Self-assembly	3	To know the biological devices and self assembly	Lecture with PPT Illustration	
V	Applications of Nanotechnology					
	1	Nanoelectronics- Single Electron Transistor- Principle- Coulomb Blockade	3	To have a knowledge on Solar power using nanotechnology	Lecture with PPT	Short test Formative assessment II

	2	NEMS- MEMS- Electronics – Batteries	3	To acquire knowledge on nanocomposites and nanotechnology in textiles	Brain storming session. Lecture Illustration	
	3	Water Purification- Ceramic membranes	3	To understand the nanooptics and nanotechnology in communication field	Lecture with PPT Illustration	
	4	Nanomedicine- photodynamic therapy – Tissue welding	3	To acquire knowledge on MEMS, Photonic crystals and thin film optics	Lecture Discussion videos	Open Book Test

PO- Program outcome; LO – Learning outcome; Cognitive Level R – Remember; U – Understand; Ap- Apply, An- Analyze; E-Evaluate; C- Create

Semester - VI **Major Core IX**

Name of the Course : Digital Systems and Applications

Subject code : PC1762

No. of Hours per week	No of Credits	Total no of Hours	Marks
6	5	90	100

Objectives: 1. To understand the different concepts in digital electronics, digital devices and applications.
2. To prepare students to perform the analysis and design of various digital electronic circuits.

CO	Upon completion of this course, students will be able to:	PSO addressed	CL
CO - 1	understand the fundamental concepts and techniques used in Digital Electronics.	PSO - 4	U
CO - 2	perform conversions among different number systems and apply in digital designing.	PSO - 2	Ap
CO - 3	infer the basic logic gates, understand Boolean algebra and simplify simple Boolean functions by using basic Boolean properties.	PSO - 1	U
CO - 4	understand, analyse and design various combinational and sequential circuits. (Flip flop, Counters, MUX, DEMUX, Encoder, Decoder etc.)	PSO - 5	Ap
CO - 5	understand the architecture and operations of microprocessor 8085.	PSO - 7	U
CO - 6	develop the basic idea about the instruction set and data transfer schemes.	PSO - 6	Ap

Total Hours: 90 (Incl. Seminar & Test)

Unit	Section	Description	Lecture hours	Learning outcome	Pagagogy	Assessment/Evaluation
I	**Logic gates and Boolean Algebra**					
	1	Universal logic gates – NOR, NAND	3	To be able to build basic logic gates OR, AND, NOT and Ex-OR using NOR	PPT, Lecture method	Quiz, Assignment, Formative assessment (I)

				and NAND only		
	2.	De Morgan's theorems – Positive and negative logic – Boolean laws and theorems	4	To simplify Boolean expressions	Lecture	
	3.	Sum of products method – truth table to Karnaugh map (Three variable and Four variable maps) – Karnaugh simplifications – Don't care conditions	4	To interpret the result of sum of product method using Karnaugh map	Lecture	
	4.	Product of sums method – Product of sums simplification.	4	To interpret the result product of sums method using Karnaugh map	PPT, Lecture, Group discussion	
II	**Number System**					
	1	Binary number system – Binary to decimal conversion	3	To understand the concept of binary number system	PPT,	Quiz, Assignment, Formative assessment (I)
	2.	Decimal to binary – Octal numbers – Hexadecimal numbers	4	To be able to convert decimal number into its equivalent binary, hexadecimal and octal numbers	Lecture, Problem solving	
	3.	Binary addition – Binary subtraction – 1^s and 2s complement method	4	To be able to add and subtract two binary numbers using 1s	Lecture, Group discussion, Problem solving	

				and 2s complement method		
	4.	Arithmetic building blocks – Half adder and full adder (truth table and Karnaugh map).	4	To know the basic Arithmetic building blocks	PPT, Lecture, Group discussion	
III	**555 timer and flipflops**					
	1	555 timer – Monostable multivibrator Astable multivibrator	4	To know the working principle of 555 timer	Lecture, Group discussion	Quiz, Assignment, Formative assessment (I & II),
	2	Frequency divider – Logic gate flip flop – R-S flip flop – Clocked R-S flip flop	4	To distinguish between R-S flip flop and Clocked R-S flip flop	PPT, Lecture,	
	3.	J-K flip flop – R-S master slave flip flop – J-K master – Slave flip flop	5	To understand the working principle of master slave flip flops	PPT, Lecture, Group discussion	
	4.	D flip flop	2	To understand the working principle of D flip flop	PPT, Lecture,	
IV	**Registers and Counters**					
	1	Types of registers – Serial in - Serial Out – Serial in - Parallel Out	2	To analyze various types of shift registers	PPT, Lecture,	Quiz, Formative assessment (II),

	2	Parallel in - Serial Out – Parallel in – Parallel Out	4	To distinguish between Parallel in Serial Out – Parallel in Parallel Out shift registers	PPT, Lecture,	
	3	Ring counter – Decade counter: A MOD - 5 counter	4	To know the principle of ring counter and decade counter	PPT, Lecture,	
	4	Shift counter – Shift counter Modulus.	3	To distinguish between various counters	PPT, Lecture,	
V	**A-D and D-A converters**					
	1	Variable Resistor Network – Binary Ladders	2	To understand the concept of binary ladders	Lecture, PPT	Group discussion, Formative assessment (II),
	2	D-A converter – A-D converter – Simultaneous conversion	3	To be able to convert D-A and A-D	Lecture.	
	3	Multiplexer – De multiplexer	4	To understand the concept of multiplexer and de multiplexer	Lecture, PPT	
	4	Encoder: Decimal to BCD encoder - Decoders : BCD to decimal decoder – Seven segment decoder	6	To be able to understand the operation of encoder and decoder	Lecture	

Semester : VI **Major Core - VIII**

Name of the Course : **Mathematical Methods of Physics**

Subject code : **PC1761**

No of hours per week	No of credits	Total no of hours	Marks
6	6	90	100

CO	Upon completion of this course, students will be able to:	PSO addressed	CL
CO - 1	Illustrate linear dependence and combination of vectors as quantities in Physics.	PSO - 4	U
CO - 2	Evaluate problems in matrices.	PSO - 4	E
CO - 3	Solve ordinary and partial differential equations related to Physical Science.	PSO - 2	C
CO - 4	Adapt Fourier transform technique to obtain the Fourier series of periodic functions of Physics.	PSO - 5	C
CO - 5	Understand and manipulate random variables using the theory of probability including tools of probability transformation and characteristic functions.	PSO - 6	U

Modules

Credit:6 **Total Hours:90 (Incl. Seminar & Test)**

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assesment/Evaluation
I	**Vector Analysis**					
	1	Point function - Scalar field – Vector field - Gradient of a Scalar field - Physical interpretation	4	To understand basic concepts of scalar field and vector field	Illustration and theoretical derivation	Evaluation through: quiz,
	2	Lamellar Vector field - line, surface and volume integrals -	3	To be able to evaluate line, surface and volume integrals	Illustration, Theoretical formulation Problem Solving	Problem solving

						Theoretical derivation
	3	Divergence of a vector function – Expression for divergence in Cartesian coordinates	2	To derive expression for divergence of a vector function	Analysis Theoretical formulation and Problem solving	Formative assessment
	4	Curl of vector function – Expression for curl in Cartesian coordinates – Physical significance of curl	4	To understand the physical significance of curl operator and solve physical problems	Theoretical formulation and Problem solving	
	5	Gauss divergence theorem – Green's theorem.	2	To derive Gauss divergence theorem and Green's theorem	Illustration and theoretical derivation	
II	**Matrices**					
	1	Eigen values - Eigen vectors	2	To understand the basic concepts of eigen values and eigen vectors	Theoretical formulation and Problem solving	Evaluation through: quiz,
	2	Characteristic equation of a matrix – Cayley – Hamilton theorem - – Theorems on eigen values and eigen vectors	5	To derive theorems on eigen values and eigen vectors	Illustration and theoretical derivation	Problem solving
	3	Diagonalization of matrices – Special type of matrices – Inverse of a matrix	5	To diagonalize and also find inverse of the given matrix	Theoretical formulation and Problem solving	Theoretical derivation
	4	Non-homogenous linear equations – Cramer's rule for solving non-homogenous linear equations	3	To solve non-homogenous linear equations using Cramer's rule	Illustration, Theoretical formulation and Problem solving	Formative assessment
III	**Differential Equations**					

	1	First order equations – Variables separable method	4	To use variable separable method to solve first order differential equations	Illustration, Theoretical formulation and Problem solving	Evaluation through: quiz,
	2	Homogenous equations – Non – homogenous equations reducible to homogenous ones –	4	To reduce non homogenous equations to homogenous equations	Illustration, Theoretical formulation and Problem solving	Problem solving
	3	Linear differential equations – Equations of first order and higher degrees	4	To understand the solving of first order and higher order differential equations	Illustration, Theoretical formulation and Problem solving	Theoretical derivation
	4	Physical examples: Radioactive decay process.	3	To apply solving techniques of differential equation to solve physical problems	Illustration, Theoretical formulation and Problem solving	Formative assessment
IV	**Fourier Analysis**					
	1	Harmonic oscillations – Harmonic synthesis and analysis – Fourier contribution	4	To understand the basic concepts of harmonic synthesis	Illustration, Theoretical formulation	Evaluation through: quiz,
	2	Fourier series –Dirichlet's theorem – Fourier coefficients – Fourier cosine and sine series	5	To evaluate Fourier series	Illustration, Theoretical formulation and Problem solving	Problem solving
	3	Symmetry – Complex form of Fourier series – Change in interval of expansion	4	To apply Fourier theorem for change in interval of expansion	Descriptive lecture and Theoretical formulation	Theoretical derivation
	4	Applications of Fourier series: Sawtooth wave - Half wave rectifier – Full wave rectifier	2	To use Fourier series to evaluate physical problems	Descriptive lecture and Theoretical formulation	Formative assessment
V	**Random Variables and Probability**					

	1	Random Variables – Simple random sample – Mean – Median – Mode – Dispersion	5	To understand basic concepts of random variables	Illustration, Theoretical formulation	Evaluation through: quiz,
	2	Elementary properties of probability – Conditional probability – Addition rule of probability – Multiplication law of probability	6	To verify addition rule of probability and multiplication law of probability	and Problem solving	Problem solving Theoretical derivation
	3	Probability distribution – Mean, variance and standard deviation of Poisson distribution.	4	To analyze probability distribution and solve physical problems	Illustration, Theoretical formulation	Formative assessment

PO- Program outcome; LO – Learning outcome; Cognitive Level R – Remember; U – Understand; Ap- Apply, An- Analyze; E-Evaluate; C- Create

Semester VI

Major core X: Nuclear Physics

Subject Code: PC1763

No of hours per week	No of credits	Total no of hours	Marks
5	5	75	100

Objective: 1. To enable the students to understand the properties, models and radioactive reaction of the nucleus.

2.To create awareness on nuclear reactions such as fission, fusion, radiation detectors and elementary particles so that students can shine.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO- 1	**Define** the fundamentals of nuclear matter (properties of nuclei and Nuclear forces)	PSO-2	R
CO- 2	**Apply** the principles of physics in the measurements of Nuclear size, Nuclear spin, Nuclear energy levels and Nuclear magnetic moment	PSO-1	Ap
CO- 3	**Assess** radioactivity and various nuclear reactions (nuclear fission and fusion)	PSO-3	E
CO -4	**Explain** the decay modes, Radiation Detectors and Particle Accelerators (Ionisation chamber,Proportional counter,Geiger Muller counter,Linear accelerator, Cyclotron, Synchro cyclotron, Betatron)	PSO-5	U
CO- 5	**Discuss** the classification of elementary particles and Quark model	PSO-5	E
CO -6	**Analyse** the characteristics and behavier of elementary particles and their fundamental interactions	PSO-7	An
CO -7	**Develop** a deeper understanding of some important applications of nuclear physics in Nuclear Reactor and Source of stellar energy.	PSO-6	C

Modules

Total contact hours: 75 (Including lectures, assignment and tests)

Unit	Section	Topics	Lecture Hours	Learning outcomes	Pedagogy	Assessment/Evaluation
I	**Properties of Nuclei**					
	1	Constituents of nuclei - Isotopes, Isobars, Isotones and mirror nuclei - Nuclear mass and binding energy - Unit of atomic mass - Binding energy and stability of nucleus	**3**	Define the basis of nuclei and stability of nucleus	Lecture discussion	Evaluation Class test, oral question Assignment I
	2	Mass defect and packing fraction - Binding fraction Vs mass number curve - Nuclear size - Nuclear spin - Nuclear energy levels	**3**	Apply various Binding energy relations	Derivation and group discussion	
	3	Nuclear magnetic moment - Parity of nuclei - Nuclear quadrupole moment - Statistics of nuclei	**3**	solution of Nuclear magnetic moment	Derivation, problem solving and group discussion	
	4	Nuclear forces - Liquid drop model - Semi-empherical mass formula - Shell model	**3**	Apply Nuclear forces in different models	Derivation and group discussion	

II	**Radioactivity**					
	1	Radioactivity - Radioactive reactions - Radioactive decay law - Statistical nature of radioactivity	**3**	Solve Radioactive reactions	Derivation discussion	Evaluation Class test, oral question Assignment I/II
	2	Activity or strength of a radio-sample - Radioactive decay : Conservation laws	**3**	Define and derive Radioactive decay	Derivation and group discussion problem solving	
	3	Radioactive series: Displacement law - Successive transformation – Radioactive equilibrium	**3**	Statement and proof of displacement law	Derivation and group discussion problem solving	
	4	Radioactive dating: Age of minerals, rocks - Alpha decay - Beta decay - Gamma decay.	**3**	Radioactive dating and its applications	Derivation and group discussion problem solving	
III	**Nuclear Reactions**					
	1	Nuclear Reactions: Basics - Conservation laws in nuclear Reactions - Energetics of nuclear Reactions	**3**	Analyse Conservation laws in nuclear Reactions	Derivation discussion	Evaluation Class test, oral question Assignment II
	2	Cross section of nuclear Reactions - Reaction mechanisms -	**2**	Define and derive nuclear Reactions , Reaction mechanisms	Derivation and group discussion	

		Nuclear fission - Energy released in fission of U-235		&Nuclear fission		
	3	Liquid drop theory of fission - Nuclear chain reaction - Nuclear Reactor - Types of reactor - Breeder reactor - Fission bomb	**4**	Define and Derive Nuclear chain reaction, Types of reactor, Breeder reactor & Fission bomb	Derivation and group discussion, PPT	
	4	Fusion: Thermo nuclear reaction - Source of stellar energy: Natural fusion - Uncontrolled fusion: Hydrogen bomb.	**3**	Define, derive and apply Uncontrolled fusion: Hydrogen bomb	Derivation and group discussion	
IV	**Radiation Detectors and Particle Accelerators**					
	1	Introduction - Ionisation chamber - Proportional counter - Geiger Muller counter - Neutron detection	**3**	Discuss different types of Radiation Detectors	Derivation discussion	Evaluation Class test, oral question Assignment II/III
	2	Cloud chamber - Scintillation counter - Photographic detection - Solid state track detector	**3**	Define and derive Cloud chamber & Scintillation counter	Derivation and group discussion, PPT	
	3	Semiconductor detector - Particle accelerators - Linear accelerator	**3**	Define and Derive different types of Particle accelerators	Derivation and group discussion	
	4	Cyclotron - Synchro cyclotron -	**3**	Define , derive and apply	Derivation and group discussion	

		Betatron		Cyclotron , Synchro cyclotron and Betatron		
V	**Elementary Particles**					
	1	Introduction - Fundamental Interactions - Pions and Muons - K mesons – Hyperons, Antiparticles	**3**	Analyse Fundamental Interactions	Discussion PPT	Evaluation Class test, oral question Assignment **III**
	2	Classification of elementary particles - Conservation laws - CPT theorem	**3**	Analyse classification of elementary particles	Derivation and group discussion, PPT	
	3	Resonance particles - Symmetry classification of elementary particles	**3**	Explain symmetry classification of elementary particles	Derivation and group discussion	
	4	Quark model Unification of interactions - The standard model.	**3**	Define , derive and apply Quark model	Derivation and group discussion, PPT	

Books:

1. Gupta, A.B. (2015). *Modern Physics*. (2nd ed.). New Delhi: Books and Allied (P) Ltd.

Unit I: Chapter 18 : 18.1-18.3, 18.5-18.16, 18.17, 18.18, 18.18.1, 18.19, 18.19.1 - 18.19.4

Unit II: Chapter 19 : 19.1 - 19.9, 19.11

Unit III: Chapter 20: 20.1-20.16

Unit IV: Chapter 21: 21.1-21.5, 21.7, 21.7.1, 21.7.2, 21.9, 21.11-21.16, 21.17.2, 21.18

Unit V: Chapter 22: 22.1-22.9, 22.10, 22.11-22.14

2. Arthur Beiser. (2006). *Concepts of Modern Physics*. (6th ed.).New Delhi: Tata McGraw - Hill Edition,

Unit II: Chapter 12: 12.4-12.6, Appendix (theory of alpha decay)

Reference Books:

1. Tayal D.C. (2002). *Nuclear Physics*. (1st ed.). New Delhi: Himalaya Publishing House.

2. Roy R.R. and Nigam B.P. (1983). .*Nuclear Physics*, (2nd ed.). Bangalore: New age International Ltd.

3. SatyaPrakash, (2004). *Nuclear Physics and Particle Physics*. (1st ed.). New Delhi: S. Sultan Chand & Sons Publications.