# B.Sc. PCM (Physics)

## SEMESTER-III

| 17UPHCC05 | Core:5 Mathematical and Solid State Physics | 4 hours/week | Credits:4 |
|---|---|---|---|

## UNIT I: *Vectors* *(12 Hr)*

- Introduction to Vector and vector algebra
- Vectors transform
- Gradient
- The operator Del (∇)
- The Divergence
- The Curl and their significance
- Fundamental theorem for Gradient for Divergences and Curls
- Relations between fundamental theorems

## UNIT II: *Fourier analysis* *(09 Hr)*

- Introduction
- Definition and derivation of the coefficients of Fourier Series
- Exponential form of Fourier series and evaluation of its constants
- Odd and Even series
- Parseval's equation and Fourier integral
- Application of Fourier integral as wave packet and derivation of uncertainty principle
- Applications of Fourier analysis

## UNIT III: *Solid state* *(10 Hr)*

- Introduction
- Forces between atoms
- Bonding energy
- Bonding in solids
- Ionic bonds and Ionic crystals
- Properties of Ionic Solids
- Covalent bonds , Covalent crystals and its properties
- Metallic bond
- Molecular bond : Hydrogen and Vander walls Bond
- Comparison between various bonds

- Electron drift in electric field
- Classical Free electron theory of metal
- Band theory of metals and classification of conductors , Insulator and semiconductor

## UNIT IV: *Crystallography* *(10 Hr)*

- Introduction
- Concept of lattice , Primitive and unit cell
- Bravais lattice in three dimension
- Seven crystal system
- Miller indices of cubic planner and directions
- Elementary crystal system ( NaCl , ZNS and Diamond)
- Hexagonal packed structure

## UNIT V: *X - Rays* *(12 Hr)*

- Origin of X - Ray
- Properties of X – Ray
- X – Ray Spectra
- Coolidge tube method
- Intensity measurement technique
- Laues Spots
- Bragg's law and Bragg spectrometer
- Application of X - Ray

**Text Book:**

- Mathematical Physics by B.S. Rajput
- Solid state Physics by C. Kittel

**Reference Books:**

- Mathematical Physics by Jyoti Kumar
- Introduction to Modern Solid State Physics by Yuri M. Galperin

| 17UPHCC06 | Core:6 Physics Practical 3 | 5 hours/week | Credits:3 |
|---|---|---|---|

Exp.1. Determination of crystal structure by X – Ray film
Exp.2. Young Modulus by bending.
Exp.3. Energy band gap by thermister
Exp.4. M.I of a Flywheel
Exp.5. Fourier analysis of given wave form
Exp.6. Determination of temperature coefficient of resistivity of given semiconductor.
Exp.7. Fabrication – I: Zener diode as voltage regulator
Exp.8. Fabrication - II: Full wave rectifier
Exp.9. To determine thermal conductivity of given bad conductor
Exp.10. Detraction grating

# B.Sc. PCM (Physics)

## SEMESTER-IV

| 17UPHCC07 | Electro and Magneto static & Electronics | 4 hours/week | Credits:4 |
|---|---|---|---|

**UNIT I:** ***Electrostatic*** ***(10 Hr)***

- Introduction
- Coulombs law ,Electric Field
- Continuous charge distribution
- Field lines and flux
- Divergence of electric field and Gauss law
- Curl of Electric filed
- Electrical Potential
- Poisson and Laplace equation
- Potential of point charge distribution
- Work and energy in electrostatic
- Energy of continuous charge distribution

**UNIT II:** ***Magneto static*** ***(8 Hr)***

- Introduction
- Magnetic field
- Magnetic forces
- Currents
- Biot-Savart's law
- Divergence and curl of magnetic field
- Comparison between magneto static and electro static
- Magnetic vector potential

**UNIT III:** ***Transistor (BJT)*** ***(12 Hr)***

- Introduction
- Current flows in transistors
- Transistor circuit configuration
- Current amplification factor
- Leakage current
- Comparison between three configuration
- Why CE amplifier is preferred?

**CE Amplifier:**

- Characteristic of CE transistor
- Cut off , active and saturation region
- Amplification action
- Phase relation between input and output

- D.C. and A.C. Load Line.
- Limit of operation

## UNIT IV: *Transistor Biasing* *(12 Hr)*

- Operating point
- Single stage transistor amplifier
- Multi stage transistor amplifier explanation with block diagram
- Biased stabilization and its requirement
- Stability factor
- Method of transistor biasing ( Fix biases , Collector to base bias , Emitter Biased and Voltage divider Biased and analysis)

## UNIT V: *Field effect transistor* *(10 Hr)*

- Introduction
- Types of FET
- Junction field effect transistor
- Working principle of JFET
- Schematic symbol of JFET
- Importance of JFET
- Difference between BJT and JFET
- JFET characteristics
- Parameters of JFET
- JFET single stage amplifier
- Advantages of JFET
- Introduction to MOSFET and its working
- Type of MOSFET
- Current flow in MOSFET

**Text Books:**

- Basic electronics by Malvino
- Properties of Matter by R Murugeshan

**Reference Books:**


- N N Bhargav and Kushreshtha ,Basic Electronics and Linear Circuits
- Allen Mottershead, Electronic Device and Circuits
- D.S. Mathur, S. Chand Publications, Elements Of Properties Of Matter
- C.Kittel , Introduction to Solid State Physics

| 17UPHCC08 | Core:8 Physics Practical 4 | 5 hours/week | Credits: 3 |
|---|---|---|---|

Exp.1. CE Transistor characteristics and parameters

Exp.2. CE Transistor characteristics and D.C. Load Line and Q - Point

Exp.3. Deflection magnetometer

Exp.4. Magnetic field of solenoid

Exp.5. FET characteristics

Exp.6. FET as a voltmeter

Exp.7. Parameters of FET

Exp.8. Fabrication of regulated power supply using 3 – Pin regulation and its Load Characteristics

Exp.9. Fabrication of Zener regulated power supply and its Load Characteristics

# B.Sc. PCM (Physics)

## SEMESTER-V

| 17UPHCC09 | C.M & Q.M | 4 hours/week | Credits:4 |
|---|---|---|---|

## Classical Mechanics

**UNIT I:** ***Lagrangian Formulation*** **(16 *Hr*)**

- Constraints
- Generalized coordinates
- D'Alembert's principle
- Lagrange' equations
- A general expression for kinetic energy
- Symmetries and laws of conservation
- Cyclic or ignorable coordinates
- Velocity-dependent potential of electromagnetic field
- Rayleigh's dissipation function
- Problems

**UNIT II:** ***Variational Principle*****:** **(16 *Hr*)**

- Lagrange's and Hamilton's Equations Configuration space,
- Hamilton's principle
- Equivalence of Lagrange's and Newton's equations
- Advantages of the Lagrangian formulation-electro-mechanical analogies
- Lagrange's undetermined multipliers
- Applications of the Lagrangian method of undetermined multiplies
- Hamilton's equations of motion
- Some applications of the Hamiltonian formulation
- Phase space
- Problems.

**Text Books for Unit I & II:**

- Introduction to Classical Mechanics by Takwale and Puranik.
- Classical mechanics by Griffith.

## UNIT III: *The Schrodinger equation and Stationary States Schrodinger equation* (13 *Hr*)

- A Free Particle In One Dimension
- Generalization To Three Dimensions
- The Operator Correspondence And The Schrodinger Equation For A Particle Subject , Normalization And ψ To Forces
- Physical Interpretation On Probability Interpretation
- Non-Normalizable Wave Functions And Box Normalization
- Conservation Of Probability
- Expectation Values, Ehrenfest's Theorem
- Admissibility Conditions On The Wave Function,
- Stationary States: The Time Independent Schrodinger Equation
- A Particle In A Square Well Potential, Bound States In A Square Well(E0)

## UNIT IV: *General Formalism of Wave Mechanics Schrodinger Equation and the Probability* (13 *Hr)*

- Interpretation for an N Particle System
- The Fundamental Postulates of Wave Mechanics: (a) Representation of States (b) Representation of Dynamical Variables
- The Adjoint of an Operator, and Self Adjointness
- The Eigen value Problem; Degeneracy
- Eigen values and Eigen functions of Self-Adjoint Operators
- The Dirac-Delta function

## Text Books for Unit III & IV:

- Text Book of Quantum Mechanics by Mathews and Venkateshan
- Quantum Mechanics: Theory and Applications by A. K. Ghatak & Loknathan

## Reference Books:


- Mathematical Physics - P.K.Chattopadhyay
- Mathematical methods in Physical Science - M.L.Bose, John Willy & Sons
- Classical Mechanics - Gupta, Kumar and Sharma. Pragati Prakashan, Meerut, India
- Classical Mechanics - Goldstein
- Quantum Mechanics - Ghatak and Loknathan, Macmillan India Ltd., Delhi
- Quantum Mechanics - Ajoy Ghatak
- Elements of Quantum Mechanics - Kamal Singh and S.P.Singh, S.Chand Co.

| | | | |
|---|---|---|---|
| **17UPHCC10** | **Self study (Recent trends in physics)** | **1 hours/week** | **Credits:4** |

**Different topics on recent trends in physics will be assigned to students (On individual base or in group)**

| | | | |
|---|---|---|---|
| **17UPHDC01** | **Optics , statistical Mechanics , Spectroscopy** | **4 hours/week** | **Credits:4** |
| **17UPHDC02** | **Solid State Physics** | **4 hours/week** | **Credits:4** |
| **17UPHCC 11** | **CBT** | | **Credits:2** |
| **17UPHCC 12** | **Practical (C.M. & Q.M.)** | **9 hours/week** | **Credits:3** |
| **17UPHDC03** | **Practical** | **6 hours/week** | **Credits:2** |
| **17UPHDC04** | **Practical** | **6 hours/week** | **Credits:2** |

# B.Sc. PCM (Physics)

## SEMESTER-VI

| | | | |
|---|---|---|---|
| **17UPHCC13** | **Electrodynamics and Nuclear Physics** | **4 hours/week** | **Credits:4** |
| **17UPHDC05** | **Electronics** | **4 hours/week** | **Credits:4** |
| **17UPHDC06** | **Electronics and Communication** | **4 hours/week** | **Credits:4** |
| **17UPHCC14** | **Practical Electrodynamics and Nuclear Physics** | **9 hours/week** | **Credits:4** |
| **17UPHDC07** | **Practical Electronics** | **5 hours/week** | **Credits:2** |
| **17UPHDC08** | **Practical Electronics and Communication** | **5 hours/week** | **Credits:2** |
| **17UPHCC15** | **Project/Internship/Training** | **6 hours/week** | **Credits:2** |