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## Syllabus 2023-24
## Panjab University

# BSc
# (PHYSICS)
# SIXTH SEMESTER

SCO 80-81, Sec.15D, Chandigarh
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## PHYSICS

## SEMESTER – VI

**Papers, marks and teaching hours allocation:**

| | | |
|---|---|---|
| Paper A : | Condensed Matter Physics - II | Total Teaching hours 30 |
| Paper B : | Electronics and Solid State Devices - II | Total Teaching hours 30 |
| Paper C : | Nuclear & Particle Physics - II | Total Teaching hours 30 |
| | Physics Practicals | Total Teaching hours 45 |

### Paper A : CONDENSED MATTER PHYSICS - II (30 Hrs.)

### UNIT-I

Lattice Dynamics : Lattice vibrations and phonons, Scattering of photons by phonons, Dynamics of a linear chain of similar atoms and chain of two types of atoms, optical and acoustic modes, Density of modes, Einstein and Debye theories of specific heats of solids.

Magnetic classification of materials (Dia, para, ferro, ferri, antiferro), Langevin theory of dia and paramagnetism, Quantum theory, Weiss's theory of Ferromagnetism, temperature dependence, hysteresis of ferromagnetic materials.

### UNIT-II

Dielectric constant & polarizability, electric susceptibility, Clausius Mosotti equation, frequency dependence, ferroelectrics and Piezoelectrics.

Liquid crystals, various types and properties. Applications.

Superconductivity: Meisner effect, London's equation and penetration depth, critical magnetic field and temperature, DC and AC Josephson effect, BCS theory (formation of cooper pairs), ground state and energy gap.

Basic ideas of materials at nanoscale: Difference from bulk material properties, Nanoparticles, introduction to fabrication and characterization techniques, Carbon Nanostructures - nanotubes, grapheme. Applications of nanotechnology in various fields.

### Recommended Books :

*Essential Readings :*

1. *Introduction to Solid State Physics, C.* Kittel, Wiley Eastern
2. *Elements of Modern Physics,S.*H. Patil, Tata McGraw Hill, 1985.
3. *Solid State Physics, 6th Edition,* S.O. Pillai, New Age International Publishers.
4. *Fundamental of Physics, Vol. II,* R.M.P. Jaiswal, S.K. Gupta and A. Rani, R. Chand and Co.

*Further Readings :*

1. *Elements of Solid State Physics,* 2nd Edition, J.P. Srivastava, Prentice Hall.
2. *Elementary Solid State Physics,* M. Ali Omar, Pearson.
3. *Crystallography for Solid State Physics,* A.R. Verma, O.N. Srivastava, Wiley Eastern.

**Paper-B : ELECTRONICS AND SOLID STATE DEVICES - II (30 Hrs.)**

**UNIT-I**

Structure and working of JEFT, characteristics, drain and transconductance curve, FET amplifier and its voltage gain, Structure and working of MOSFET.
Feed back in amplifiers, voltage gain of negative feedback amplifier, advantages of negative voltage feedback, negative current feedback circuit, emitter follower .
Theory of sinusoidal oscillations, loop gain and phase, Lead-lag RC circuit, Wein bridge oscillator. Barkhausen criterion of sustained oscillations, positive feedback amplifier, LC oscillators, Colpitts and Hartley oscillators.
(Book1, Book2)

**UNIT-II**

Operational amplifier (black box approach) : Characteristics of ideal and practical opamp 741, open-loop and closed-loop gain, characteristics and applications - inverting and non-inverting amplifiers, adder, subtractor, differentiator and integrator, Comparator, Timer IC555, pin diagram and its applications as astable and monostable multivibrator.
(Book1, Book2)

Analog and digital circuits, binary numbers, decimal to binary conversions, AND, OR, NOT gates, NAND NOR gates as universal gates, XOR and XNOR gates.
De Morgan's theorem, Simplification of logic circuit using Boolean algebra, Minterms and Maxterms, Conversion of a truth table into an equivalent logic circuit by Sum of products method. (Book 3)

Analog and digital communication systems, Amplitude and Frequency modulation, Power in AM wave, generation and detection, Brief account of Satellite communication, Sky-wave communication, and mobile communication.

**Recommended Books :**

*Essential Readings :*

1. *Electronic Devices and Circuit Theory*, 7th Ed., R. Boylestad, L. Nashelsky, Prentice Hall Inc
2. *Electronic Principles, A.P.* Malvino, and D.J. Bates, 7th *ed.* McGraw Hill
3. Digital Principles and Applications, 7th Ed., A.P. Malvino, D.P. Leach and Saha, 2011, Tata McGraw Hill

*Further Readings :*

1. *Basic Electronics,* 5th Edition, B.L. Thareja, S. Chand.
2. *Basic Electronics and Linear Circuits, N.N.* Bhargave, D.C. Kulshreshtha, and S.C. Gupta,Tata McGraw Hill.
3. *Foundations of Electronics, D.* Chatopadhyay, P.C. Rakshit, B. Saha and N.N. Purkit, New Age International

**Paper-C : NUCLEAR AND PARTICLE PHYSICS - II (30 Hrs.)**

**UNIT-I**

Interaction of nuclear radiation with matter: Energy loss due to ionization (Bethe Bloch formula), Range and energy straggling, Energy loss of electrons and positrons, radiation loss by fast electrons, Bremsstrahlung, electron-positron annihilation, production of Cerenkov radiation,
Gamma-ray interaction with matter, photoelectric effect, Compton scattering, pair production (qualitative description).
Detectors for nuclear radiation: Gas-filled detectors, Ionization chamber, proportional counter, G.M. counter, Scintillation detector and Photomultiplier tube, Brief account of Semiconductor detectors.

**UNIT-II**

Particle Physics : Particle interactions : basic features and their exchange particles, Classification of elementary particles, properties, decay modes of leptons and mesons, Antiparticles, charge conjugation
Symmetries and Conservation principles, Lepton number, baryon number, Isospin, Hypercharge, Strangeness and charm, Gell-mann Nishijima formula
Concept of the quark model, color quantum number and gluons.
Origin and composition of Cosmic rays, Secondary cosmic rays, Effect of magnetic field of earth, Van Allen belts.
Particle accelerators: Cockcroft-Walton accelerator, Van-de Graaff generator, Tandem accelerator Linear accelerator, Cyclotron. Brief account of Syncrhrotron, Accelerator facilities available in India.

**Recommended Books :**

*Essential Readings:*

1. *Concept of Modern Physics,* 6th Ed., A. Beiser, S. Mahajan and S.R. Choudhury, Tata McGraw Hill.
2. *Nuclear Physics, I.* Kaplan,Addition-Wesley, Publishing Company Inc.
3. *Physics for Degree Students*, C.L. Arora and P.S. Hemne, S. Chand & Co., 2014.
4. *An Introduction to Nuclear Physics, M.R.* Bhiday, and V.A. Joshi, Orient Longman.

*Further Readings :*

1. *Concepts of Nuclear Physics, B.L.* Cohen, Tata McGraw Hill
2. *Fundamentals of Nuclear Physics, J.* Verma, CBS.

**PHYSICS PRACTICALS**

**The Practical examination will be held along with the sixth semester examinations.General Guidelines for Physics Practical Examinations and syllabus is given in syllabus for Semester V.**

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