

**B. Tech. I (All branches)**  
**PH 113 S2: Physics of Materials and Nuclei**

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- **CRYSTALLOGRAPHY (10 hours)**  
Crystalline and amorphous solids, Lattice and unit cell, Seven crystal system and Bravais lattices, Symmetry operation, Miller indices, Atomic radius, Coordination number, Packing factor calculation for SC, BCC, FCC, Bragg's law of X-ray diffraction, Laue Method, Powder crystal method.
  - **SEMICONDUCTOR PHYSICS (06 hours)**  
Introduction, Direct and indirect band gap semiconductors, Intrinsic and extrinsic semiconductors, Law of Mass action, Charge neutrality, Hall effect.
  - **NANOMATERIALS (10 hours)**  
Introduction and properties, Synthesis: Chemical vapour deposition, Ball milling and relevant applications, Carbon nanotubes: structure and properties and Synthesis: Arc method and Pulsed laser deposition, Applications.
  - **MAGNETIC MATERIALS, CONDUCTORS AND SUPERCONDUCTORS (10 hours)**  
Magnetic materials: Definition of terms, Classification of magnetic materials and properties, Domain theory of ferromagnetism, Hard and soft magnetic materials, Conductors: Classical free electron theory (Lorentz–Drude theory), Electrical conductivity, Superconductors: Definition, Meissner effect, Type I & II superconductors.
  - **STATISTICAL MECHANICS (10 hours)**  
Macroscopic and microscopic states, Phase space, Condition for statistical equilibrium, Micro-canonical ensemble, canonical ensemble, Grand-canonical ensemble, Partition function, Bose-Einstein and Fermi-Dirac distribution.
  - **NUCLEAR AND PARTICLE PHYSICS (10 hours)**  
Nuclear properties and forces, Nuclear models, Shell model, Nuclear reaction, Radioactivity, Types and half-lives, Application in determining the age of rock and fossils, Stellar nucleosynthesis, Fundamental forces, Particle physics, Classification of matter, Quark model, Neutrino properties and their detection.

**Total Contact Time: 56 Hours**

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**BOOKS RECOMMENDED:**

**Text Books:**

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|--------------------------------------|-------------------------------|-------------|------|
| 1. <b>R. Resnick and D. Halliday</b> | Physics (Part I & II)         | Wiley       | 2007 |
| 2. <b>A. Beiser</b>                  | Concept of the Modern Physics | McGraw-Hill | 2008 |
| 3. <b>K. Huang</b>                   | Statistical mechanics         | Willey      | 2008 |

**Reference Books:**

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|--|-------------------------------------|---------|------|
| 1. <b>M. N. Avadhanulu and P. G. Kshirsagar</b>  | A text book of Engineering Physics  | S Chand | 2009 |
| 2. <b>C. Kittel</b>                              | Introduction to Solid State Physics | Wiley   | 2016 |
| 3. <b>K. K. Chattopadhyay and A. N. Banerjee</b> | Nanoscience and Nanotechnology      | PHI     | 2014 |