# ENGINEERING PHYSICS

**I B. Tech: ECE, EEE, CSIT, IT, AERO, MECH**

| Course Code: | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| A5BS09 | BSC | 3 | 1 | 0 | 4 | 30 | 70 | 100 |
| Contact Classes: 44 | Tutorial Classes: 08 | Practical Classes:0 | | | | Total Classes: 52 | | |

## Course Objectives:

**The course should enable the students to:**

1. Describe the chemical reaction and phase transformation in materials by using modern thermodynamic models
2. Learn the fundamentals of transport properties of materials
3. Describe the interactions of light with materials which results in colour and the temperature dependence of magnetic susceptibility
4. Learn the basic principles of optical fiber and its communication system
5. Understand the development of Nano technology and synthesis of Nano materials by using different techniques

## Course Outcomes:

**The student will able to:**

1. **Analyze** the bonding scheme and its physical properties of a given material
2. **Evaluate** the dimensionality, rates of a nucleation and growth process from kinetic data
3. **Evaluate** the curie and Neel temperature of a given substance.
4. **Justify** how the graded index optical fibre is more efficient than step index optical fiber in fiber optic communication system
5. **Recommend** appropriate synthesis method and explain the characterization techniques

| UNIT-I | The Structure of Materials&Thermodynamics of Condensed Phases | Classes: 09 |
|---|---|---|

**The Structure of Materials:** Structure of Metals and Alloys-- Space lattice, unit cell, basis, crystal systems, Bravais lattice, S.C, B.C.C & F.C.C Structures. Structure of Ceramics and Glasses – Rock salt structure, Diamond structure, structure of $SiO_4$.

**Thermodynamics of Condensed Phases:** Introduction – Thermodynamics of Metals and Alloys, -Gibbs rule, Cu- Ni phase diagram, Eutectic systems, Iron-Iron carbide (Fe-$Fe_3C$) equilibrium diagram.

| UNIT-II | Transport Properties of Materials& Band theory of solids | Classes: 09 |
|---|---|---|

**Transport Properties of Materials:** Introduction -Momentum Transport properties of Materials, -The Molecular Origins of Viscosity, Temperature Dependence of Pure MetalViscosity, Composition Dependence of alloy Viscosity.

**Band theory of solids**: Free electron theory, Origin of energy band formation in solids, Estimation of Fermi-level, Kronig-Penny model, E-K diagram.

| UNIT-III | Properties of materials | Classes: 09 |
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**Electrical and Optical properties** -Conduction, Semi conductivity, Electrical Conduction in Ionic Ceramics.Reflection, Refraction, Absorption and transmission. Opacity and Translucency in insulators. Light interaction with solids, EMR, atomic and electronic interaction.

**Magnetic properties** – Introduction, Types of magnetic materials, influence of temperature on magnetic behavior, Hysteresis curve, Soft and Hard magnetic materials, Magnetic storage, Ferrite applications.

| UNIT-IV | Optoelectronic devices and optical fibers | Classes: 09 |
|---|---|---|

**Optoelectronic devices:** Introduction to Semiconductors, PN Junction Diode, V-I characteristics and applications. LED - Construction, working and applications. Solar cells- working and its applications. Efficiency issues of Solar cell, PIN diode characteristics.

**Fiber Optics:** Structure of fibers, Principle of fiber (TIR), Acceptance angle and NA. Types of fibers- SI and GI fibers- R.I profiles. Single and Multimode fibers-SMSI, MMSI, MMGI. OFC System with block diagram. Fiber optic sensors – Basic principle, working of Pressure and Temperature Sensors. Applications of fibers in different fields.

| UNIT-V | Introduction to Engineered materials | Classes: 08 |
|---|---|---|

**Synthesis of Nano materials:** Introduction to nano particles, nano scale, Surface to volume ratio and quantum confinement. Techniques for synthesis of nano materials-Top Down and Bottom Up methods– Sol gel, CVD methods and Photolithography.

**Characterization of Nanomaterials:** Imaging methods – SEM, TEM and STM. Applications of Nano materials in engineering and Biomedical fields and other fields.

**Text Books:**


1. Engineering Physics, B.K. Pandey, S. Chaturvedi – Cengage Learing
2. Haliday and Resnick, Physics – wiley
3. P.K Palanisamy, Engineering Physics, Sitech Publications, 2013, IVthEdn.
4. Essentials of Nano Tecnology by Jeremy Ramsden.
5. An introduction to materials engineering and science by Brian S. Mitchell


**Reference Books:**


1. Hecht, “Optics”, Pearson Education, 2008.
2. D. A. Neamen, “Semiconductor Physics and Devices”, Times Mirror High EducationGroup, Chicago, 1997.
3. Fundamentals of material science and engineering by William D. Callister, Jr. David G. Rethwisch


**Web references:**

1. https://www.edx.org/course?search_query=semiconductor+physics
2. https://www.edx.org/course/nanotechnology-fundamentals-purduex-nano530x
3. https://www.edx.org/course/physics-electronic-polymers-pep-purduex-nano600

**E -Text Books:**

1. http://www.phys.sinica.edu.tw/TIGP-NANO/Course/2010_Fall/classnotes/NanoB_week14.pdf
2. https://www.scribd.com/document/70908178/Semiconductor-Devices-Basic-Principles-Jasprit-Singh
3. https://www.scribd.com/doc/105174065/Fundamentals-of-Photonics
4. ftp://nozdr.ru/biblio/kolxo3/P/PE/PEo/Thyagarajan%20K.,%20Ghatak%20A.%20Lasers..%20Fundamentals%20and%20Applications%20(2ed.,%20GTP,%20Springer,%202010)(ISBN%2014419644 1X)(O)(674s)_PEo_.pdf
5. https://subodhtripathi.files.wordpress.com/2012/01/optical-fiber-communications-by-gerd-keiser_2.pdf
6. http://www.hailienene.com/resources/nano-technology.pdf

**MOOCs Courses:**

1. http://nptel.ac.in/courses/118104008/1 (Fundamentals of Nano technology)
2. http://nptel.ac.in/courses/118104008/13 (Nano structures, synthesis and characterization)
3. https://nptel.ac.in/courses/113/104/113104096/( mateiral science)
4. https://nptel.ac.in/courses/113/102/113102080/(Metallurgy and material science)