Syllabi-2012 Regulation:

12S104 MATERIALS SCIENCE				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

COURSE OBJECTIVES- Upon completion of this course the students will be familiar with:

- The properties of conducting, semiconducting and magnetic materials.
- The application of magnetic and super conducting materials.
- Application and properties of dielectric materials.
- Applications and properties of Modern engineering materials.
- Nano materials and its properties.

COURSE OUTCOMES-Upon completion of this course the students will be able to:

CO1: Analyze properties of conducting materials. **[Familiarity]**

CO2: List and analyze the properties of Semiconducting materials and devices. **[Familiarity]**

CO3: Identify and analyze magnetic and super conducting materials. **[Familiarity]**

CO4: List and analyze the properties of dielectric materials. **[Familiarity]**

CO5: List the properties and applications of modern engineering materials. **[Familiarity]**

UNIT ICONDUCTING MATERIALS	**(9)**

Introduction to Conductors – classical free electron theory of metals – Draw backs of classical theory – quantum theory - Electrical and Thermal conductivity of Metals – Derivation for Wiedemann – Franz law – Lorentz number –– Fermi distribution function - effect of temperature – density of energy states – calculation of Fermi energy- carrier concentration in metals.

UNIT IISEMICONDUCTING MATERIALS AND DEVICES	**(9)**

Introduction – Properties – elemental and compound semiconductors - Intrinsic and extrinsic semiconductors – properties - Carrier concentration in intrinsic Semiconductor - variation of Fermi level with temperature and carrier concentration - Electrical Conductivity – band

gap determination - extrinsic semiconductors - Carrier concentration in P- type and N-type semiconductors – variation of Fermi level with temperature and impurity concentration – Hall effect- Determination of Hall Co-efficient in N type and P type Semiconductor - Applications.

UNIT IIIMAGNETIC AND SUPER CONDUCTING MATERIALS	**(9)**

Introduction - Origin of magnetic moment - Bohr magnetron - Dia, Para, and Ferro magnetic materials - Domain theory of ferromagnetism - Hysteresis - Hard and Soft magnetic materials. Ferrites - structure and applications. - Magneto optical recording and readout – Superconductivity - Types of superconductors - BCS theory of superconductivity (qualitative) - properties- High Tc superconductors, Applications of superconductors- SQUID, Cryotron, Magnetic levitation.

UNIT IVDIELECTRICS	**(9)**

Introduction to dielectric materials – Electric polarization and Dipole moment - Electrical susceptibility – dielectric constant – Various polarization mechanisms in dielectrics - electronic, ionic, orientational and space charge polarization– frequency and temperature dependent of polarization – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown –BaTiO3 - Applications of dielectric materials.

UNIT VMODERN ENGINEERING MATERIALS	**(9)**

Metallic glasses- preparation of metallic glasses - properties – applications of the metallic glasses - Shape Memory Alloys (SMA) - Characteristics, properties of NiTi alloy - applications of the Shape memory alloys - advantages and disadvantages of SMA - Nanomaterials-synthesis –chemical vapour deposition – Sol Gels – ball Milling – properties of nanoparticles and applications of nanoparticles – Carbon Nanotubes (CNT) – structure – properties – applications of the CNTs.

LECTURE: 45 TUTORIAL: 0 TOTAL: 45

Text Books

1	Ganesan S. Iyandurai N, "**Engineering Physics II**", Gems Publishers, Coimbatore 2009.

Reference Books

1	Jayakumar S, "**Materials Science**", RK Publishers, Coimbatore, 2004
2	William D CallisterJr, "**Materials Science and Engineering – An Introduction**",John Wiley and Sons Inc.,7th edition, New York, 2006
3	James F Shackelford, S "**Introduction to materials Science for Engineers**", 6th edition, Pearson education Company, New York, 2007

12S203 ENGINEERING PHYSICS

	L	T	P	C
	3	**0**	**0**	**3**

COURSE OBJECTIVES-Upon completion of this course the students will be Familiar with:

- Concepts and types of lasers and its applications.
- Theory of fibre optics principles and its applications.
- Origin of quantum physics and Schrodingers' equation and applications.
- About principles of ultrasonic and their industrial applications.
- About fundamentals of crystal physics and its packing factor calculations.

COURSE OUTCOMES-Upon completion of this course the students will be able to:

CO1: Analyze the construction and working of CO2, Nd-Yag, Semiconductor and Dye lasers.**[Usage]**

CO2: Explain fiber optics and classify fibers based on index profiles and modes. **[Familiarity]**

CO3: Analyze the dual nature of matter using Heisenberg's Uncertainty principle and Schrodinger's time independent and dependent wave equations.**[Assessment]**

CO4: Apply piezoelectric detector method for industrial applications. **[Usage and Assessment]**

CO5: Compare crystalline and non crystalline materials and describe the lattice structure, coordination number and packing factor for crystals. **[Usage and Assessment]**

UNIT ILASERS	**(9)**
Introduction- Principle of laser action - characteristics of laser - Spontaneous emission and Stimulated emission –Einstein's coefficients - population inversion – methods of achieving population inversion - Types of pumping –Optical Resonator - Types of Lasers – Principle, construction and working of different types of laser- $CO_{2,}$Nd- YAG, Semiconductor laser and Dye laser- applications of laser -Lasers in microelectronics, welding, heat treatment, cutting – holography – construction and reconstruction of a hologram – applications of holography.	
UNIT IIFIBER OPTICS AND APPLICATIONS	**(9)**
Introduction – Basics Principles involved in fiber optics- Total internal reflection – Structure of optical fiber –Propagation of light through optical fiber –Derivation for Numerical Aperture and acceptance angle - fractional index change - Preparation of optical fiber- Crucible and Crucible technique - Classification of optical fiber based on materials, refractive index profile and Modes - Splicing-fusion and multiple splices - Light sources for fiber optics.- LED- Detectors- Principle of photo detection - PIN Photodiode, - Fiber optical communication links-Fiber optic sensors-Temperature, displacement.	
UNIT IIIQUANTUM PHYSICS AND APPLICATIONS	**(9)**
Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation- de-Broglie wavelength in terms of voltage, energy, and temperature –Heisenberg's Uncertainty principle – verification - Schrödinger's Time independent and Time dependent wave equations – physical significance of a wave function - Particle in a one dimensional deep potential well– microscope – basic definitions of microscope - Electron microscope-Scanning Electron Microscope (SEM)-Transmission Electron Microscope (TEM).	
UNIT IVULTRASONICS	**(9)**
Introduction – properties of ultrasonic waves – production of ultrasonic waves Magnetostriction effect- Magnetostriction generator- Piezoelectric crystals - Piezoelectric effect- Piezoelectric generator- Detection of ultrasonic wave – kundt's tube method – sensitive flame method – thermal detector method – piezo electric detector method- cavitation - industrial applications- ultrasonic drilling- ultrasonic welding- ultrasonic soldering and ultrasonic cleaning-Non- destructive Testing-Pulse echo system, through transmission and resonance system.	

UNIT VCRYSTAL PHYSICS	(9)
Introduction – Crystalline and Non- crystalline materials –Lattice – Unit Cell –Crystal system - Bravais lattices – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC, and HCP structures – NaCl– Polymorphism and allotropy – Crystal defects – Point, line and surface defects.	
LECTURE: 45 TUTORIAL: 0 TOTAL: 45	
Text Books	
1	Ganesan S. Iyandurai N, "**Engineering Physics I**", Gems Publishers, Coimbatore,2010
Reference Books	
1	Gaur R K and Gupta S L-"**Engineering Physics**", Dhanpat Raj and sons, 2002.
2	Avadhanulu M N and Kshirsagar P G,"**A textbook of Engineering Physics**"S.Chand and Company Ltd,NewDelhi,2005
3	Arumugam M- "**Engineering Physics**", Anuadha Publishers, 2002
4	Jayakumar S, "**Engineering Physics**", RK Publishers, Coimbatore, 2003

Programmes Organised:

The department of Physics has conducted a conference and Faculty Development Programme as follows:

Conference:

- One day National Conference on Nanomaterials and their Applications – NCNMA – 15 on 15.07.2015

Faculty development Programme:

- FDP programme onCurrent Research Trends in Nanoscience & Technology & applications in solar cells has been organized by department of Physics and Chemistry during 15.05.2013 – 21.05.2013

FDP programme on Energy storage devices has been organized by department of Physics and Chemistry during 31.07.2015 – 01.08.2015