VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

Ibrahimbagh, Hyderabad-500 031, Telangana State

DEPARTMENT OF PHYSICS

SYLLABUS OF ENGINEERING PHYSICS UNDER CBCS W.E.F ACADEMIC YEAR 2016-2017

***1/4 B.E I-Semester (*Common to all Branches)**

Syllabus Reference Code: PH 1100	Duration of Sem Exam: 3 Hrs	Sem Exam Marks:50
Instruction:2+1 Hours per week	Credits: 2	Sessional Exam Marks: 25

Course objectives	***Course outcomes***
Students will be able to	***At the end of the course students will be able to***
• Learn fundamentals in optics and apply in engineering fields • Explain the construction and working of various lasers systems • Tell the working of optical communication system • Solve simple mathematical formulations for Harmonic Oscillators • List various magnetic and dielectrics materials for engineering applications.	• Use principles of interference, diffraction, polarization to explain various optical phenomena. • Ascertain selection of laser systems for practical applications. • Appreciate optical communication system • Solve solutions under different situation of damped and forced oscillations. • Differentiate properties, characteristics and applications of various magnetic and dielectric materials.

UNIT- I*Fundamentals of vibrations*: (8 hours)

- Free, Damped and Forced Harmonic Oscillators equation of motion and their solutions. Under damping, Over damping and critical damping conditions
- Logarithmic decrement, Relaxation time, amplitude and velocity resonance, sharpness, bandwidth, q-factor.
- Superposition of two mutually perpendicular simple harmonic vibrations of same frequency, Lissajous figures.

UNIT- II PHYSICAL OPTICS (10Hours)

- Conditions for Interference, Thin films interference, Newton's rings (reflected light)-measurement of wavelength of a light source and refractive index of a liquid.
- Types of diffraction, diffraction due to a single slit, double slit and diffraction grating (Qualitative), measurement of wavelength of a light source.
- Polarization of light, Malus Law–double Refraction-Nicol's prism, wave plates, optical activity, Laurent's half shade polarimeter, determination specific rotation.

Unit - III INTRODUCTION TO FIBRE OPTICS (8 Hours)

- Fibre construction**,** Propagation of light through an optical fiber, Acceptance angle, Numerical aperture, Types of optical fibers: Step index, Grin fibers, SMF and MMF fibers.
- Losses in optical fiber: absorption losses, bending losses, signal distortion. Merits and demerits of optical fiber, applications of optical fiber, overview of optical fiber communication system

UNIT-IV–LASERS (09Hours)

- Characteristics of Lasers induced absorption, spontaneous and stimulated emission of radiation - Einstein Coefficients A and B, Meta stable state, Population inversion.
- Solid state lasers: Nd-YAG laser and Semiconductor laser, Gas Laser:Helium-Neon Laser, Applications of lasers in engineering (drilling, welding, CD write, medicine), laser safety.
- Basic principles of holography– Construction and reconstruction of image on hologram – advantages of Holography-Applications of holography.

Unit - V Dielectric and Magnetic Materials (7 Hours)

- Polar and non-polar dielectrics, types of dielectric polarizations, Expression for electronic and ionic polarizabilities, Frequency and temperature dependence of dielectric polarizations, phase transitions and structure of $BaTio_3$, Piezo and ferroelectric materials.
- Ferro, antiferro and ferrimagnetic materials, Weiss molecular field theory of ferromagnetism- magnetic domains-hysteresiscurve-Soft and hard magnetic Materials-Ferrites fundamentals

Learning Resources:

1. Physics for scientists and engineers - Jewett Serway - Cengage learning - seventh edition
2. Principles of Physics- David Halliday, Robert Resnick and Walker - Wiley Eastern limited, 9th Ed
3. Optical Fiber Communication -Principles and Practice - John M Senior - PHI - third edition
4. *Textbook of Engineering Physics*-Avadhanulu and KshiraSagar*, -S.Chand.*
5. Applied Physics for Engineers, Neeraj Mehta, PHI
6. A text book of Engineering Physics, Sanjeev Gupta
7. Materials Science,A.Armugam
8. http://ocw.mit.edu/courses/physics
9. http://oyc.yale.edu/physics
10. www.nptel.ac.in

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SYLLABUS OF APPLIED PHYSICS UNDER CBCS W.E.F ACADEMIC YEAR 2016-2017

***1/4 B.E II-Semester*(Common to CSE, ECE, EEE, IT and Mechanical)**

Syllabus Reference Code: PH 1200	Duration of Sem Exam: 3 Hrs	Sem Exam Marks:50
Instruction:2+1 Hoursper week	Credits: 2	Sessional Exam Marks: 25

Course objectives	***Course outcomes***
Students will be able	***At the end of the course students will be able to***
• Know the structures and defects in crystal • Learn classification of solids using band theory • Explain the characteristics of diodes • Gain knowledge on ac fundamentals and basics of electromagnetic theory • Appreciate transformation and wave mechanics.	• Ascertain the selection of materials by structure and defects • Differentiate types of solids and their applications • Analyze characteristics of diode and its uses • Inquire LCR circuits and derive EM equations for various media. • Correlate inertial and non-inertial frames and derive Eigen values for quantum mechanical systems.

UNIT- I MODERN PHSICS (8 Hours)

- Concept of de-Broglie wave - wavelength of matter waves of particles - Concept of wave function - Schrödinger time dependent and time independent wave equations- Applications: particle in an Infinite Square well (particle in a box) potential.
- Frames of references-inertial and non-inertial frames, postulates of special theory of relativity
- Galilean and Lorentz transformations, length contraction, time dilation, Relativistic velocity addition, relativistic mass, mass-energy equivalence.

UNIT-II CRYSTALLOGRAPHY & SUPERCONDUCTIVITY(10 Hours)

- **Crystal Systems**:Introduction-Space lattice, Basis, Unit cell, Bravais lattices and crystal systems, Miller Indices, X-ray diffraction, Bragg's law, powder x-diffractionmethod
- **Defects in crystals**: point defects-Schottky and Frankel defects, line defects: screw and edge dislocations, concentration of Schottky and Frankel defects in a crystal.
- **Superconductivity:** Superconductivity -General properties of super conductors – Meissner effect. Type I and Type II superconductors - BCS Theory (in brief)–Cooper pairs- high T_c superconductors (1-2-3 type)-Josephson's Junction –SQUIDS- Applications of superconductors

UNIT- III BAND THEORY OF SEMICONDUCTORS(6Hours)

- Qualitative concepts on Free electron theoryandKronig-Penny model -Classification of solids as conductors, insulators and semiconductors based on band theory.
- Types of semiconductors: intrinsic and extrinsic, Carrier concentration in intrinsic semiconductors and its conductivity - Fermi energy.

UNIT-IV PHYSICS OF PN JUNCTION DIODE (9Hours)

- Drift and diffusion currents,mobility, equation of continuity,Hall Effect.
- Formation of PN junction - V-I Characteristics of PN Junction diode and their temperature dependence
- Construction and working of LED, solar cell and photodiode, Construction and working of Half Wave, Full Wave and Bridge Rectifier - Efficiency and Ripple Factor
- Characteristics of Zener diode - Working of Simple Zener Voltage Regulator.

UNIT – V AC CIRCUITS AND EM THEORY (9 Hours)

- **AC Circuits**: Basic Definitions of RMS and average values of a.c voltage, reactance and impendence, AC through pure resistor, capacitor and inductor, AC throughRC, RL and CL circuits, Series and parallel LCR resonance circuits, band width,sharpness, electromechanical analogy.
- ***Electromagnetic theory:***Conduction and displacement current, Maxwell's equations in integral and differential forms, electromagnetic wave equations in free space and conducting medium, transverse nature of EM waves and Poynting vector

Learning Resources

1. *Introduction to Solid State Physics,* Kittel C, Wiley Eastern
2. Solid State Physics, S.O. Pillai, *New Age International publishers, 7th Ed 2015*
3. *Physics of Semiconductor Devices SM Sze*
4. *A text book of electrical Technology Volume-I, BL Theraja and AK Theraja, S Chand, 2013*
5. Introduction to special Relativity Robert Resinick, John Wiley, 2003
6. A text book of Engineering Physics, Sanjeev Gupta
7. Applied Physics for Engineers, Neeraj Mehta, PHI
8. http://ocw.mit.edu/courses/physics
9. http://oyc.yale.edu/physics
10. www.nptel.ac.in

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SYLLABUS OF APPLIED PHYSICS UNDER CBCS W.E.F ACADEMIC YEAR 2016-2017

1/4 B.E II-Semester(only for **CIVIL**Engineering Branch)

DEPARTMENT OF PHYSICS

Syllabus Reference Code: PH 1210	Duration of Sem Exam: 3 Hrs	Sem Exam Marks:50
Instruction:2+1 Hoursper week	Credits: 2	Sessional Exam Marks: 25

Course objectives	***Course outcomes***
Students will be able to	***At the end of the course students will be able to***
• Know the structures and defects in crystal • Learn classification of solids using band theory • Discoveruse of acoustic waves in engineering • Gain knowledge on ac fundamentals • Realize applications of statistical and wave mechanics.	• Ascertain the selection of materials by structure and defects • Differentiate types of solids and their applications • Investigateacoustic characteristics of a building • Inquire use of LCR circuits. • Apply statistical and quantum mechanical equations.

UNIT- I FUNDAMENTALS OF STATISTICAL ANDQUANTUM MECHANICS (8 Hours)

- ***Statistical Mechanics:***Concept of phase space-types of ensembles-micro canonical-canonical and grand canonical ensembles-qualitative treatment of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics
- ***Quantum Mechanics***: Concept of de-Broglie wave - wavelength of matter waves of particles - concept of wave function - Schrödinger time dependent and time independent wave equations- Applications: particle in an Infinite Square well (particle in a box) potential.

UNIT-II CRYSTALLOGRAPHY& SUPERCONDUCTIVITY(10 Hours)

- **Crystal Systems**: Introduction-Space lattice, Basis, Unit cell, Bravais lattices and crystal systems, Miller Indices, X-ray diffraction, Bragg's law, powder x-diffractionmethod
- **Defects in crystals**: point defects-Schottky and Frankel defects, line defects: screw and edge dislocations, concentration of Schottky and Frankel defects in a crystal.
- **Superconductivity**: Superconductivity -General properties of super conductors – Meissner effect. Type I and Type II superconductors - BCS Theory (in brief)–Cooper pairs- high T_c superconductors (1-2-3 type)-Josephson's Junction –SQUIDS- Applications of superconductors

UNIT- III BAND THEORY OF SEMICONDUCTORS (7 Hours)

- Qualitative concepts on Free electron theory andKronig-Penny model -Classification of solids as conductors, insulators and semiconductors based on band theory.
- intrinsic and extrinsic semiconductors -Conductivity of semiconductors - Fermi energy, Formation of PN junction, V-I Characteristics of PN Junction diode

UNIT– IV AC CIRCUITS (7 Hours)

- Basic Definitions: RMS, Average values of AC voltage, Reactance and Impendence, AC through pure resistor, capacitor and inductor
- AC through RC, RL and CL circuits, Series and parallel LCR resonance circuits, band width,sharpness, and electromechanical analogy.

UNIT- VULTRASONICS (10 Hours)

- ***Ultrasonic*** waves and their properties, Production of ultrasonics by Piezo-electric and magnetostriction methods, Detection of ultrasonics, Wavelength of ultrasonic waves -Engineering applications of ultrasonics-SONAR-Non-destructive testing- ultrasound cleaning (cavitation)-Seismography (concepts only)
- ***Acoustics***: Intensity of sound-intensity level-reverberation-reverberation time-Sabine's formula-Remedies to reverberation- sound absorbent materials-Conditions for good acoustics of a building-Acoustic quieting: effects and remedies

Learning Resources

1. Introduction to Solid State Physics, Kittel C, Wiley Eastern
2. Solid State Physics, S.O. Pillai, New Age International publishers, 7th Ed 2015
3. Physics of Semiconductor Devices SM Sze
4. A text book of electrical Technology Volume-I, BL Theraja and AK Theraja, S Chand, 2013
5. A text book of Engineering Physics, Sanjeev Gupta
6. Applied Physics for Engineers, Neeraj Mehta, PHI
7. http://ocw.mit.edu/courses/physics
8. http://oyc.yale.edu/physics
9. www.nptel.ac.in

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DEPARTMENT OF PHYSICS

SYLLABUS OF ENGINEERING PHYSICS LAB UNDER CBCS W.E.F ACADEMIC YEAR 2016-2017

1/4 B.E I-Semester (common to all Branches)

Syllabus Reference Code: PH 1101	Duration of Sem Exam:3Hrs	Sem Exam Marks:30
Instruction:2 Hoursper week	Credits: 1	Sessional Exam Marks: 20

1. Estimation of errors using Gaussian distribution in simple pendulum and to calculate the probable error and 'g'.
2. Plot of B-H curve of a ferromagnetic specimen and to find Coercivity (H_c), Remanence (B_r) and Hysteresis loss
3. Determination of moment of inertia 'I 'of a flywheel about its axis of rotation.
4. Study of characteristics of Thermistor and to evaluate its constants.
5. Determination of rigidity modulus of a given material of wire by Torsional Pendulum.
6. Determination of radius of curvature of a given Plano-convex lens by forming Newton's Rings.
7. Determination of wavelength of spectral lines of Mercury light source using Diffraction grating under normal incidence.
8. Determination of wavelength of given Semiconductor Laser by diffraction.
9. Verification of Malus law in polarization.
10. Calculation of Numerical aperture, acceptance angle and Power loss due to bending of an Optical Fiber& to study Power Loss.
11. Determination of frequency of ac signal using CRO

**** Students should perform a minimum of 8 experiments in a semester***

1/4 B.E II-Semester (common to all Branches)

Syllabus Reference Code: PH 1201	Duration of Sem Exam:3Hrs	Sem Exam Marks:30
Instruction:2 Hoursper week	Credits: 1	Sessional Exam Marks: 20

1. Study of V-I Characteristics of P-N Junction diode and to determine Forward & Reverse Resistances of the diode.
2. Determination of energy gap of a given Semiconductor.
3. Calculation of Seebeck Coefficient by measurement of thermoelectric power.
4. Study of resonance in LCR series circuit and to find resonance frequency & quality factor.
5. Study of parallel resonance in LCR circuits and to find frequency & quality factor.
6. Calculation of Efficiency, ripple factor of half wave and bridge rectifier (Without filters)
7. Determine the Specific Rotatory Power of Sugar Solutions of different concentration by Lorent half shade polarimeter.
8. Study of V-I Characteristics of Solar Cell &to calculate Fill Factor, Efficiency & Series resistance.
9. To find Planck's constant using Photo Cell and Draw its V-I Characteristics.
10. Characteristics of Zener diode and determination of Zener voltage.
11. Study of Hall Effect and determination of Hall's coefficient.

**** Students should perform a minimum of 8 experiments in a semester***

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DEPARTMENT OF PHYSICS

SYLLABUS OF APPLIED PHYSICS UNDER CBCS W.E.F ACADEMIC YEAR 2017-2018

2/4 B.E I-Semester Bridge Course

PHYSICS OF MATERIALS

Syllabus Reference Code: PH 2100	Duration of Sem Exam:90 min	Sem Exam Marks:25
Instruction:2 Hoursper week	Credits: NIL	Sessional Exam Marks: NIL

Course objectives	*Course outcomes*
Students will be able	***At the end of the course students will be able to***
• Classify solids based on band theory	• Ascertain the types of solids for used in engineering
• Learn properties of dielectric, magnetic and superconducting materials	• Make use of dielectric, magnetic and superconducting materials for appropriate applications
• Learn fundamentals of semiconductor devices	• Acquire knowledge on semiconductor devices

UNIT-I MATERIAL SCIENCE (7 hours)

Dielectric Materials: Polar and non-polar dielectrics-Different types of polarizations in dielectrics- Ferroelectric materials- properties and applications.

Magnetic Materials: Ferro, Ferri and anti-ferro magnetic materials and their properties-Weiss theory of ferromagnetism- Hysteresis (B-H) curve-soft and hard magnetic materials

Superconductivity: Superconductivity -General properties of super conductors – Meissner effect. Type I and Type II superconductors Josephson's Junction –Applications of superconductors

UNIT-IISEMICONDUCTOR DEVICES: (5 hours)

Qualitative concepts of Kronig-Penny model - Classification of solids as conductors, insulators and semiconductors based on band theory.

Construction and working of Light Emitting diode, Semiconductor Laser, solar cell and photodiode

Reference Books

1. Introduction to Solid State Physics, Kittel C, Wiley Eastern
2. Solid State Physics, S.O. Pillai, New Age International publishers, 7th Ed 2015
3. Physics of Semiconductor Devices SM Sze

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DEPARTMENT OF PHYSICS

PROPOSED SYLLABUS OF OPEN ELECTIVE UNDER CBCS

B.E Program

OPEN ELECTIVE-I

QUANTUM MECHANICS FOR ENGINEERS

Syllabus Reference Code: PH 3100	Duration of Sem Exam:3 hours	Sem Exam Marks:70
Instruction:3 Hoursper week	Credits: 3	Sessional Exam Marks: 30

Course objectives	*Course outcomes*
Students will be able	***At the end of the course students will be able to***
• Differentiate classical and quantum laws • Write quantum operators • List perturbation theories • Learn fundamentals of quantum computing	• Write wave functions for particles moving under various potentials • Use quantum operators • Appreciate applications of quantum mechanics in computing

Unit I: Inadequacy of classical mechanics-photoelectric effect, Compton effect -de Broglie waves, Wave–particle duality, de Broglie's Wave-phase velocity, group velocity- Heisenberg uncertaintyrelations; Wave function and its interpretation, experimental evidence of matter waves-Davisson-Germerexperiment and Stern-Gerlach experiment

Unit II: Probability density and probability current, equation ofcontinuity; Wave function as a vector, quantummechanical operators; Eigenvalues, Eigen functions,expectation values-postulates of quantum mechanicsPotential barrier, tunnelling, tunnelling probability- resonant tunnelling, Harmonic oscillator, energy levels and wave functions, Hydrogen atom model (qualitative) quantum picture of the LC-circuit, Esaki tunnel diode,WKB approximation

Unit III: Elements of linear vector spaces- The idea of *n*–dimensional vector space, bra-ket notation, linear independence, basis, inner product, norm of a vector; Hilbert space, Ortho normality; Matrix representation of kets and linear operators; Pauli matrices; Definitions of Hermitian, Inverse and Unitary operators; Commutators

Unit IV: Basic ideas of perturbation theory, time independent and time dependent perturbations; symmetric and antisymmetric wave functions, statistics of electrons and photons.

Unit V: Finite potential well, GaAs quantum well between AlGaAs layer in a semiconductor hetero structureapplication to electron in a MOSFET.
Quantum Computation-idea of qubit, examples of single qubit logic gates- Classical bits, Qubit as a two level system, EPR paradox

Text Books:

1. Quantum Mechanics: An Introduction for Device Physicists and Electrical Engineers, SecondEdition, David K Ferry, Institute of Physics Publishing 2001.
2. Quantum Physics for Scientists and Technologists – Paul Sanghera, Wiley Publication
3. Fundamental Quantum Mechanics for Engineers, Leon van Dommelen, 15 Jun 2012 Version
4. Introduction to Quantum Mechanics, David J.Griffiths
5. Quantum Mechanics, Leonard I. Schiff

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DEPARTMENT OF PHYSICS

PROPOSED SYLLABUS OF OPEN ELECTIVE UNDER CBCS

B.E Program

OPEN ELECTIVE-II

NANAO MATERIALS AND NANO TECHNOLOGY

Syllabus Reference Code: PH 3200	Duration of Sem Exam:3 hours	Sem Exam Marks:70
Instruction:3 Hoursper week	Credits: 3	Sessional Exam Marks: 30

Course objectives	***Course outcomes***
students will be able to	***At the end of the course students will be able to***
• Differentiate bulk, thin and nanostructures • List various nanomaterial synthesis techniques • Appreciate applications of nanomaterials in science and technology	• Identify various structures of materials • explainnanoparticle synthesis techniques • Become familiar with the different sub-areas of the field and general nature and prospectsof nanotechnology.

Unit I: ***Nanomaterials***: Distinction between bulk, thin and nano materials-surface to volume ratio, quantum Confinement-Reduction of dimensionality, density of states, quantum dots (zero dimensional), quantum wires (one dimensional), quantum wells (two dimensional) and their density of states. excitons, single electron tunnelling, electrical, electronic, magnetic, mechanical and optical properties of nanomaterials.

Unit II: ***Synthesis of Nano materials***: Metallic nanoparticles, semiconducting nanoparticles, top-down and bottom-up approaches; preparation techniques sputtering, chemical vapour deposition (CVD), pulsed laserdeposition, MBE, sol-gel and ball milling.

Unit III: Characterization tools of nanomaterials: Scanning Probe Microscopy, Atomic force microscopy (AFM)- Scanning electron microscope (SEM), Tunneling Electron Microscope (TEM).

Unit IV: Carbon Nanostructures: Carbon bond, carbon clusters, Buckminsterfullerene, Elementary ideas on graphene, Carbon nanotubes, nano diamond, applications of nanomaterials; propertiesand applications of CNT

Unit V: Disordered solid nanostructures, properties, nanostructuredmultilayers, metal nanostructure composites, single electron transistor, infrared detectors, QD lasers Nanodevices: MEMS and NEMS, molecular and supramolecular switches, nano MOSFET

Text Books:

1. Introduction to Nanotechnology, Charles P. Poole Jr and frank J. Owens, Wiley-Interscience,John WIley, 2003
2. Nanophysics materials and Nanotechnologies and Design: An introduction for Engineers and Architects Michael F Ashby, Paulo J Ferreira and Daniel L Schodek, Elsvier, 2011
3. Introduction to Nanoscience and Nano technology, KK Chattopadhyay and AN Banerjee, PHI, 2010
4. Engines of Creation by Drexler