Subject Code: R13103/R13 **Set No - 1**

I B. Tech I Semester Supplementary Examinations Aug. - 2015

ENGINEERING PHYSICS

(Common to ECE, EEE, EIE, Bio-Tech, EComE, Agri.E)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**

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PART-A

1.(a) What is a diffraction grating? Explain with the help of a diagram.
(b) With the help of a labeled diagram state and explain Bragg's law.
(c) Calculate the magnetic moment associated with an electron moving in a circular orbit of radius 0.51×10^{-10}m with a frequency of 6.8×10^{14} revolutions per second.
(d) Define the term coefficient of absorption. Explain the procedure to determine the coefficient of absorption.
(e) Explain the physical significance of wave function (ψ).
(f) Find the resistivity of intrinsic germanium at 300K, if the intrinsic carrier density is $2.5X10^{19}/m^3$ and mobility of electron and hole are $0.39m^2V^{-1}s^{-1}$ and $0.19m^2V^{-1}s^{-1}$ respectively.

[4+4+2+4+4+4]

PART-B

2.(a) Derive an expression for the diameter of the nth dark ring in Newton's rings viewed under reflected system.
(b) In Newton's rings experiment the diameter of the 10^{th} dark ring changes from 1.40cm to 1.27cm when a liquid is introduced between the lens and the plate. Calculate the refractive index of the liquid.
(c) Prove that a superconductor behaves as a perfect diamagnetic.

[8+4+4]

3.(a) Explain Einstein's coefficients. Derive the relation between them.
(b) Calculate the numerical aperture of an optical fibre in air, if the refractive indices of its core and cladding are 1.5 and 1.495 respectively.
(c) What is an LED? Explain its working.

[8+4+4]

4.(a) What is meant by local field in a dielectric and how is it calculated for a cubic structure?
(b) Presuming that the electronic polarizability of an atom is 10^{-40} Fm^2 and the radius of the sphere having negative charge distribution is 9.65×10^{-11}m, determine ε_o.
(c) Derive an expression for the electrical conductivity of a metal

[8+4+4]

5.(a) Discuss the factors affecting the architectural acoustics of a building and their remedy.
(b) Calculate the reverberation time of hall with volume of $1500m^3$ and whose total absorption is equivalent to $100m^2$ sabine.
(c) Outline the principle behind the working of an optical fibre.

[8+4+4]

Subject Code: R13103/R13 **Set No - 1**

6.(a) Explain the Kronig-Penny model of solids and show that it leads to energy band structure of solids.

(b) Calculate the de Broglie wavelength of a neutron whose kinetic energy is 0.025eV. Given: mass of neutron = 1.674×10^{-27} kg and Planck's constant h = 6.625×10^{-34} J-s.

(c) Express Maxwell's equations in differential form

[8+4+4]

7.(a) What is Hall Effect? Deduce an expression for Hall coefficient.

(b) Find the Hall voltage in silicon doped with 10^{23} phosphorous atoms/m^3. The Si sample is 100µm thick with a current flow of 1mA for a magnetic field of 10^{-5}Wb/cm^2

(c) Distinguish between polarized and unpolarized light.

[8+4+4]

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Subject Code: R13103/R13 **Set No - 2**

I B. Tech I Semester Supplementary Examinations Aug. - 2015

ENGINEERING PHYSICS

(Common to ECE, EEE, EIE, Bio-Tech, EComE, Agri.E)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**

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PART-A

1.(a) Explain Rayleigh's criteria for resolution.
(b) Derive an expression for numerical aperture of an optical fibre in terms of fractional index change.
(c) Distinguish between Hard and Soft superconductors.
(d) State and explain Maxwell's equations.
(e) A copper wire of radius 1mm and length 10m carries a direct current of 5A. Calculate the drift velocity of electrons in copper if $n = 5 \times 10^{28}/m^3$.
(f) Describe Drift and Diffusion currents.

[4+4+4+4+4+2]

PART-B

2.(a) Analyze qualitatively the spectrum obtained on exposing a diffraction grating to monochromatic light.
(b) A plane grating having 10520 lines/cm is illuminated with light of wavelength 5×10^{-5} cm at normal incidence. How many orders are visible in the grating spectra?
(c) Explain hysteresis of a ferromagnetic material with the help of B-H curve.

[8+4+4]

3.(a) Define acceptance angle of an optical fibre and derive an expression for it in terms of refractive indices of the core and cladding.
(b) An optical fibre has a core of refractive index 1.51 and cladding of refractive index 1.49. Calculate (i) numerical aperture (ii) acceptance angle.
(c) Write a short note on photovoltaic cell.

[8+4+4]

4.(a) Explain superconductivity. Briefly outline BCS theory of superconductivity.
(b) For a specimen of Ga, the critical fields are 1.4×10^5 and 4.2×10^5 A/m at 14K and 13K respectively. Calculate the transition temperature and critical fields at 0K and 4.2K.
(c) Explain the concept of effective mass of an electron.

[8+4+4]

5.(a) State the acoustic requirements of good hall. Explain how these requirements can be achieved.
(b) A hall with a volume of $1000m^3$ has a sound absorbing surface of area $400m^2$. If the average absorption coefficient of the hall is 0.2 sabines, what is the reverberation time
(c) What are Miller indices? Explain.

[8+4+4]

Subject Code: R13103/R13 **Set No - 2**

6.(a) Obtain the eigen values and normalized wave functions for a particle in a one dimensional infinite potential box.

(b) The resistivity of aluminium at room temperature is 2.62×10^{-8} ohm-m. Calculate the (i) drift velocity (ii) mobility on the basis of classical free electron theory.

(c) Derive expressions for growth and decay of sound energy inside a hall.

[8+4+4]

7.(a) Derive an expression for Fermi level in a p-type semiconductor and hence obtain an expression for concentration of holes in the p-type semiconductor.

(b) Calculate the wavelength of light emitted by an LED with band gap of energy 1.8eV.

(c) Explain the phenomenon of double refraction.

[8+4+4]

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Subject Code: R13103/R13 **Set No - 3**

I B. Tech I Semester Supplementary Examinations Aug. - 2015

ENGINEERING PHYSICS

(Common to ECE, EEE, EIE, Bio-Tech, EComE, Agri.E)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**

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PART-A

1.(a) Derive the expressions for thickness of quarter wave plate and half wave plate.
(b) Differentiate between spontaneous and stimulated emission of radiation.
(c) Calculate the polarization produced in a dielectric medium of relative permittivity 15 in the presence of an electric field of 500V/m.
(d) Define the term coefficient of absorption and write short notes on it.
(e) Write a note on Fermi-Dirac statistical distribution law.
(f) Explain with a neat sketch the principle of photoconductivity.

[4+4+4+4+4+2]

PART-B

2.(a) Analyze qualitatively Fraunohofer diffraction at double slit with suitable diagrams.
(b) A grating has 6000 lines/cm. Find the angular separation between two wavelengths of 500nm and 510nm in the 3^{rd} order.
(c) Classify magnetic materials on the basis of their susceptibility.

[8+4+4]

3.(a) Describe the construction and working of He-Ne laser with relevant energy level diagram. List out its advantages over a ruby laser.
(b) Copper has FCC structure and its atomic radius is 0.1278nm. Calculate interplanar spacing for (111) and (321) planes.
(c) Distinguish between direct and indirect band gap semiconductors.

[8+4+4]

4.(a) Discuss DC and AC Josephoson's effects and explain their importance.
(b) The critical temperature T_c for mercury with isotopic mass 199.5amu is 4.185K. Calculate its critical temperature when its isotopic mass changes to 203.4amu.
(c) Explain the terms relaxation time, collision time and mean free path as applied to electric conduction.

[8+4+4]

5.(a) Derive Sabine's formula for Reverberation time.
(b) A hall has dimensions $20x15x5m^3$. The reverberation time is 3.5sec. Calculate the total absorption of its surfaced and the average absorption coefficient.
(c) Explain the phenomenon of spontaneous and stimulated emissions.

[8+4+4]

Subject Code: R13103/R13 **Set No - 3**

6.(a) What is density of energy states in metals? Derive an expression for density of energy states and hence obtain Fermi energy of a metal.

(b) The density and atomic weight of Cu are 8900kg/m^3 and 63.54 respectively. The relaxation time of electrons in Cu at 300K is 10^{-14}s. Calculate the electrical conductivity of copper.

(c) Express Maxwell's equations in integral form.

[8+4+4]

7.(a) Derive an expression for carrier concentration in an intrinsic semiconductor.

(b) Calculate the mobility of electron in Cu, considering that each atom contributes one electron for conduction. Resistivity of Cu is 1.721 X 10^{-8} Ω-m, Atomic weight is 63.54, density of Cu is 8.9 x10^3 kg/m^3 and Avagadro number is 6.025 x10^{26}/ kg-mole.

(c) Discuss interference phenomenon in thin films.

[8+4+4]

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Subject Code: R13103/R13 **Set No - 4**

I B. Tech I Semester Supplementary Examinations Aug. - 2015

ENGINEERING PHYSICS

(Common to ECE, EEE, EIE, Bio-Tech, EComE, Agri.E)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**

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PART-A

1.(a) List out the differences between interference and diffraction.
(b) Describe the FCC crystal structure.
(c) Deduce the Clausius-Mosotti relation.
(d) A cinema hall has a volume of 7500m^3. What should be the total absorption in the hall if a reverberation time of 1.5 seconds is to be maintained?
(e) Explain the concept of effective mass of an electron.
(f) Mobilities of electrons and holes in a sample of intrinsic germanium at 300K are 0.36 $m^2V^{-1}s^{-1}$ and 0.17$m^2V^{-1}s^{-1}$ respectively. If the resistivity of the specimen is 2.12Ω-m, compute the forbidden energy gap.

[4+4+4+4+4+2]

PART-B

2.(a) What is Rayleigh's criterion of limit of resolution? Obtain an expression for the resolving power of a plane diffraction grating.
(b) Find the number lines a grating should have in order to resolve the second order doublet having a wavelength difference $6x10^{-10}$m at $5893x10^{-10}$m.
(c) Distinguish between type I and type II superconductors with suitable diagrams.

[8+4+4]

3.(a) Define the terms coordination number, atomic radius and packing density. Calculate these factors for simple cubic, body centered cubic and face centered cubic crystals.
(b) If the lattice constant of a cubic crystal is 3nm, find the interplanar spacing between (111) planes.
(c) Describe in detail the Einstein's relation between diffusivity and mobility.

[8+4+4]

4.(a) Explain electronic polarization and show that electronic polarizability is directly proportional to the volume of the atom.
(b) A solid elemental dielectric with density 3 x 10^{28} atoms/m^3 shows an electronic polarizability of 10^{-40} Fm^2. Calculate the ε_r of the material.
(c) What is Fermi energy function? Explain with the help of a diagram how it varies with change of temperature.

[8+4+4]

5.(a) By using Gauss Divergence and Stokes theorems convert Maxwell's equations from differential form to integral form.
(b) The average reverberation time of a hall is 1.5sec. and the area of the interior is 3340m^2, find the absorption coefficient.
(c) Explain lasing action in a three level system. [8+4+4]

Subject Code: R13103/R13 **Set No - 4**

6.(a) Discuss the formation of energy bands in solids and explain how solids are classified on the basis of energy band gap.
(b) Calculate the temperature at which the probability of occupancy of a state with energy 2eV is 1% (Given: Fermi energy = 1.5eV).
(c) Explain the terms 'Reverberation' and 'Reverberation time'.

[8+4+4]

7.(a) Explain principle, working and construction of a solar cell with a neat diagram.
(b) Calculate the intrinsic carrier concentration in the undoped specimen which when doped contains 6.25×10^{24} electrons and 1.6×10^{15} holes.
(c) Why Newton's rings are circular? Explain.

[8+4+4]

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