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

I B.Tech I Semester Regular/Supple. Examinations Nov./Dec. - 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) Describe phenomenon of interference in thin films.
   (b) Explain Bragg's law for X-ray diffraction.
   (c) Mention various types of polarizations in dielectrics. and explain how they vary with temperature.
   (d) State Gauss divergence theorem.
   (e) What are matter waves and list out their properties?
   (f) Distinguish between direct and indirect energy bandgap semiconductors.

[4+4+4+4+3+3]

PART-B

2. (a) Qualitatively analyse the spectrum obtained when a plane diffraction grating is exposed to monochromatic light of wavelength, λ.
   (b) A grating has 6000 lines/cm. Find the angular separation between two wavelengths of 500nm and 510nm in the 3^{rd} order.
   (c) Explain the concept of effective mass of a hole.

[8+4+4]

3. (a) Obtain an expression for acceptance angle of an optical fibre and express its numerical aperture in terms of fractional refractive index change.
   (b) Calculate the numerical aperture of an optical fibre in air, if the refractive indices of its core and cladding are 2.5 and 2.495 respectively.
   (c) Explain the principle of working of an LED.

[8+4+4]

4. (a) Derive the London equations and explain how their solution explains Meissner effect.
   (b) The polarizability of ammonia molecule is found approximately by the measurement of dielectric constant as 2.42 x 10^{-39} $C^2\ m/N$ and 1.74 x 10^{-39} $C^2\ m/N$ at 309 K and 448 K respectively. Calculate the orientation polarizability at each temperature.(Given that k_B=1.38 x 10^{-23}J/K)
   (c) Explain the phenomenon of double refraction.

[8+4+4]

5. (a) Discuss the factors affecting the architectural acoustics of a building and their remedies.
   (b) A hall of volume 5500m^3 is found to have a reverberation time of 2.3s. The sound absorbing surface of the hall has an area of 750m^2. Calculate the average absorption coefficient.
   (c) Explain hysteresis loop of a ferromagnetic material.

[8+4+4]

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

6. (a) Derive an expression for density of energy states in metals.
   (b) The density and atomic weight of copper are 8900 kg/m^3 and 63.5. 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 differential form.

[8+4+4]

7. (a) What is Hall Effect? Deduce an expression for Hall coefficient.
   (b) An n-type semiconducting specimen has a Hall coefficient of 3.66×10^{-11} m^3/As. The conductivity of the specimen is found to be 112×10^{7} Ω^{-1}m^{-1}. Calculate the charge carrier density and the electron mobility at room temperature.
   (c) Distinguish between spontaneous and stimulated emissions.

[8+4+4]

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

I B. Tech I Semester Regular/Supple. Examinations Nov./Dec. - 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 why the central fringe in Newton's rings is dark in the case of reflected system.
   (b) How light waves are guided in an optical fibre? Explain.
   (c) Distinguish between Type-I and Type-II superconductors
   (d) State and explain Stoke's theorem.
   (e) Explain the concept of the effective mass of an electron.
   (f) Write short notes on drift and diffusion currents.

[4+4+4+4+3+3]

PART-B

2. (a) Explain Rayleigh's criterion for resolution. Obtain an expression for the resolving power of a diffraction grating.
   (b) A grating of width 2inches is ruled with 15000 lines per inch. Find the smallest wavelength separation that can be resolved in second order at a mean wavelength of 500nm.
   (c) Describe conductivity in an intrinsic semiconductor

[8+4+4]

3. (a) Explain the construction and working of He-Ne laser with energy level diagram. What are the merits of He-Ne laser?
   (b) An optical fibre has a core of refractive index 1.5 and a cladding of refractive index 1.45. The diameter of the core of the fibre is 100μm and the medium surrounding the fibre is air. Determine (i) Numerical Aperture (ii) Acceptance angle
   (c) Describe the principle behind working of a Photoconductor.

[8+4+4]

4. (a) Explain the phenomenon of superconductivity. Outline the BCS theory of superconductivity.
   (b) Determine the critical current for a wire having diameter of 1mm at 4.2K. Critical temperature of the material is 8K and H_C at 0K is 6×10^4 A/m.
   (c) Distinguish between a polarized light and an unpolarized light.

[8+4+4]

5. (a) Define sound absorption coefficient of a material and describe a method for its determination.
   (b) A hall has a volume of $2265 m^3$ and its total absorption is equivalent to $92.9 m^2$ of open window. What will be the effect on reverberation time if audience fill the hall and thereby increase the absorption by another $92.9 m^2$.
   (c) Enumerate the properties of paramagnetic materials.

[8+4+4]

Subject Code: R13103/R13

Set No - 2

6. (a) Explain Fermi-Dirac distribution function. Describe how the Fermi function varies with temperature.
   (b) Find the relaxation time of conduction electrons in a metal of resistivity $1.54 \times 10^{-8}\Omega m$ if the metal has 5.8×10^{28} conduction electrons/m^3.
   (c) Express Maxwell's equations in integral form.

[8+4+4]

7. (a) Obtain an expression for carrier concentration in an intrinsic semiconductor.
   (b) Calculate the intrinsic carrier concentration of Ge at 300K using the data E_g=0.7eV, and effective mass of electron and hole is $0.55m_e$ and $0.37m_e$ respectively.
   (c) What are Miller indices? Explain.

[8+4+4]

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

I B. Tech I Semester Regular/Supple. Examinations Nov./Dec. - 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) Explain the terms (i) Basis (ii) Unit cell (iii) Crystal lattice and (iv) Lattice parameters
   (c) Describe how ferromagnetic susceptibility varies with temperature.
   (d) Define the term coefficient of absorption and write short notes on it.
   (e) Outline the Sommerfeld's quantum free electron theory.
   (f) Write short note on solar cells.

[4+4+4+4+3+3]

PART-B

2. (a) Derive an expression for the diameter of the n^{th} 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 glass plate. Calculate the refractive index of the liquid
   (c) Explain the drift velocity and relaxation time of free electrons in metals.

[8+4+4]

3. (a) Describe the seven systems of crystals with suitable diagrams.
   (b) Copper has FCC structure and its atomic radius is 0.1278nm. Calculate inter planar spacing for (111) and (321) planes.
   (c) Explain Einstein's relation for mobility and diffusion coefficient of charge carriers.

[8+4+4]

4. (a) Define electronic polarization and polarizability. Deduce an expression for electronic polarizability in terms of radius of atom.
   (b) Calculate the electronic polarizability of argon atom. Given that ε_r=1.0024 at NTP and N=2.7x10^{25} atoms/m^3.
   (c) How do you determine the refractive index of a liquid using Newton's rings experiment?

[8+4+4]

5. (a) State and explain Sabine's formula for reverberation time of a hall. Derive Sabine's formula for reverberation time.
   (b) A hall has dimensions 20 x 15 x 5m^3. The reverberation time is 3.5s. Calculate the total absorption of its surface and the average absorption coefficient.
   (c) Describe the FCC crystal structure.

[8+4+4]

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

6. (a) How does the band theory of solids lead to the classification of solids into conductors, semiconductors and insulators?
   (b) Calculate the drift velocity of conduction electrons in copper at a temperature of 300K when a copper wire of length 2m and resistance 0.02Ω carries a current of 15A. Given that mobility of the electrons is 4.3 x 10^{-3} m^2/Vs.
   (c) How does a SQUID work?

[8+4+4]

7. (a) Derive an expression for carrier concentration in an n-type semiconductor.
   (b) The energy gap of Si is 1.1eV. The average electron effective mass is $0.31m_e$, where m_e is the free electron mass. Calculate the concentration of electrons in the conduction band of Si at room temperature, T=300K. Assume that $E_F = E_g/2$.
   (c) Explain in detail the acoustic demands of a hall.

[8+4+4]

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

I B. Tech I Semester Regular/Supple. Examinations Nov./Dec. - 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**
*****

PART-A

1. (a) Discuss in detail the phenomenon of double refraction.
   (b) Explain how X-rays can be made to diffract?
   (c) Explain Meissner effect in superconductors.
   (d) Explain the terms 'Reverberation' and 'Reverberation time'.
   (e) Define relaxation time and mobility of charge carriers.
   (f) Describe the working of an LED.

[4+4+4+4+3+3]

PART-B

2. (a) Analyze qualitatively Fraunhofer diffraction at double slit with suitable diagrams.
   (b) A plane transmission grating with 5000 lines/cm gives a second order diffraction maximum at an angle of 30^0 from the central maximum. Find (i) the wavelength of light diffracted and (ii) the maximum order of diffraction possible.
   (c) Write down any four applications of Hall effect.

[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) A beam of X-rays of wavelength 0.071nm is diffracted by (110) plane of rock salt with lattice constant of 0.28nm. Find the glancing angle for the second order diffraction.
   (c) What are the drawbacks of classical free electron theory?

[8+4+4]

4. (a) Distinguish between ferro, anti-ferro and ferri magnetic materials in terms of susceptibility and its dependence on temperature.
   (b) An electron is moving in a circular orbit of radius 0.62 x 10^{-10}m. The electron performs 10^{15} revolutions per second. Determine the magnetic moment associated with the orbital motion of the electron.
   (c) State and explain Eyring's formula.

[8+4+4]

5. (a) By using Gauss divergence and Stokes theorems convert Maxwell's equations from differential form to integral form.
   (b) Explain lasing action in a three level system.
   (c) Deduce the Claussius-Mossotti relation for dielectrics.

[8+4+4]

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

6. (a) Discuss the Kronig-Penny model for the motion of an electron in a periodic potential.
   (b) Use the Fermi Dirac distribution function to obtain the value of *F(E)* for $E-E_F=0.01eV$ at 200K. Given that $k_B = 1.38 \times 10^{-23}$ J/K.
   (c) Outline the principle behind the working of an optical fibre.

[8+4+4]

7. (a) Derive an expression for carrier concentration in a p-type semiconductor.
   (b) The forbidden gap in pure silicon is 1.1eV. Compare the number of conduction electrons at temperatures 37^0C and 27^0C.
   (c) What is a diffraction grating? Explain with the help of a diagram.

[8+4+4]

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