

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**

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

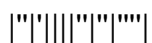
2. (a) Qualitatively analyse the spectrum obtained when a plane diffraction grating is exposed to monochromatic light of wavelength, λ .
 - (b) A grating has 6000 lines/cm. Find the angular separation between two wavelengths of 500nm and 510nm in the 3rd order.
 - (c) Explain the concept of effective 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 $2.42 \times 10^{-39} \text{ C}^2 \text{ m} / \text{N}$ and $1.74 \times 10^{-39} \text{ C}^2 \text{ m} / \text{N}$ at 309 K and 448 K respectively. Calculate the orientation polarizability at each temperature. (Given that $k_B = 1.38 \times 10^{-23} \text{ J/K}$)
 - (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 5500 m^3 is found to have a reverberation time of 2.3s. The sound absorbing surface of the hall has an area of 750 m^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 $3.66 \times 10^{-11} \text{ m}^3/\text{As}$. The conductivity of the specimen is found to be $112 \times 10^7 \text{ } \Omega^{-1}\text{m}^{-1}$. Calculate the charge carrier density and the electron mobility at room temperature.
(c) Distinguish between spontaneous and stimulated emissions. [8+4+4]



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**

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

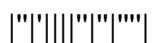
2. (a) Explain Rayleigh's criterion for resolution. Obtain an expression for the resolving power of a diffraction grating.
 - (b) A grating of width 2 inches is ruled with 15000 lines per inch. Find the smallest wavelength separation that can be resolved in second order at a mean wavelength of 500nm.
 - (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 2265m^3 and its total absorption is equivalent to 92.9m^2 of open window. What will be the effect on reverberation time if audience fill the hall and thereby increase the absorption by another 92.9m^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 $1.54 \times 10^{-8} \Omega\text{m}$ 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 $E_g=0.7\text{eV}$, 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]



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**

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 $\epsilon_r=1.0024$ at NTP and $N=2.7 \times 10^{25}$ atoms/m³.
- (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 5m³. 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

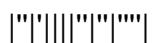
Set No - 3

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 $4.3 \times 10^{-3} \text{ m}^2/\text{Vs}$.
 (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, $T=300\text{K}$. Assume that $E_F = E_g/2$.
 (c) Explain in detail the acoustic demands of a hall.

[8+4+4]



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**

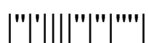
PART-A

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° 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 0.62×10^{-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 $E-E_F=0.01\text{eV}$ at 200K. Given that $k_B=1.38 \times 10^{-23}\text{J/K}$.
(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°C and 27°C .
(c) What is a diffraction grating? Explain with the help of a diagram. [8+4+4]

