Subject Code: R13203/R13 **Set No - 1**

I B. Tech II Semester Regular/Supplementary Examinations May - 2016

ENGINEERING PHYSICS

(Common to CE, ME,CSE,PCE,IT, Chem E, Aero E, Auto E, Min E, Pet E, Metal E, Textile Engg.)

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) How do you determine refractive index of a material using Newton's Rings?
   (b) Copper has FCC structure and its atomic radius is 0.1273nm. Find (i) Lattice parameter (ii) Density of copper. Given that atomic weight of the copper is 63.5 and Avagadro's number is $6.026 \times 10^{26} mol^{-1}$.
   (c) What is Meissner effect? Prove that all superconductors are perfect dia-magnets in superconducting state.
   (d) A magnetic field of 1800A/m produces a magnetic flux of 3×10^{-5}Wb in an iron bar of cross sectional area $0.2cm^2$. Calculate permeability.
   (e) Define Fermi energy level and discuss its importance in semiconductors.
   (f) For an intrinsic semiconductor with gap width $E_g = 0.7$ eV, calculate the concentration of intrinsic charge carriers at 300K assuming that $m_e^* = m_h^* = m_0$ (rest mass of electron).

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

PART-B

2. (a) Explain the theory of plane transmission grating and derive equations for maxima and minima.
   (b) A grating has 6000 lines/cm. Find the angular separation between two wavelengths of 500nm and 510nm in the 3rd order.
   (c) What are the drawbacks of classical free electron theory of metals?

[8+4+4]

3. (a) What is packing factor? Find the packing factor of FCC.
   (b) Draw crystal planes having Miller indices (111), (110) and (211).
   (c) Explain electronic transport mechanism of SOLAR cell.

[8+4+4]

4. (a) Derive the London equations and explain how their solution explains Meissner effect.
   (b) The dielectric constant of He gas at NTP is 1.0000684. Calculate the electronic polarizability of He atoms if the gas contains 2.7×10^{25} atoms/m^3 and hence evaluate the radius of the He atom. Given $\varepsilon_0 = 8.85 \times 10^{-12}$F/m.
   (c) Describe double refraction in a calcite crystal and define ordinary and extraordinary rays.

[8+4+4]

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5. (a) Discuss the important factors that affect the acoustics of the auditorium and describe methods to maintain good acoustics.
   (b) The total absorption for a movie theatre is 300 sabine. The reverberation time has been measured to be 3.5s. Calculate the total volume from this information.
   (c) Explain the origin of magnetic moment in magnetic materials.

[8+4+4]

6. (a) State the assumptions of quantum free electron theory. Derive an expression for current density of a metal by using this theory.
   (b) Calculate the conductivity of Al at 25^0C using the following data. Density of Al is $2.7g/cm^3$, atomic weight of Al is 27 and relaxation time is 10^{-14}s.
   (c) State and explain Eyring's formula.

[8+4+4]

7. (a) Explain Hall Effect. Derive an expression for Hall coefficient and mobility of charge carriers.
   (b) The Hall co-efficient of certain silicon was found to be $-7.35x10^{-5}$ m^3C^{-1} from 100 to 400 K. Determine the nature of the semiconductor. If the conductivity was found to be 200 m^{-1} Ω^{-1}, calculate the density and mobility of the charge carriers.
   (c) What are the characteristics of a laser?

[8+4+4]

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Subject Code: R13203/R13 **Set No - 2**

I B. Tech II Semester Regular/Supplementary Examinations May - 2016

ENGINEERING PHYSICS

(Common to CE, ME,CSE,PCE,IT, Chem E, Aero E, Auto E, Min E, Pet E, Metal E, Textile Engg.)

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) In a grating spectrum, which spectral line in 4^{th} order will overlap with 3^{rd} order line of 549.1nm?
   (b) Can a two level system be used for the production of laser? Justify your answer.
   (c) If a NaCl crystal is subjected to an electric field of 1000V/m and the resulting polarization is $4.3x10^{-8}$ C/m^2, calculate the relative permeability of NaCl. Given $\varepsilon_0 = 8.85 \times 10^{-12}$F/m.
   (d) How does the band theory of solids differ from the free electron model in explaining the properties of metals?
   (e) A conducting rod contains $8.5x10^{28}$ electrons per m^3. Calculate the electrical conductivity at room temperature if the collision time for electron is 2×10^{-14} s.
   (f) Explain the method of determining the band gap of an intrinsic semiconductor in terms of conductivity.

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

PART-B

2. (a) Describe Rayleigh's criterion for resolution. Obtain an expression for the resolving power of a diffraction grating.
   (b) Calculate the minimum number of lines in a grating that is just able to resolve two sources of light of wavelengths 600 and 610nm.
   (c) Explain the electronic transport mechanism of an LED.

[8+4+4]

3. (a) State and explain spontaneous and stimulated emission processes in lasers. Derive expressions for Einstein's coefficients.
   (b) Explain lasing action in a He-Ne laser with neat energy level diagram.
   (c) Derive expression for Fermi energy in case of a conductor.

[8+4+4]

4. (a) Explain indetail how susceptibility varies with temperature for dia, para, ferro, anti ferro and ferri magnetic materials.
   (b) A magnetic field of 2000 A/m is applied to a material which has a susceptibility of 1000. Calculate the (i) Intensity of Magnetisation and (ii) Flux density.
   (c) Distinguish between e-ray and o-ray.

[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 presentation room has a total absorption magnitude of 400sabine and its volume is 10,000m^3. Calculate the resultant reverberation time
   (c) Mention the properties of antiferromagnetism.

[8+4+4]

6. (a) Write Schrodinger's equation for a particle in a box. Solve it to obtain eigen values and eigen functions and show that they are discrete.
   (b) Calculate the energy difference between the lowest energy state and the first energy state of an electron moving in one dimensional box of width 0.1nm.
   (c) State any four factors that affect acoustics of buildings.

[8+4+4]

7. (a) What are the limitations of intrinsic semiconductors? Obtain an expression for the carrier concentration of holes in the valence band of p-type semiconductor.
   (b) Find the intrinsic resistivity of Ge at room temperature 300K if the carrier density is $2.15x10^{13}/cm^3$. Given that mobilities of charge carriers are $\mu_e=3900cm^2V^{-1}s^{-1}$ and $\mu_h=1900cm^2V^{-1}s^{-1}$ respectively.
   (c) Explain the procedure followed to obtain the Miller indices of a plane.

[8+4+4]

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Subject Code: R13203/R13 **Set No - 3**

I B. Tech II Semester Regular/Supplementary Examinations May - 2016

ENGINEERING PHYSICS

(Common to CE, ME,CSE,PCE,IT, Chem E, Aero E, Auto E, Min E, Pet E, Metal E, Textile Engg.)

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) Show that in double slit diffraction, angular spacing between two consecutive bright bands is inversely proportional to the sum of slit width 'a' and size of the opaque part 'b'.
   (b) How x-rays are diffracted by a crystal structure? What is the limiting condition for x-ray diffraction?
   (c) What are the factors affecting dielectric loss? Explain.
   (d) Calculate the critical current for a wire of lead having a diameter of 1mm at 4.2 K. Critical temperature for lead is 7.18 K and $H_0 = 6.5 \times 10^4$ A/m.
   (e) The mobility of electron in copper is 3×10^{-3} m^2/Vs. Assuming e = 1.6×10^{-19}C and $m_e = 9.1 \times 10^{-31}$ kg, Calculate the mean free time.
   (f) For an intrinsic semiconductor with a band gap of 0.7 eV, determine the position of E_F at T=300 K if $m_h^* = 6\, m_e^*$.

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

PART-B

2. (a) What is interference? Prove that the diameter of the nth dark ring in a Newton's ring set-up is directly proportional to the square root of the ring number.
   (b) Newton's rings are observed in reflected light of wavelength 600nm. The diameter of the 10^{th} dark ring is 0.5cm. Find the radius of curvature of the lens and thickness of the corresponding air film.
   (c) Explain the terms dielectric loss and dielectric breakdown.

[8+4+4]

3. (a) What are the Miller indices? Show that for a cubic lattice the distance between two successive (h,k,l) planes is given by $d = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$.
   (b) Determine lattice constant for FCC lead crystal of radius 0.1746nm. Also find the spacing of successive (i) (111) planes (ii) (200) planes and (iii) (220) planes.
   (c) Explain the electronic transport mechanism of Photoconductors.

[8+4+4]

4. (a) What is meant by local field in a dielectric? How can it be calculated for a cubic structure?
   (b) The dielectric constant of He gas at NTP is 1.0000684. Calculate the electronic polarizability of He atoms if the gas contains 2.7×10^{25} atoms/m^3 and hence evaluate the radius of the He atoms. Given $\varepsilon_0 = 8.85 \times 10^{-12}$F/m.
   (c) How do you determine the refractive index of a given liquid by using Newton's rings experiment? [8+4+4]

5. (a) State and explain Maxwell's equations and express them in differential form as well as in integral form.
   (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) Calculate the packing factor for a Bace Centred Cubic crystal.

[8+4+4]

6. (a) Write an expression for the Fermi energy distribution function F(E) and discuss its behaviour with change in temperature. Plot F(E) versus E for T=0K and T > 0K.
   (b) Use the Fermi distribution function to obtain the value of F(E) for the level just 0.01eV above the Fermi level at 200 K.
   (c) Differentiate between Soft and Hard superconductors.

[8+4+4]

7. (a) Give any four differences between n-type and p-type semiconductors. Derive an expression for carrier concentration in an n-type semiconductor.
   (b) An n-type semiconductor specimen has Hall coefficient $R_H=3.66x10^{-11}m^3A^{-1}s^{-1}$. The conductivity of the specimen is found to be $112x10^7\Omega^{-1}m^{-1}$. Calculate the electron density and mobility at room temperature.
   (c) Difine Reverberation Time and Explain the Sabine's formula.

[8+4+4]

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Subject Code: R13203/R13 **Set No - 4**

I B. Tech II Semester Regular/Supplementary Examinations May - 2016

ENGINEERING PHYSICS

(Common to CE, ME,CSE,PCE,IT, Chem E, Aero E, Auto E, Min E, Pet E, Metal E, Textile Engg.)

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 will be the path difference between O & E rays when unpolarized light falls on quarter wave plate along the optic axis? Justify the answer.
   (b) Distinguish between interplanar spacing and interatomic spacing.
   (c) Why ferromagnetic materials exhibit spontaneous magnetization?
   (d) Find the first two energy levels of an electron confined to move in a one dimensional box of width 0.1nm. Express the result in eV.
   (e) What are the characteristics of a LASER light? How these can be achieved with stimulated emission.
   (f) Define Fermi level in the case of semiconductors. Determine the position of the Fermi level in an n-type semiconductor at T=0K.

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

PART-B

2. (a) Discuss Fraunhofer's diffraction at a double slit with neat diagram. What is the effect of increasing (i) slit width (ii) slit separation on the diffraction pattern.
   (b) Light of wavelength 550nm falls normally on a slit of width 2.2×10^{-4}cm. Calculate the angular position of the first two minima on either side of the central maxima.
   (c) Distinguish between direct & indirect band gap semi conductors.

[8+4+4]

3. (a) Explain the physical basis of classifying crystals into seven systems and 14 Bravais lattices.
   (b) Molybdenum has a BCC structure. Its density is 10.2×10^3 kg/m^3 and its atomic weight is 95.94. Determine the radius of molybdenum atom.
   (c) What are the drawbacks of quantum 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) What is meant by reverberation? Discuss Sabine's formula.

[8+4+4]

5. (a) State and explain Gauss divergence and Stokes theorems. Elucidate their importance in converting Maxwell's equations from differential form to integral form.
   (b) A seminar room has a total volume of $1500m^3$. The magnitude of total absorption within the conference room is 80sabin. Calculate the reverberation time.
   (c) Deduce the Claussius-Mossotti relation for dielectrics.

[8+4+4]

6. (a) Derive an expression for the density of states and based on that calculate the carrier concentration in metals.
   (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) Explain the principle of propagation of light through optical fibre.

[8+4+4]

7. (a) What are the limitations of intrinsic semiconductors? Derive an expression for density of electrons in the conduction band of an intrinsic semiconductor.
   (b) For a silicon semiconductor with a band gap of 1.12eV, determine the position of the Fermi level at 300K if $m_e^* = 0.12m_0$ and $m_h^* = 0.28m_0$.
   (c) Define interference. What do you mean by coherent sources?

[8+4+4]

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