Code No: R05010103 **Set No. 1**

I B.Tech Semester Supplimentary Examinations, June 2009
ENGINEERING PHYSICS
(Common to Civil Engineering, Mechanical Engineering, Chemical Engineering, Mechatronics, Metallurgy & Material Technology, Production Engineering, Aeronautical Engineering and Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is superposition principle and explain the interference of light.
   (b) Explain why soap bubbles exhibit colors.
   (c) In a Newton's rings experiment the diameter of the 10^{th} dark ring is 0.5 cm by using a light of wavelength 5.9 $\times 10^{-5}$ cm. Find thickness of air film. [6+6+4]
2. (a) What is meant by double refraction?
   (b) Explain briefly optic axis and its characteristics.
   (c) Discuss the construction of a nicol prism. [6+4+6]
3. (a) Describe Josephson effects and their applications.
   (b) Write a note on flux quantization.
   (c) The London penetration depths for lead at temperatures 3 K and 7.1 K are respectively 39.6 nm and 173 nm. Calculate its transition temperature as well as depth at 0 K. [6+4+6]
4. (a) Explain the characteristics of a laser beam.
   (b) Describe the construction and working of a Ruby laser.
   (c) Discuss how lasers are helpful in induced fusion and isotope separation processes. [4+8+4]
5. (a) Define the relative refractive index difference of an optical fibre. Show how it is related to numerical aperture.
   (b) Draw the block diagram of an optical fibre communication system and explain the function of each block. [6+10]
6. (a) Define magnetic flux density, intensity of magnetization, magnetic permeability and magnetic susceptibility.
   (b) What is meant by magnetic domains?
   (c) How the magnetic materials are classified? Explain the properties of diamagnetic materials. [6+4+6]
7. (a) Explain how the X-ray diffraction can be employed to determine the crystal structure.

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(b) The distance between (110) planes in a body-centered cubic structure is 0.203 nm. What is the size of the unit cell? What is the radius of the atom? [10+6]

8. (a) What is Frenkel defect? Explain.

(b) Derive an expression for the concentration of Frenkel defects present in a crystal at any temperature. [6+10]

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Code No: R05010103 **Set No. 2**

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ENGINEERING PHYSICS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the colors in a thin film when exposed it to sun light.
   (b) Determine the refractive index of transparent liquid by using Newton's ring method.
   (c) A soap film of refractive index 1.33 and thickness 5000 A.U. is exposed to white light. What wavelengths in the visible region are reflected? [6+6+4]

2. (a) Explain the following:
      i. Polarization by selective absorption
      ii. Polarization by scattering.
   (b) Prove that if the angle of incidence corresponds to the Brewster's angle, then the angle between reflected and refracted beams is 90^0. [12+4]

3. (a) Define "reverberation" and "reverberation time" of a hall.
   (b) Derive Sabine's formula for reverberation time.
   (c) Find the reverberation time of a hall with dimensions 7 m length, 4 m width and 4 m height with the sound absorption coefficients: 0.30 for walls, 0.04 for ceiling and 0.10 for floor. [4+6+6]

4. (a) Explain the following typical characteristics of laser:
      i. coherence
      ii. divergence and
      iii. monochromaticity.
   (b) Explain the principle and working of a Ruby laser. [6+10]

5. (a) Derive expressions for numerical aperture and acceptance angle of an optical fibre.
   (b) What is the principle of optical fibre communication? Explain. [10+6]

6. (a) What are the characteristics of soft magnetic materials?
   (b) What is ferro-magnetic curie temperature? Discuss the behaviour of a ferro-magnetic material below the Curie temperature.
   (c) The magnetic induction in the interior of a certain solenoid has the value of 6.5×10^{-4} T when the solenoid is empty. When it is filled with iron, the induction becomes 1.4 T. Find the relative permeability of iron. [6+6+4]

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7. (a) Explain Bragg's law of X-ray diffraction.
   (b) Describe Laue's method for determination of crystal structure.
   (c) A beam of X-rays is incident on a NaCl crystal with lattice spacing 0.282 nm. Calculate the wavelength of X-rays if the first order Bragg reflection takes place at a glancing angle of $8^o35'$. Also calculate the maximum order of diffraction possible. [6+6+4]

8. (a) Explain edge dislocation with suitable sketch of it.
   (b) Discuss Burgers circuit around edge dislocation and explain Burgers vector in this case. [8+8]

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Code No: R05010103 **Set No. 3**

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ENGINEERING PHYSICS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State and explain conditions for interference of light.
   (b) Compare the formation of Newton's rings by reflected light with rings formed by transmitted light.
   (c) Two coherent light sources whose intensity ratio is 9:1 produce interference fringes. Find the ratio of maximum to minimum intensity of interference fringes. [6+6+4]

2. (a) Explain the following terms in ultrasonics:
      i. Galton's whistle
      ii. Piezoelectric effect
      iii. Acoustic impedance
      iv. Attenuation.
   (b) Discuss the important uses of ultrasonics. [12+4]

3. (a) What are DC and AC Josephson effects?
   (b) What is a SQUID? Explain its functioning.
   (c) Write any three applications of superconductivity. [8+5+3]

4. (a) Explain the terms
      i. absorption,
      ii. spontaneous emission
      iii. stimulated emission
      iv. population inversion, relating to laser.
   (b) Describe the principle of lasing action.
   (c) Mention the important characteristics of laser beam. [8+4+4]

5. (a) What is total internal reflection? Discuss its importance in optical fibres.
   (b) Describe the various types of optical fibres, their advantages and limitations.
   (c) If the numerical aperture of a fibre is 0.245 with a core refractive index 1.51, calculate the refractive index of cladding as well as acceptance angle. [6+6+4]

6. (a) Describe the crystal structure of ZnS.

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(b) Obtain the relations between the edge of the unit cell and atomic radius for the BCC and FCC lattices.

(c) Lithium crystallizes in BCC structure. Calculate the lattice constant, given that the atomic weight and density for lithium are 6.94 gm/mole and 530 kg/m^3 respectively. [6+6+4]

7. (a) What are Miller indices? Draw (111) and (110) planes in a cubic lattice.

(b) Explain Bragg's law of X-ray diffraction.

(c) The Bragg's angle for reflection from the (111) plane in a FCC crystal in the first order, is 19.2^o for an X-ray wavelength of 1.54 A.U. Compute the cube edge of the unit cell.

[6+6+4]

8. (a) Write in detail the different kinds of crystal imperfections.

(b) Explain the significance of Burgers vector. [10+6]

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Code No: R05010103 **Set No. 4**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain with theory how the refractive index of a liquid can be found using Newton's rings.
   (b) Give the applications of interference of light. [10+6]
2. (a) Distinguish between polarized and unpolarized lights.
   (b) What is Brewster's law? Explain how this can be used to find the polarizing angles of various crystals.
   (c) Find the Brewster angle for a glass slab (μ =1.5) immersed in water (μ =4/3). [4+8+4]
3. (a) Explain Meissner effect.
   (b) What is meant by isotopic effect? Explain with suitable example.
   (c) A superconducting material has a critical temperature of 3.7 K, and a magnetic field of 0.0306 tesla at 0 K. Find the critical field at 2 K. [6+6+4]
4. (a) What do you understand by population inversion? How it is achieved?
   (b) Derive the relation between the probabilities of spontaneous emission and stimulated emission in terms of Einstein's co-efficients. [6+10]
5. (a) Explain the principle behind the functioning of an optical fibre.
   (b) Derive an expression for acceptance angle for an optical fibre. How it is related to numerical aperture?
   (c) An optical fibre has a numerical aperture of 0.20 and a cladding refractive index of 1.59. Find the refractive index of core and the acceptance angle for the fibre in water which has a refractive index of 1.33. [4+8+4]
6. Write notes on the following:
   (a) Diamagnetic materials
   (b) Paramagnetic materials
   (c) Ferromagnetic materials
   (d) Antiferromagnetic materials. [4×4]
7. (a) Draw the (112) and (120) planes, and the [112] and [120] directions of a simple cubic crystal.

(b) Derive an expression for the inter-planar spacing in the case of a cubic structure.

(c) Calculate the glancing angle at (110) plane of a cubic crystal having axial length 0.26 nm corresponding to the second order diffraction maximum for the X-rays of wavelength 0.065 nm. [4+8+4]

8. (a) Explain edge dislocation with suitable sketch of it.

(b) Discuss Burgers circuit around edge dislocation and explain Burgers vector in this case. [8+8]

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