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

I B.Tech Regular Examinations, Apr/May 2007
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) Differentiate between interference and diffraction. [6]
   (b) Explain Rayliegh's criterion for resolving power of a telescope. [6]
   (c) A plane transmission grating having 6000 lines/cm is used to obtain a spectrum of light from a sodium lamp in the second order. Calculate the angular separation between two sodium lines D_1 and D_2 of wavelengths 5890 A.U. and 5896 A.U. [4]

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

3. (a) Define the terms of superconductivity:
      i. Critical temperature
      ii. Critical magnetic field and
      iii. Critical current. [6]
   (b) What are Copper pairs? Explain. [4]
   (c) Write notes on any four applications of superconductors. [6]

4. (a) Explain the following:
      i. Life time of an energy level.
      ii. Optical pumping processes.
      iii. Metastable states. [6]
   (b) Distinguish between spontaneous and stimulated emission processes of light. [4]
   (c) Discuss briefly the different methods of producing laser light. [6]

5. (a) Explain the terms 'numerical aperture' and 'acceptance angle'. [6]
   (b) With the help of a suitable diagram explain the principle, construction and working of an optical fibre as a wave guide. [6]

(c) An optical fibre has a core material of refractive index of 1.55 and cladding material of refractive index 1.50. The light is launched into it in air. Calculate its numerical aperture. [4]

6. (a) What are the properties of antiferromagnetic materials? [6]
   (b) What is meant by Neel temperature? [4]
   (c) Explain how antiferromagnetic materials are different from diamagnetic and para-magnetic materials. [6]

7. (a) What are Miller indices? How are they obtained? [8]
   (b) Explain Bragg's law of X-ray diffraction. [8]

8. (a) Give an account on the effects of dislocations on the properties of solids. [10]
   (b) Explain the significance of Burgers vector. [6]

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

I B.Tech Regular Examinations, Apr/May 2007
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) With ray diagram discuss the theory of thin films and the condition for constructive and destructive interference in the case of transmitted system. [10]
   (b) Two slits separated by a distance of 0.2 mm are illuminated by a monochromatic light of wavelength 550 nm. Calculate the fringe width on a screen at distance of 1 m from the slits. [6]

2. (a) Write notes on:
      i. Magnetostriction effect and
      ii. Piezo-electric effect [8]
   (b) Describe with a neat circuit diagram to produce ultrasonics by magnetostriction effect. [8]

3. (a) Derive Sabine's formula for reverberation time. [6]
   (b) Define the term coefficient of absorption and write short notes on it. [6]
   (c) A hall has dimensions $20 \times 15 \times 5$ m^3. The reverberation time is 3.5 sec. Calculate the total absorption of its surfaces and the average absorption coefficient. [4]

4. (a) Explain the following:
      i. Life time of an energy level.
      ii. Optical pumping processes.
      iii. Metastable states. [6]
   (b) Distinguish between spontaneous and stimulated emission processes of light. [4]
   (c) Discuss briefly the different methods of producing laser light. [6]

5. (a) Explain the terms 'numerical aperture' and 'acceptance angle'. [6]
   (b) With the help of a suitable diagram explain the principle, construction and working of an optical fibre as a wave guide. [6]
   (c) An optical fibre has a core material of refractive index of 1.55 and cladding material of refractive index 1.50. The light is launched into it in air. Calculate its numerical aperture. [4]

6. (a) Explain "unit cell" and "Lattice parameters". What is a primitive cell and how does it differ from unit cell? [6]
   (b) Describe the crystal structure of CsCl. [6]
   (c) Chromium has BCC structure. Its atomic radius is 0.1249 nm. Calculate the free volume per unit cell. [4]

7. (a) Derive Bragg's law of X-ray diffraction. [6]
   (b) Describe Bragg's X-ray spectrometer and explain how Bragg?s law can be verified. [6]
   (c) Monochromatic X-rays of λ=1.5 A.U. are incident on a crystal face having an interplanar spacing of 1.6 A.U. Find the highest order for which Bragg?s reflection maximum can be seen. [4]

8. (a) Explain Schottky and Frenkel defects with the help of suitable figures. [6]
   (b) Derive an expression for the number of Schottky defects in equilibrium at a temperature T. [6]
   (c) The fraction of vacancy sites in a metal is 1 $\times 10^{-10}$ at 500 ^{0}C. What will be the fraction of vacancy sites at 1000 ^{0}C? [4]

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

I B.Tech Regular Examinations, Apr/May 2007
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) Write the expression for resolving power of a telescope. [8]
   (b) Explain how resolving power can be improved? [4]
   (c) Calculate the linear separation between two points at a distance of 10 km from a telescope objective of width 0.5 m if the wavelength of light used is 600 nm. [4]

2. (a) Explain the following:
      i. Polarized light
      ii. Double refraction [10]
   (b) Calculate the thickness of a quarter wave plate for a monochromatic light of wavelength 600 nm if the refractive indices of ordinary and extra-ordinary rays in the medium are 1.5442 and 1.5533 respectively. [6]

3. (a) Define the terms of superconductivity:
      i. Critical temperature
      ii. Critical magnetic field and
      iii. Critical current. [6]
   (b) What are Copper pairs? Explain. [4]
   (c) Write notes on any four applications of superconductors. [6]

4. (a) Explain the characteristics of a laser beam. [4]
   (b) Describe the construction and working of a ruby laser. [8]
   (c) Discuss how lasers are helpful in induced fusion and isotope separation processes. [4]

5. (a) What are the advantages of an optical fibre communication system over the conventional ones? [6]
   (b) Describe the basic elements of a fibre optics communication system with block diagram. [10]

6. (a) What are the characteristics of hard magnetic materials. [6]
   (b) Give the explanation of spontaneous magnetization of ferro-magnetic materials below the curie temperature. [6]

(c) What are the uses of ferrites? [4]

7. (a) Explain Bragg's law of X-ray diffraction. [6]

(b) Describe Laue's method for determination of crystal structure. [6]

(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. [4]

8. (a) Give an account on the effects of dislocations on the properties of solids. [10]

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

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

I B.Tech Regular Examinations, Apr/May 2007
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) Show that the fringe width of bright and dark fringes in Young's experiment is same. [6]
   (b) Explain the interference of light due to thin films. [6]
   (c) In a Newton's rings experiment the diameter of the 10^{th} dark ring changes from 1.4 cm to 1.27 cm when a liquid is introduced between the lens and the plate. Find the refractive index of the liquid. [4]
2. (a) Explain why the sky appears blue and red at different times during a day. [4]
   (b) Discuss how the circular and elliptical polarized lights can be produced. [6]
   (c) The refractive index of calcite crystal is 1.658 for ordinary ray and it is 1.486 for extra-ordinary ray. A slice having thickness 0.9×10^{-4} cm is cut from the crystal. For what wavelengths this slice behave as a
      i. quarter wave plate,
      ii. half wave plate? [6]
3. (a) Explain Josephson effect of superconductivity. [6]
   (b) What is penetration depth? Explain. [6]
   (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. [4]
4. (a) Explain the characteristics of a laser beam. [4]
   (b) Mention any two applications of laser, each in the field of scientific research, engineering and medicine. [6]
   (c) Describe the construction and working of a Ruby laser. [6]
5. (a) What is meant by an acceptance angle for an optical fibre? Obtain mathematical expressions for acceptance angle and numerical aperture (NA). [10]
   (b) An optical fibre has a NA of 0.20 and cladding refractive index of 1.59. Determine the refractive index of core and the acceptance angle for the fibre in water which has a refractive index of 1.33. [6]
6. (a) What are paramagnetic and diamagnetic materials? Give examples. [10]
   (b) Discuss the temperature variation of susceptibilities in paramagnetic and diamagnetic materials. [6]

7. (a) Define Miller indices. Sketch the following atomic planes in a simple cubic structure (010), (110) and (111). [6]
   (b) Derive an expression for the inter-planar distance in terms of Miller indices for a cubic structure. [10]

8. (a) Explain Schottky and Frenkel defects with the help of suitable figures. [6]
   (b) Derive an expression for the number of Schottky defects in equilibrium at a temperature T. [6]
   (c) The fraction of vacancy sites in a metal is 1×10^{-10} at 500 ^{0}C. What will be the fraction of vacancy sites at 1000 ^{0}C? [4]

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