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

I B.Tech Supplimentary Examinations, February 2008
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) Describe the interference pattern obtained due to superposition of coherent sources.
   (b) Derive an expression for the distance between two successive bright fringes formed in Young's experiment.
   (c) In a double slit experiment a light of $\lambda = 5460$ A.U. is exposed to slits which are 0.1 mm apart. The screen is placed 2 m away from the slits. What is the angular position of the 10^{th} maximum and 1^{st} minimum? [6+6+4]

2. (a) Define the following:
      i. Plane of vibration
      ii. Plane of polarization
      iii. Optic axis.
   (b) Differentiate the linearly polarized and circularly polarized lights.
   (c) Find the minimum thickness of half-wave and quarter-wave plates for a light beam (λ= 589.3 nm) if $\mu_0 = 1.65835$ and $\mu_e = 1.48640$. [6+6+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 the principle of optical fibre communication? Explain.
   (b) Discuss various types of fibres for light wave communication. [8+8]

6. (a) Explain the salient features of anti-ferromagnetic materials.

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(b) Define the terms magnetic susceptibility, magnetic induction and permeability. How is magnetic susceptibility of a material measured? [6+10]

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 the various point defects in a crystal.

(b) Obtain the expression for the equilibrium concentration of vacancies in a solid at a given temperature. [8+8]

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

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

Answer any FIVE Questions
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1. (a) What is diffraction of light?
   (b) Describe the Fraunhofer diffraction pattern obtained with single slit.
   (c) In a diffraction due to single slit the screen is placed at 1 m from the slit that is illuminated by a light of wavelength 5890 A.U. The width of the slit is 0.1 mm. Find the separation between the central maximum and the first minimum. [4+8+4]

2. (a) Explain how nicol prism acts as an analyzer.
   (b) With necessary diagram explain elliptically polarized light.
   (c) Calculate the thickness of quarter wave plate and half wave plate, given that refractive indices of ordinary ray and extra-ordinary ray are 1.653 and 1.644 respectively. Wavelength of light used is 5400 A.U. [6+6+4]

3. (a) Explain in detail the basic requirements of an acoustically good hall.
   (b) For an empty auditorium of size 20 × 15 × 10 m^3, the reverberation time is 3.5 sec. Calculate the average absorption co-efficient of the auditorium. What area of the wall should be covered by the curtain so as to reduce the reverberation time to 2.5 sec? Given that the absorption co-efficient of curtain cloth is 0.5. [10+6]

4. (a) Explain the characteristics of a laser beam.
   (b) Mention any two applications of laser, each in the field of scientific research, engineering and medicine.
   (c) Describe the construction and working of a Ruby laser. [4+6+6]

5. (a) Describe the construction of a typical optical fibre and give the dimensions of the various parts.
   (b) Define the acceptance angle and numerical aperture. Obtain an expression for the numerical aperture of an optical fibre.
   (c) Calculate the numerical aperture and acceptance angle for an optical fibre with core and cladding refractive indices being 1.48 and 1.45 respectively. [4+8+4]

6. (a) Define the terms magnetic susceptibility, magnetic permeability, magnetic induction and magnetization.

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(b) What are the sources of permanent dipole moment in magnetic materials?

(c) Explain the important properties of Ferrites. [6+6+4]

7. (a) Derive Bragg's law of X-ray diffraction.

(b) Describe Bragg's X-ray spectrometer and explain how Bragg?s law can be verified.

(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. [6+6+4]

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

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

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

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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) Obtain the condition for primary and secondary maxima in Fraunhofer diffraction due to a single slit and derive an expression for width of the central maxima.
   (b) A lens of focal length 0.4 m and slit of width 0.2 mm are used to obtain diffraction pattern. Calculate the distance of first dark band and width of central maxima, if the wavelength of light used is 500 nm. [12+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) State the acoustic requirements of a good hall. Explain how these requirements can be achieved.
   (b) A concert hall has a volume of 2265 m^3 and its total absorption is equivalent to 92.9 m^2 sabines. How many persons should be seated in the hall so that the reverberation time becomes 2 seconds? Given that the absorption area of one person is equivalent to 18.6 m^2 of open window. Calculate the reverberation time of the empty hall, also. [10+6]

4. (a) Explain the terms:
      i. Absorption.
      ii. Spontaneous emission.
      iii. Stimulated emission.
      iv. Pumping mechanism.
      v. Population inversion.
      vi. Optical cavity.
   (b) Mention the medical applications of lasers. [12+4]

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

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6. (a) Explain the physical basis for classifying crystals into seven systems and fourteen Bravais lattices. [6+10]
   (b) Describe the crystal structure of CsCl.

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 why different colors are exhibited by a thin film when exposed to white light.
   (b) Write the necessary theory to determine the radius of curvature of a lens using Newton's rings method.
   (c) In Young's double slit experiment the separation of slits is 1.9 mm and the fringe spacing is 0.31 mm. The screen is placed at a distance of 1 m from the slits. Find the wavelength of the light? [6+6+4]

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

4. (a) Describe the principle, construction and working of a semiconductor laser.
   (b) Write the applications of laser. [10+6]

5. (a) Derive expressions for the numerical aperture and the fractional index change of an optical fibre.
   (b) Write a note on the applications of optical fibres.
   (c) Calculate the fractional index change for a given optical fibre if the refractive indices of the core and the cladding are 1.563 and 1.498 respectively. [8+4+4]

6. (a) Explain how the magnetic materials are classified from the atomic point of view.
   (b) What are the differences between hard and soft magnetic materials.
   (c) A magnetic material has a magnetization of 3300 ampere / m and flux density of 0.0044 wb / m^2. Calculate the magnetizing force and the relative permeability of the material. [6+6+4]

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7. (a) Sketch the following planes of a cubic unit cell: (001), (120) and $(\bar{2}11)$.
   (b) Explain Bragg's law of X-ray diffraction.
   (c) Describe Laue's method for determination of crystal structure. [3+5+8]

8. (a) Explain Schottky and Frenkel defects with the help of suitable figures.
   (b) Explain the significance of Burgers vector. [10+6]

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