

I B.Tech Supplementary Examinations, Aug/Sep 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**

1. (a) Explain how Newton's rings are formed in the reflected light.
(b) Derive the expressions for the diameters of dark and bright rings.
(c) Newton's rings are observed in the reflected light of wavelength $5900 \text{ \AA}$. The diameter of tenth dark ring is 0.5 cm. Find the radius of curvature of the lens used. [6+6+4]
2. (a) What is meant by diffraction of light? Explain it on the basis of Huygen's wave theory.
(b) What are the types of diffraction and give the difference between them.
(c) What is the difference between Interference and Diffraction? [6+6+4]
3. (a) What is meant by double refraction?
(b) Explain briefly optically axis and its characteristics.
(c) Discuss the construction of a nicol prism. [6+4+6]
4. (a) Explain the purpose of an active medium in a gas laser.
(b) With the help of suitable diagrams, explain the principle, construction and working of a helium-neon laser. [6+10]
5. (a) Give an example of engineering application in which you would use a material with a low value of specific heat and a high value of specific heat.
(b) Discuss the variation of thermal conductivity of a solid with temperature.
(c) Explain the terms:
 - i. drift velocity
 - ii. relaxation time
 - iii. collision time and
 - iv. mean free path. [4+4+8]
6. (a) How are the dielectric materials classified?
(b) Write short notes on "Porcelain". [10+6]
7. (a) Describe the hysteresis of a ferro-magnetic material.
(b) Explain the properties and applications of ferrites.

- (c) Calculate the paramagnetic susceptibility at room temperature for iron oxide, when the material density is 5×10^{28} atoms / m^3 . [6+6+4]
8. (a) What is meant by dislocation?
- (b) Explain the role of dislocation in the strength of crystals.
- (c) Explain the mechanism of creep in materials. [4+6+6]

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1. (a) Explain the principle of superposition of waves.
(b) Explain the phenomenon of interference.
(c) With relevant diagram explain Young's experiment on the basis of wave theory. [5+5+6]
2. (a) What is meant by diffraction of light? Explain it on the basis of Huygen's wave theory.
(b) What are the types of diffraction and give the difference between them.
(c) What is the difference between Interference and Diffraction? [6+6+4]
3. (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 ($\mu = 1.5$) immersed in water ($\mu = 4/3$). [6+6+4]
4. (a) Give the various pumping mechanisms that are adopted in lasers.
(b) Discuss the essential features of a laser beam.
(c) Explain the uses of lasers in various fields. [6+6+4]
5. (a) Define molar specific heat of a solid.
(b) Discuss the merits and demerits of Einstein's theory of specific heat of solids.
(c) What are phonons? [4+10+2]
6. (a) Discuss, in detail, the theory of dielectrics in alternating field.
(b) A dielectric material has $\epsilon_r = 12$ and it contains 5×10^{28} atoms/ m^3 . Calculate the electronic polarizability assuming Lorentz field. [12+4]
7. (a) What are paramagnetic materials? Explain.
(b) Obtain an expression for paramagnetic susceptibility (χ). How does the paramagnetic susceptibility of a material vary with temperature?
(c) A paramagnetic material has 10^{28} atoms per m^3 . Its susceptibility at 350 K is 2.8×10^{-4} . Calculate the susceptibility at 300 K. [6+6+4]

8. (a) What are the general requirements for spacecraft materials?
- (b) What are the different classifications of the spacecraft materials? Explain how they are classified? [6+10]

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1. (a) What are coherent sources? Why any two independent sources of light cannot produce interference fringes?
(b) With relevant diagram, explain Young's experiment on the basis of wave theory. [8+8]
2. (a) Write the expression for resolving power of a telescope.
(b) Explain how resolving power can be improved?
(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. [8+4+4]
3. (a) Explain the following:
 - i. Polarized light
 - ii. Double refraction
 - iii. Non-destructive testing(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. [12+4]
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. [6+4+6]
5. (a) Define molar specific heat of a solid.
(b) Give an account of the various theories of specific heat of a solid. Discuss any one of them in detail. [4+12]
6. (a) Explain the term "relative permittivity" of a dielectric medium.
(b) Derive an expression for dielectric loss of a dielectric material. [6+10]

7. (a) What is meant by hysteresis in magnetic materials?
(b) What are magnetic domains? Explain hysteresis basing on domain theory. [8+8]
8. (a) What is the effect of stress and temperature on creep?
(b) Explain with neat sketch the different types of creep and their mechanism.
(c) What is the difference between creep and fatigue? [4+8+4]

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2. (a) What is meant by diffraction of light? Explain it on the basis of Huygen's wave theory.
(b) What are the types of diffraction and give the difference between them.
(c) What is the difference between Interference and Diffraction? [6+6+4]
3. (a) Explain how nicol prism acts as an analyser.
(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. Wave length of light used is 5400 A.U. [6+6+4]
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) Explain in detail
 - i. Seebeck effect
 - ii. Peltier effect and
 - iii. Thomson effect.
(b) For a thermo-couple, the Seebeck coefficients are $\alpha = 3.44 \mu\text{V}/^\circ\text{C}$ and $\beta = 0.008 (\mu\text{V}/^\circ\text{C})^2$. Calculate the thermo-e.m.f. when the junctions are at 0°C and 200°C [12+4]

6. (a) Explain the terms:
- i. relative permittivity
 - ii. loss factor and
 - iii. dielectric strength of a dielectric medium.
- (b) What is dielectric polarization? Briefly, describe the major types of polarization which occur in dielectrics. [6+10]
7. Write notes on the following:
- (a) Soft magnetic materials
 - (b) Hard magnetic materials
 - (c) Hysteresis curve. [5+5+6]
8. (a) What are the general requirements for spacecraft materials?
- (b) What are the different classifications of the spacecraft materials? Explain how they are classified? [6+10]
