

**I B.Tech Supplementary Examinations, November/December 2005**  
**ENGINEERING PHYSICS**  
**( Common to Civil Engineering, Mechanical Engineering, Chemical Engineering, Mechatronics, Metallurgy & Material Technology and Production Engineering)**

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

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. (a) Give the theory of colours in thin films with a ray diagram for a reflected system.  
(b) Thin film of thickness 0.2 mm is illuminated by light of wavelength 620 nm. If the 3<sup>rd</sup> dark band was observed at the refracting angle of 5°35' calculate the refractive index of the film. [12+4]
2. (a) Differentiate between interference and diffraction.  
(b) Explain Rayleigh's criterion for resolving power of a telescope.  
(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<sub>1</sub> and D<sub>2</sub> of wavelengths 5890 A.U. and 5896 A.U. [6+6+4]
3. (a) What is meant by double refraction?  
(b) Explain briefly optical axis and its characteristics.  
(c) Discuss the construction of a Nicol prism. [6+4+6]
4. (a) Describe the construction of a typical optical fiber 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 fiber.  
(c) Calculate the numerical aperture and acceptance angle for an optical fiber with core and cladding refractive indices being 1.48 and 1.45 respectively. [6+6+4]
5. (a) Discuss the reasons for the failure of Dulong and Petit's law in predicting the specific heat of a solid at low temperature.  
(b) Derive an expression for the specific heat of a solid on the basis of quantum theory. [6+10]
6. (a) How are the dielectric materials classified?  
(b) Write short notes on "Porcelain". [10+6]
7. (a) Explain superconducting phenomenon. Distinguish Type I and Type II superconductors.

- (b) Discuss various applications of superconductors. [10+6]
8. (a) Explain the different stages of creep using the creep curve.
- (b) What is the role of grain size in creep strength?
- (c) Explain how the phenomena of creep is controlled in metals. [8+4+4]

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1. (a) With relevant theory explain how radius of curvature of a convex lens be determined by forming Newton's rings.  
(b) In Newton's rings system if the diameters of 4<sup>th</sup> and 6<sup>th</sup> rings are found to be 0.2 mm and 0.25 mm, calculate the wavelength of light used. The radius of curvature of the convex surface of the lens is 0.9 m. [12+4]
2. (a) Differentiate between interference and diffraction.  
(b) Explain Rayleigh's criterion for resolving power of a telescope.  
(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<sub>1</sub> and D<sub>2</sub> of wavelengths 5890 A.U. and 5896 A.U. [6+6+4]
3. (a) Discuss the various non-destructive testing systems which are commonly adopted in industries using ultrasonics.  
(b) Write a note on ultrasonic testing methods that are used in non-destructive testing. [8+8]
4. (a) Describe the construction of a typical optical fiber 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 fiber.  
(c) Calculate the numerical aperture and acceptance angle for an optical fiber with core and cladding refractive indices being 1.48 and 1.45 respectively. [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) How are the dielectric materials classified?  
(b) Write short notes on "Porcelain". [10+6]
7. (a) What is ferromagnetism? What are the distinguishing features of ferromagnetism?

- (b) What are ferrites? Explain the magnetic properties of ferrites and mention their industrial applications. [8+8]
8. (a) Describe in detail how slip and twinning can cause plastic deformation.
- (b) Describe Frank - Read mechanism for dislocation motion. [8+8]

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1. (a) Give the analytical treatment of interference of light and hence obtain the condition for maximum and minimum intensity.  
(b) Two coherent sources of intensity  $10 \text{ Wm}^{-2}$  and  $25 \text{ Wm}^{-2}$  interfere to form fringes. Find the ratio of maximum intensity to minimum intensity. [12+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) 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) Describe the construction of a typical optical fiber 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 fiber.  
(c) Calculate the numerical aperture and acceptance angle for an optical fiber with core and cladding refractive indices being 1.48 and 1.45 respectively. [6+6+4]
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) How are the dielectric materials classified?  
(b) Write short notes on "Porcelain". [10+6]
7. (a) Explain Josephson effect.  
(b) What is penetration depth?  
(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. [8+4+4]

8. (a) Distinguish between elastic and plastic deformation.
- (b) Draw the creep diagram and explain the different stages of creep. [6+10]

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1. (a) With relevant theory explain how radius of curvature of a convex lens be determined by forming Newton's rings.  
(b) In Newton's rings system if the diameters of 4<sup>th</sup> and 6<sup>th</sup> rings are found to be 0.2 mm and 0.25 mm, calculate the wavelength of light used. The radius of curvature of the convex surface of the lens is 0.9 m. [12+4]
2. (a) Explain with theory the Fraunhofer diffraction due to 'n' slits.  
(b) Find the highest order that can be seen with a grating having 15000 lines/inch. The wavelength of the light used is 600 nm. [12+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 need of a cavity resonator in a laser.  
(b) With the help of suitable diagrams, explain the principle, construction and working of a Ruby laser. [6+10]
5. (a) Write notes on
  - i. Thermo-gravimetric analysis and
  - ii. Thermo-mechanical analysis.(b) The junctions of a thermo-couple are maintained at the ice point and steam point. Calculate
  - i. thermo-e.m.f.,
  - ii. thermo-electric power,
  - iii. neutral temperature and
  - iv. inversion temperature,if the variation of the thermo-e.m.f. (E) with temperature difference between the junctions (t), is given by  $E = (35.6 \times 10^{-6})t - (0.145 \times 10^{-6})t^2$ . [10+6]

6. (a) Explain the terms:
- i. dielectric displacement, and
  - ii. relative dielectric constant.
- (b) Obtain an expression for the dielectric loss in a dielectric. [6+10]
7. Write notes on the following:
- (a) Magnetic materials
  - (b) Superconductors. [8+8]
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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