B.Tech. Degree I & II Semester Examination in Marine Engineering May 2015

MRE 1103 ENGINEERING PHYSICS

Time: 3 Hours   Maximum Marks: 100

(5 × 20 = 100)

I.   (a) What are Newton's rings? How are they formed? Derive an expression for the diameter of the nth dark ring.   (12)

 (b) Explain an interference method for testing the optical planeness of a glass plate.   (5)

 (c) Interference fringes are produced using monochromatic light of wavelength 600 nm falling normally on a wedge-shaped film of refractive index 1.4. If the fringe width is 1.2 mm, calculate the angle of the wedge.   (3)

OR

II. (a) Explain how X-rays are produced using Coolidge tube. How is the intensity and quality of the X-rays controlled?   (9)

 (b) What are continuous and characteristic X-rays? Explain their origin.   (8)

 (c) Second order Bragg's reflection is found to occur at glancing angle 30° from crystal planes having interplanar spacing 1.6 $\overset{\circ}{A}$. Determine the wavelength of X-rays.   (3)

III. (a) Describe the construction and action of a zone plate. Derive an expression for its focal length.   (10)

 (b) State and explain Rayleigh's criterion for resolution. Apply it to find an expression for the resolving power of a grating.   (7)

 (c) Plane waves of wavelength 500 nm are incident on a zone plate whose first zone has radius 0.025 cm. Find where a screen must be placed so that light is focused on to it.   (3)

OR

IV. (a) Explain the construction and action of a Nicol prism.   (8)

 (b) What is optical activity? Explain how specific rotation is determined using half-shade polarimeter.   (9)

 (c) Calculate the minimum thickness of a doubly refracting crystal required to introduce a phase difference of 60° between the ordinary and extraordinary rays. Given that the wavelength of light used is 600 nm and the refractive indices of the crystal for ordinary and extra ordinary rays are 1.54 and 1.55 respectively.   (3)

V.   (a) Explain 'spontaneous emission' and 'stimulated emission'.   (4)

 (b) With the help of necessary diagrams, describe the construction and working of He-Ne laser.   (12)

 (c) Explain the characteristics of laser in contrast to ordinary light.   (4)

OR

VI. (a) What is the basic principle of holography? Explain.   (4)

 (b) Explain the recording and reconstruction of a transmission hologram.   (12)

 (c) Write a note on white light hologram.   (4)

VII. (a) Define 'numerical aperture' and 'mode' in an optical fibre. (4)

(b) Derive an expression for the numerical aperture of a step-index fibre. (12)

(c) An optical fibre has core refractive index 1.5 and fractional refractive index 0.04. (4)
Estimate the refractive index of the cladding, critical angle at the core-cladding
interface and the acceptance angle in air.

OR

VIII. (a) Explain with the help of block diagram the optical fibre communication system. (10)

(b) Explain the applications of fibre (i) in medicine   (ii) in sensors. (10)

IX. (a) What is piezoelectric effect? Describe how it is used in the production of ultrasonic (8)
sound.

(b) Write notes on: (12)
   (i) SONAR
   (ii) NDT using ultrasonic sound
   (iii) Gyrocompass

OR

X. (a) Explain Meissner effect, isotope effect and Josephson effect. (12)

(b) Distinguish between type I and type II superconductors. (8)

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