B. Tech Degree I & II Semester Examination in Marine Engineering, June 2010

MRE 103 ENGINEERING PHYSICS

Time : 3 Hours   Maximum Marks : 100

I. (a) Explain the formation of Newton's rings. (3)
    (b) Explain with necessary theory, how to determine the wavelength of a monochromatic light, using Newton's rings set-up. (8)
    (c) How will you determine the refractive index of a liquid using Newton's rings experimental set-up? (6)
    (d) Newton's rings are formed with reflected light of wavelength 5890 A° with a liquid between a plane glass and a curved surface. The diameter of the 6th ring is 5 mm and the radius of curvature of the curved surface is 10^3 mm. Calculate the refractive index of the liquid. (3)

OR

II. (a) Two optically plane glass plates slightly inclined to each other at an angle θ is illuminated with monochromatic light from the top and observed under a microscope. Discuss the interference phenomenon involved. (3)
    (b) With supporting diagrams and theory, obtain an expression for the fringe width β of the interference pattern formed. (10)
    (c) How can you determine the thickness of a strand of your hair with the set-up mentioned above? (4)
    (d) Two optically plane glass plates of length 0.1 m are placed one over the other with a thin wire at one end separating the two. The fringes formed with light of wavelength 5893 A° are of width 3 mm. Calculate the radius of the wire. (3)

III. (a) Explain the phenomenon of diffraction of light. Write four differences between Fresnel and Fraunhofer diffraction. (6)
     (b) What do you mean by resolving power of a plane diffraction grating? Obtain an expression for the resolving power of a grating. (7)
     (c) Discuss with necessary diagrams, Rayleigh's criterion for the resolution of two nearby spectral lines. (4)
     (d) Calculate the minimum number of lines per cm in a 2.5 cm grating which will just resolve the sodium lines (5890 A° and 5896 A°) in the second order spectrum. (3)

OR

IV. (a) What do you mean by double refraction? (3)
    (b) Write *any four* differences between positive and negative crystals. (4)
    (c) Explain the construction and working of a Nicol's prism. (6)
    (d) Briefly describe the method by which circularly polarized light can be analyzed. (4)
    (e) Find the thickness of a quarter wave plate when the wavelength of light used is 5.89 x 10^{-7} m. Refractive index for ordinary light is 1.55 and for extra ordinary light is 1.54. (3)

(Turn Over)

V.	(a)	Write short notes on spatial and temporal coherence.	(5)
	(b)	What do you mean by population inversion and why is it needed for laser action?	(4)
	(c)	Explain the construction and working of a Helium Neon laser with the help of a neat energy level diagram.	(8)
	(d)	Calculate the coherence length of He-Ne line (1.15 μm), if coherence time is 26.7 ns.	(3)

OR

VI.	(a)	Briefly explain the recording and reproduction of sound using magnetic tapes.	(7)
	(b)	Explain the principle of holography.	(3)
	(c)	Discuss with necessary diagrams, the recording and reconstruction of holograms.	(10)

VII.	(a)	Explain the propagation of light through an optical fiber, discussing how minimum attenuation is attained.	(5)
	(b)	Discuss how optical fibers are classified based on their modes of propagation and refractive index profile.	(9)
	(c)	Write short note on fiber optic sensors.	(3)
	(d)	Calculate the maximum value of the angle of incidence that a ray can make with the axis of a step index fibre such that it gets guided through the fibre for the following fibre parameters, $n_1 = 1.6$; $n_2 = 1.5$. Assume that the outside medium is air.	(3)

OR

VIII.	(a)	What do you mean by numerical aperture of an optical fiber?	(3)
	(b)	Obtain an expression for the numerical aperture of an optical fiber.	(10)
	(c)	A step index fibre has the following parameters, $n_1 = 1.68$; $n_2 = 1.44$. Calculate the numerical aperture, acceptance angle and critical angle.	(3)
	(d)	Briefly explain two applications of optical fibers.	(4)

IX.	(a)	Describe magnetostriction method of producing ultrasonic waves.	(7)
	(b)	Explain the use of ultrasonic waves in the non-destructive testing of materials.	(4)
	(c)	Write short notes on :	
		(i) Gyroscopic effect	
		(ii) SONAR	
		(iii) Dielectrics	(9)

OR

X.	(a)	Briefly explain the BCS theory of superconductivity.	(5)
	(b)	Explain Josephson effect. Distinguish between ac and dc Josephson effect.	(6)
	(c)	Write short notes on :	
		(i) Meissner effect	
		(ii) Isotope effect	
		(iii) SQUID	(9)

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