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BT-102

Roll No. A2305212176

B. TECH (CSE, IT, ECE, MAE, CE, E&EE, E&IE,  
AE, NST, S&AE), B. TECH (MAE) + M. TECH  
AUTOMOBILE ENGINEERING (DD), B. TECH  
(CSE, ECE, MAE, CE) + MBA DUAL DEGREE  
PROGRAMMES, B. TECH + M. TECH (NS&T) - DD  
& B. TECH (AE) + M. TECH (A) - DD

FIRST SEMESTER END TERM EXAMINATION :  
NOVEMBER - 2012

APPLIED PHYSICS - I - FIELDS & WAVES

Time : 3 Hrs.

Maximum Marks : 70

Note: Attempt questions from all sections as directed.

SECTION - A (30 Marks)

Attempt any 5 questions.

Each question carries 6 marks.

1. What fraction of total energy of simple harmonic oscillator is kinetic, when its displacement from the mean position is equal to half the amplitude?
2. What do you understand by Sharpness of resonance. Explain with suitable diagram.

P.T.O.

3. (a) Discuss piezoelectric method for the generation of ultrasonic waves.
- (b) A quartz crystal vibrates at its natural frequency of 30 kHz. Calculate the thickness if its density is  $2650 \text{ kgm}^{-3}$  and Young's modulus is  $7.9 \times 10^{10} \text{ Nm}^{-2}$ . (4+2)
- ~~4.~~ (a) What do you understand by the resolving power of grating?
- (b) What is the ratio of resolving power of two gratings which have 15,000 lines in 2 cm and 10,000 lines in 1 cm in first order? Each grating has lines in its 2.5 cm width. (3+3)
5. (a) What is the meaning of curl of a vector field?
- (b) If  $V = 2x^2 - 3y^2 + z^2$  represents the electrostatic potential at a point, find the electric field at a point (3, 2, -2). (3+3)
6. (a) What do you understand by double refraction?
- (b) Calculate the thickness of half wave plate of material for which refractive indices of ordinary and extraordinary rays are  $\mu_o = 1.65$  and  $\mu_e = 1.60$  with sodium light of wavelength  $\lambda = 5893 \text{ \AA}$ . (2+4)

## SECTION - B (20 Marks)

Attempt any two questions.

Each question carries 10 marks.

7. (a) Derive the second order differential equation for plane progressive wave. (4)

- (b) A plane progressive wave is

$$y = 0.04 \sin \pi (100t - 0.005x)$$

Calculate the amplitude, frequency and maximum velocity of particles. (6)

8. (a) Write Maxwell's equations in differential form in free space.

- (b) Prove that electromagnetic waves are transverse in nature. (4+6)

9. (a) Derive an expression for the diameter of  $n^{\text{th}}$  dark ring formed by monochromatic light in Newton's ring experiment.

- (b) In Newton's ring experiment the diameters of  $4^{\text{th}}$  and  $12^{\text{th}}$  dark rings are 0.4 cm and 0.7 cm respectively. Calculate the diameter of  $20^{\text{th}}$  dark ring. (6+4)

## SECTION - C

(20 Marks)

*(Compulsory)*

10. (a) Describe Fraunhofer diffraction due to a single slit and deduce the positions of maxima and minima. Also, show that the relative intensities of successive maxima are approximately

$$1 : 1/2^2 : 1/6^2 : 1/12^2 \dots \dots \dots \quad (8)$$

- (b) For the position vector  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$  show that

(i)  $\text{div } \vec{r} = 3$

(ii)  $\text{curl } \vec{r} = 0 \quad (6)$

- (c) Describe the construction and working of Nicol prism. (6)