53 (PH 101) ENPH

2017

ENGINEERING PHYSICS

Paper : PH-101

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* What is scalar and vector fields ? Determine if function $\vec{F} = x^2 y\hat{i} + xyz\hat{j} - x^2 y^2 \hat{r}$ is a conservative vector field. 8

   (b) Calculate the curl of the following vector functions 6

   (i) $\vec{F} = yz^2\hat{i} + xy\,\hat{j} + yz\hat{r}$

   (ii) $\vec{F} = e^x \cos y\,\hat{i} + e^x \cos y\,\hat{j}$

   (c) Calculate the divergence of the following functions 6

   (i) $\vec{F} = xy\hat{i} + 2yz\hat{j} + 3zx\hat{r}$

(ii) $\vec{F} = yz^2\hat{i} + xyz\hat{j} - x^2y^2\hat{r}$

2. (a) What is Gauss theorem for electricity? Write down the condition for the Gaussian surface. 6

(b) What is Ampere's Law ? Calculate the magnetic field due to a current carrying wire. 7

(c) Use the Gauss's theorem to calculate the electric field due to uniformly charged sphere at a point 7

(i) Outside the sphere

(ii) Inside the sphere.

3. (a) Show that the electromagnetic waves are transverse in nature and calculate the velocity of the propagation of EM wave in free space. 7

(b) Write a comparative statement about diamagnetic, paramagnetic and ferromagnetic materials. 6

(c) What is ferromagnetic Curie temperature ? Discuss the variation of Magnetization *Vs.* temperature curve for a ferromagnetic material. 7

4. *(a)* What is LASER ? Write a short note on it. Describe the optical pumping. 7

(b) What is chromatic and achromatic aberration ? Write a short note on Fresnel bi-prism. 6

(c) Calculate the longitudinal aberration for a lens made of crown glass, having focal length of 50*cm*. Given $\mu_c = 1{\cdot}5206$ and $\mu_F = 1{\cdot}5249$. 7

5. *(a)* Define torque and angular momentum. Then derive the relation between them. 7

(b) State law of conservation of angular momentum. 3

(c) Derive Bernoulli's equation of fluid. 7

(d) State Hook's Law of elasticity. Then define modulus of elasticity. 3

6. *(a)* Discuss the significance of simple harmonic motion. 3

(b) If two simple harmonic motion be superposed to each other, then derive the expression for resultant motion. 7

(c) Write short notes on Lissajous figures. 5

(d) How does elastic (mechanical) wave differ from electromagnetic wave ? 5

7. (a) What do you mean by damping ? How is it related to Q-factor ? 5

(b) Explain resonance of forced vibration with the help of resonance curves. 5

(c) Write the Progressive wave equation in differential form and identify the involved parameters. 3

(d) The equation of a particle executing *SHM* is $y = 5 \sin\left(\pi t + \frac{\pi}{3}\right)$. Calculate

(i) amplitude, (ii) time period,

(iii) frequency, (iv) maximum velocity. 7

8. (a) Calculate the amount of radiant energy emitted per unit area per second by a black body at 27°C. 3

(b) Write the working of Carnot's engine. 7

(c) Discuss first law of thermodynamics. 3

(d) Explain energy distribution curves for black body with radiation curves. 7
