53 (PH 101) ENPH

2018

Paper : PH 101

ENGINEERING PHYSICS

Time : Three hours

Full Marks : 100

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

Answer *any five* questions.

1. (a) What is laser? Discuss the characteristics of laser radiation. 7

   (b) Discuss the difference between spontaneous and stimulated emission for a laser. 6

   (c) Discuss the basic principle of laser action. 7

2. (a) Apply Gauss's law to calculate the electric field intensity due to uniform infinite cylindrical charge distribution at points.

   (i) outside the charge distribution.

   (ii) on the surface of the charge distribution.

   (iii) inside the charge distribution. 8

(b) Discuss the ferromagnetic material with examples. Discuss the variation of magnetization with temperature. 6

(c) What is Ampere's law? Calculate the magnetic field due to a current carrying wire. 6

3. (a) What is Faraday's law of electromagnetic induction? 5

(b) Write down the expression for Lorentz force in the presence of magnetic field and also in the presence of electric and magnetic field. 5

(c) Write down the Maxwell's equations in differential and integral form. 5

(d) Show that electromagnetic wave is transverse in nature. 5

4. (a) State and explain Stokes' Theorem. 5

(b) Evaluate $\iint_S (3x\hat{i} + 2y\hat{j}) \cdot d\vec{a}$, where 'S' is the sphere given by the equation $x^2 + y^2 + z^2 = 9$. 5

(c) Prove that $curl\ \vec{v} = 2\vec{u}$. 5

(d) Explain the physical interpretation of divergence and curl of a vector function. 5

5. (a) Define interference. Obtain the conditions for maxima and minima of light intensity. 8

(b) What do you mean by chromatic aberration? What is its remedy? 6

(c) What is Cornot's theorem? Explain the working principle of Carnot's engine. 6

6. (a) Establish the relation between three constants. 8

(b) What is Stokes' law? Derive Bernoulli's equation. 6

(c) Obtain the relation between torque and angular momentum. 4

(d) Define bending moment. Why are girders I shaped? 2

7. (a) The displacement of an object is described by the following equation, where 'x' is in meter and 't' is in seconds:

$x = (0.3m)\cos(8.0t)$.

Determine the oscillating object's (a) amplitude, (b) frequency, (c) period, (d) maximimum speed, and (e) maximum acceleration.

(b) Sketch graphs of the kinetic energy, potential energy, and total energy of a spring-block oscillator as a function of time and position.

5

(c) Discuss the effect of combining two mutually perpendicular simple harmonic vibrations of same frequency.

10

8. (a) Define damped harmonic oscillator and derive the differential equation of damped harmonic oscillator and obtain its solution under over-damped condition.

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(b) Define Q-factor. Explain sharpness of resonance.

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(c) What is a progressive wave ? Differentiate between mechanical and electromagnetic waves.

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