

Ref. No.: Ex/EE/Ph/T/1A/2019(Old)

B.E Electrical Engineering First Year First Semester (Old) Examination- 2019

(1st Year, 1st Semester)

PHYSICS -IA

Time: 3 Hours

Full Marks: 100

Answer any five (5) Questions

1. (a) What does Curl of a vector field mean? State Stoke's theorem.
- (b) Discuss the different conditions for a force to be conservative?
- (c) Define central force. Give two examples.
- (d) Prove that central force is conservative.
- (e) Show that $\text{Grad} (1/r) = - r/r^3$

(4+4+4+5+3)

2. (a) Define SHM.
- (b) Differentiate free, damped and forced vibrations. Discuss three different cases of damped vibrations with graphical presentation.
- (c) Obtain the differential equation of forced vibration. Find out both the transient and steady state solution. Discuss the velocity resonance condition.

(2+6+2+10)

3. (a) Show that the dark and bright fringes produced in Young's experiment are equally spaced.
- (b) Fringes are produced with monochromatic light of wavelength 689 nm. A thin film of glass of refractive index 1.53 is placed normally in the path of one of the interfering rays. The central fringe is found to move to a position occupied by the fifth bright band from the centre. Calculate the thickness of the glass plate. Derive the required expression.

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(c) In Newton's ring experiment, the diameter of m^{th} dark ring is 8 mm and the diameter of $(m+5)^{\text{th}}$ dark ring is 12 mm. If the radius of curvature of the lower surface of the lens is 10 m, find the wavelength of light used. Derive the required mathematical expression.

(6+7+7)

4. (a) Explain the de Broglie concept of matter waves. Describe the Davisson-Germer experiment.

(b) State and explain Heisenberg uncertainty principle.

(c) Using Schrodinger equation show that the energy of a particle confined within a one dimensional box is quantized. Find the expectation value $\langle x \rangle$ of the particle.

((2+6)+2+10)

5. (a) State the zeroth and the first law of thermodynamics in differential form. What do you mean by thermodynamic equilibrium?

(b) Using first law of thermodynamics prove the adiabatic equation of an ideal gas

i.e. $PV^\gamma = \text{constant}$.

(c) Explain the working principle of a Carnot cycle by plotting P-V diagram and estimate its efficiency.

[(4+3) + 6 + (4 +3)]

6. (a) Define coefficient of viscosity. What is its dimension? What do you mean by streamline and turbulent motion?

(b) Derive Poiseuille's equation for the flow of incompressible liquid. What are the assumptions you made while deriving the equation.

(2+ 2+4 +8+4)

7. (a) Explain the term "Moment of Inertia". Prove perpendicular axis and parallel axis theorem for a lamina body. What is "radius of gyration"?

(b) Estimate Moment of Inertia of a rectangular lamina about the axis perpendicular to its plane and passing through its centre of gravity.

(b) Compare the moment of inertia of a uniform circular disc about a diameter with that about a tangent to the disc in its own plane.

[(2+ 4+ 4 +2)+4+4]

8. Write short notes (any two)

(2 × 10)

(a) Bernoulli's Theorem and its applications

(b) Newton's Ring

(c) Second Law of thermodynamics

(d) Curl of a vector and stokes theorem