Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 70175

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

First Semester

Civil Engineering

PH 3151 – ENGINEERING PHYSICS

(Common to All Branches)

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A clock is mounted on the wall. What is the value of the angular acceleration of the second hand of the clock?

2. What are the differences between linear and nonlinear oscillations?

3. What is the physical meaning of Gauss law of magnetostatics?

4. A light pulse with a power of 100 mW has a duration of 10^{-5} s. If it is absorbed completely by an object at rest. Find the final momentum of the object.

5. What are standing waves?

6. Why is population inversion necessary for lasing action?

7. What is Compton effect?

8. An electron trapped in a one dimensional infinite potential well has a ground-state energy of 1 eV. What is the width of the box?

9. Mention some differences between the classical and quantum harmonic oscillators.

10. State Bloch's theorem.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive an expression for the moment of inertia for a hollow cylinder about its own axis and about an axis passing through the centre and perpendicular to its own axis. (12)

    (ii) The Earth has a mass of 5.97×10^{24} kg, and the Moon has a mass of 7.36×10^{22} kg. The center of the Moon is at a distance of 384,000 km from the center of Earth. Find the centre of mass of the earth-moon system from the centre of the earth. (4)

Or

(b) (i) Discuss in detail the rotational energy states of a diatomic molecule. (12)

    (ii) A large disc is spun by applying a torque on the top edge. Assuming a force of 100 N is exerted through a rotation of 1 rad, find the final angular velocity and rotational kinetic energy. Given, the radius of the disc is 0.22 m and mass is 5kg. (4)

12. (a) Derive the wave equation for plane electromagnetic waves in vacuum from the Maxwell's equations.

Or

(b) Discuss in detail the production of electromagnetic waves.

13. (a) (i) Explain the energy transfer of a wave. (12)

    (ii) A vehicle has bad suspension system and undergoes oscillations when crossing over a bump. Calculate the frequency and period of oscillations for the vehicle if its mass is 1 ton and the force constant of the suspension is 2.69×10^4 N/m. (4)

Or

(b) (i) Discuss the construction and working of a CO_2 laser with suitable diagrams. (12)

    (ii) A point light source 5 m below the surface of a water pool produces a circular pattern of light when viewed from above. Taking the refractive index of water to be 1.33, find the radius of the circle. (4)

14. (a) (i) Obtain the Schrodinger's time independent and time dependent equations for the one dimensional case. (12)

    (ii) What is the physical significance of a wave function? (4)

Or

(b) (i) Derive an expression for the wave function and energy of a particle trapped in a one dimensional infinite potential well. (12)

    (ii) What do you understand from the correspondence principle? (4)

15. (a) Describe the construction and working of scanning tunneling microscope with suitable diagrams.

Or

(b) Describe the dynamics of a fundamental particle trapped in a one dimensional well of finite potential.

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