POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Applied Physics

Semester: Spring

Year : 2024
Full Marks : 100
Pass Marks : 45
Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Derive time period of torsion pendulum and find an expression for modulus of rigidity of the material of the suspension wire. 9

OR

Differentiate the terms free, damped and forced vibration. Develop the differential equation of a particle executing damped vibration in a medium. Explain the physical meaning of each term and each constant in the equations.

b) Categorise the wave according to the modes of vibrations and show that the intensity of a progressive wave is directly proportional to the square of its amplitude. 6

2. a) Explain the construction and working of He-Ne laser with a suitable energy level diagram. Hence, explain its applications. 9

b) The reverberation time of an empty hall is 1.5 sec. The same hall with 500 people is 1.4 sec. Find the reverberation time with 800 people in hall. 6

3. a) What do you mean by capacitance? Derive a relationship for charge stored at any time 't' in the capacitor in case of discharging and show that the charge decreases to 37% of its maximum value at capacitive time constant. 9

b) A solid sphere of mass 40 kg and diameter 0.10 m is suspended on a wire. Find the period of angular oscillations for small displacement if the torque required to twist the wire is 4×10^{-3} Nm/rad. 6

4. a) Derive an expression for the resonant frequency in a forced EM oscillation. Hence, find the maximum current in the circuit. 9

b) Show that $\nabla . \vec{J} + \frac{d\rho}{dt} = 0$. Where symbols carry their usual meaning. 6

5. a) Using Schrodinger's wave equation obtain the energy and wave function of a small particle confined in an infinite potential well. And show that energy level are quantized. 9

b) Show that, $\vec{D} = \epsilon_0 \vec{E} + \vec{P}$, where $\vec{D}$= displacement vector, $\vec{E}$= electric field and $\vec{P}$ = polarizing vector. 6

6. a) Explain the modes of heat transfer with suitable examples. 9

b) A refrigerator has to transfer an average of 200 J of heat per second form the temperature 15°C to 30°C. Calculate the average power consumed, assuming an ideal reversible cycle and no other losses. 6

OR

A thin metal plate is insulted on the back and exposed its front surface to solar radiation. The exposed surface of the plate has an emissivity of 0.7. If the solar radiation is including on the plate at the rate of 750 W/m^2 and the surrounding air temperature is 20^{0}C, determine the surface temperature of the plate. Assume convection heat transfer coefficient 40 W/m^{2}K.

7. Write short notes on: **(Any two)** 2×5

a) First law of thermodynamics

b) Semi-conductor laser

c) Inadequacy of classical mechanics