KATHMANDU UNIVERSITY
End Semester Examination [C]
July 2024

Level : B.E./B.Sc.
Year : I
Time : 2 hrs. 30 mins.

16 JUL 2024

Course : PHYS 101
Semester : I
F. M. : 40

SECTION "B"
[5Q × 3 = 15 marks]

Attempt ALL questions.

1. Show that the strain energy per unit volume in longitudinal strain is equal to $\frac{1}{2} stress \times strain$.

OR

Define conservative force. Show that the conservative force can be expressed as $F = -grad\, U$, where U is potential energy

2. What is population inversion? Explain the process of production of LASER with reference of energy level diagram.

3. State and prove Bernoulli's theorem.

OR

Show that Rayleigh-Jeans law and Wien's law are special cases of Plank's law.

4. What is Nicol prism? How it can be used as a polarizer and analyzer?

5. A thin film of oil $\mu = 1.25$ is located on smooth, wet pavement. When viewed perpendicular to the pavement, the film reflects most strongly red light at $640\, nm$ and reflects no green light at $512\, nm$. How thick is the oil film?

OR

Light traveling in water strikes a glass plate at an angle of incidence of 53.0^0, part of the beam is reflected. If the reflected and refracted portions make an angle of 90.0^0 with each other, what is the index of refraction of the glass?

SECTION "C"
[5Q × 5 = 25 marks]

Attempt ALL questions.

6. Explain the interference in thin film due to reflected light. Find the refractive index of the transparent liquid by Newton's ring method.

P.T.O.

7. Derive the relation $M_f = M_0 e^{-\frac{v_f}{v_{rel}}}$ for rocket, where symbols have their usual meaning.

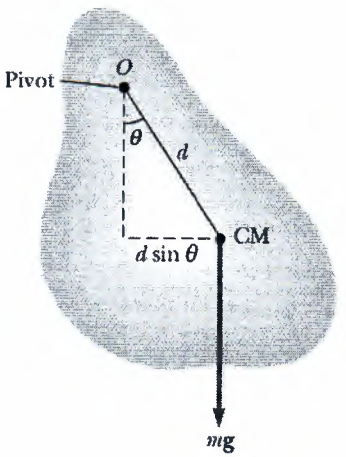
OR

Discuss the phenomenon of Fraunhofer diffraction at a single slit and show that relative intensity of the successive maximum are nearly $1:\frac{1}{22}:\frac{1}{62}:\frac{1}{121}$.

8. What is damped harmonic oscillator? Obtain the differential equation of damped harmonic oscillator and solved it for under damping condition.

OR

Consider a physical pendulum as shown in figure below. Represent its moment of inertia about an axis passing through its centre of mass and parallel to the axis passing through its pivot point as I_{CM}.



a. Show that its period is $I = 2\pi\sqrt{\frac{I_{CM} + Md^2}{mgd}}$. Where d is the distance between the pivot point and center of mass
b. Show that the period has a minimum value when d satisfies $md^2 = I_{CM}$.

9. State perpendicular axes theorem of moment of inertia. Find the moment of inertia of a uniform rigid rod of length L and mass M about an axis passing through the centre of mass and perpendicular to the rod.

10. A block of mass $m = 3.57\,kg$ is drawn at a constant speed a distance $d = 4.06\,meters$ along a horizontal floor by rope exerting a constant force of magnitude $F = 7.68N$ making an angle $\theta = 15^0$ with the horizontal. Compute
a. the total work done on the block,
b. the work done by the rope on the block,
c. the work done by the friction on the block,
d. the coefficient of kinetic friction between the block and floor