

NOTE: i) All the questions are compulsory

ii) Figures to the right indicates full marks

iii) Use of non-programmable calculator is allowed

**Q I. Attempt the following:**

20 marks

A. Explain damped oscillation in brief and derive the equation for displacement

(8)

(OR)

A. a) The equation of motion of a forced oscillator is

$$10 \times 10^{-3} \frac{d^2x}{dt^2} + 2 \times 10^{-3} \frac{dx}{dt} + 4 \times 10^{-2}x = 12 \times 10^{-3} \sin 4t. \text{ Find the quality factor} \quad (4)$$

b) What is compound pendulum?

(4)

B. Define logarithmic decrement and obtain an expression for it.

(7)

(OR)

B. What do you mean by under damping, critical damping and over damping?

(7)

C. A periodic external force acts on 6 kg mass suspended from massless spring of spring constant 150 N/m is 50 N. The damping force is 18 N when the velocity is 1 m/s. ( $\omega_0=20$ ) write equation of motion for forced vibration.

(5)

C. Explain the parts and working of Kater's pendulum

(5)

**Q II. Attempt the following:**

20 marks

A. Explain average deviation and standard deviation. Find the best value and determine the average deviation of the followings values 500.45, 501.56, 500.99, 500.89, 501.112,

(8)

(OR)

A. Explain the significant digits and state the general rules to determine significant digits.

State the number of significant figure: i) 0.001232 ii) 6.043 iii) 4544.6

(8)

B. Describe normal distribution curve. Show that  $\frac{\rho}{\sigma} = \sqrt{\frac{2}{\pi}}$

(7)

(OR)

B. Explain various kind of errors in measurements, how one can detect and eliminate these errors. (7)

C. If the numbers 22.6 and 44.4 are correct upto their last digit finds the value of the product. If one number were exact what would be the product.

(5)

(OR)

C. Find the value of i)  $\frac{\pi}{57.3}$  ii)  $\frac{\pi}{22.2}$

**Q III. Attempt the following:**

20 marks

A. Determine the depression when beam is supported at the ends and loaded in the middle. Discuss the experimental determination of young's modulus 'Y' by using this arrangement.

(8)

(OR)

A. What is mean by L-frame and C-frame? How can we relate recoil angle in L-frame with scattering angle in C-frame.

(8)

B. Explain the bending moment? Derive expression for it.

(7)

(OR)

B. By ignoring the mass of cantilever derive an expression for the depression produced at the free end when it loaded. Explain what is mean by the cantilever?

(7)

C. Give any five differences between centre of mass frame of reference and Laboratory frame of reference.

(OR)

C. A cantilever, loaded at its free end, shows a depression of 1 cm at its free end. Find the depression at the mid-point of the cantilever.

Q IV. Attempt any three:

A. Give the rounding figures of the following nos. i) 9.8689 to 4 digit ii) 534569 to 5 digit iii) 0.7075 to 3 digit iv) 4655778 to 5 digit v) 3.32543 to 4 digit

B. Explain the concept of collision. What are the difference between scattering and reaction

C. The equation of motion of damped harmonic oscillator is given by  $\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 3x = 0$

Is the motion of oscillator is oscillatory or not

D. Define Q-factor and obtain the expression of it for driven damped oscillator.

E. Show that the mean average deviation for normal distribution is zero

F. A particle moving with velocity of 13 m/s is scattered by another particle at rest. The velocities scattered particle and target particle are 12 m/s and 5 m/s respectively. If both the particle have mass, is scattering elastic or inelastic.

\*\*\*\*\*