B. N. BANDODKAR COLLEGE OF SCIENCE, THANE

USPH 301

Duration : Hrs 2 ½ Hrs. **Total Marks : 75**

N.B.: 1) *All questions are* ***compulsory.***

2) *Figures on the right indicate* ***full marks.***

3) *Draw neat and clean diagrams where ever necessary.*

4) ***Non – programmable calculators*** *are allowed.*

Q.1) (A) *Attempt any* Two

1) Obtain the expression for Peter's formula. When it should not be used. **(8)**

2) Show that the average deviation of the distribution is $\rho = \frac{1}{h\sqrt{\pi}}$ where h is precision index. **(8)**

3) What is precision index? How it determines the width of Gaussian distribution curve. **(8)**

4) Explain various kinds of error in measurements, how one can detect and eliminate these errors. **(8)**

(B) *Attempt any* ***ONE.***

1) Find the product of two numbers 0.21 ± 0.01 and 8.4 ± 0.2 , correct to significant digits only. **(4)**

2) Find the value of i) $\frac{\pi}{57.3}$ ii) $\frac{5\pi}{57.3}$. **(4)**

Q.2) (A) *Attempt any* Two

1) Define logarithmic decrement and obtain an expression for under damped harmonic oscillator. **(8)**

2) Show that amplitude resonance in a driven damped oscillator occurs at a driven frequency slightly less than the natural frequency of the oscillator. **(8)**

3) Define Q factor and obtain its expression for a lightly damped harmonic oscillator. **(8)**

4) Set up the equation of motion of a compound pendulum and obtain an expression for its time period. **(8)**

(B) *Attempt any* ***ONE.***

1) A thin circular disc is pivoted at its rim. Show that for small oscillations, its time **(4)**

period is given by $T = \sqrt{\frac{3R}{2g}}$.

2) Show that the rate at which the energy decrease is twice the rate at which amplitude decreases of an under damped oscillator. (4)

Q.3) (A) *Attempt any* Two

1) Obtain the relation between scattering angles in an elastic collision in Lab frame and CM frame. When the two angles are equal? (8)

2) Discuss Searle's method of determination of Y and η. (8)

3) Show that restoring couple per unit twist of a wire of radius r and length l is given by $C = \frac{\pi\eta r^4}{2l}$, where η is modulus of rigidity of the material of the wire. (8)

4) What is a cantilever? Derive an expression for the depression produced at the free end when it is loaded. Ignore the mass of the cantilever. (8)

(B) *Attempt any* ***ONE.***

1) Discuss the various assumptions made in development of the theory of bending of beam. (4)

2) The period of flexural oscillations and the period of torsional oscillation in a Searle's experiment were found to be 1.25sec and 2.0sec respectively. If Y = 18×10^{11} dynes/cm^2, calculate η and σ. (4)

Q.4) *Attempt any* ***THREE.***

1) Find the error in the value of an expression $\frac{log\ 24.76}{\sin 70°6'}$ .Assume that the angle is measured with possible error by 1' and the number may be in error by a unit in its last digit. (5)

2) Explain Systematic and Random errors. (5)

3) Show that the average value of $\sin^2(\omega t + \theta)$ over one complete cycle is ½. (5)

4) A student performed Kater's pendulum experiment and obtained the following data.l_1 =31.5 cm , T_1 = 1.784 sec. and l_2=43.5 cm, T_2 = 1.771 sec. Calculate the value of g using Bessel's formula. (5)

5) In a Searle's apparatus, the length, the breadth and the mass of each bar are 30 cm, 1 cm and 500 gm respectively. What length of sample wire of Y = 18×10^{11} dyne/cm^2 and radius 0.06 cm should be taken such that the period of flexural (5)

oscillations is more than 1 sec.

6) Define Young's modulus. A wire of radius 1 mm is bent into an arc of radius 1m. If the maximum stress produced is 10^7 N/m^2, calculate Young's modulus of the wire. **(5)**

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