20U226

Reg. No ..... Name .....

B. Sc DEGREE END SEMESTER EXAMINATION - MARCH 2020

SEMESTER 2 : PHYSICS

COURSE : **19U2CRPHY02 : MECHANICS AND PROPERTIES OF MATTER**

(For Regular - 2019 Admission)

Time : Three Hours Max. Marks: 60

Section A

Answer any 8 (2 marks each)

1. What is Poisson's ratio and what is the limiting values of Poisson's ratio
2. What is shearing strain and derive the work done per unit volume?
3. Give the expression for the energy possessed by a flowing liquid
4. State and explain Bernoulli's equation
5. Describe what is a tidal wave.
6. Compare graphically, three oscillators with different relaxation times.
7. Give two examples of damped harmonic oscillation.
8. Differentiate between decrement and logarithmic decrement.
9. Outline the concept of moment of inertia.
10. Differentiate between rotatory and translatory motions.

(2 x 8 = 16)

Section B

Answer any 6 (4 marks each)

11. A bar 0.01 m^2 in cross section is supported on two knife edges 1.5 m apart. A load of 2 kg at the center of the bar produces a depression of the midpoint of the bar by 2.51 mm. Find the Young's modulus of the material.
12. A cylindrical bar of length 0.2 m and diameter 0.05 m is suspended by a wire 0.5 m long and 1 mm in radius such that the axis of the bar is horizontal. The arrangements make 10 oscillations in 24 sec. find the rigidity modulus of the material. Density of the material is 8000 kg/m^3
13. A pipe is running full of water. At a certain point M in the pipe it tapers from 0.6 m diameter to 0.2 m diameter at another point N. If the pressure difference between M and N is 1m water column, find the rate of flow of the water through the pipe.
14. capillary tube of length 0.35 m and radius 0.38 mm is fitted horizontally at the bottom of a constant pressure head arrangement in which water level remains constant at a height of 0.25 m above the axis of the tube. If 40 x 10^{-6} cubic meter water flows out through the capillary in 10 minutes calculate the viscosity of the water.
15. A wave of frequency 580 Hz, has a phase velocity of 360 m/s. (a) How far apart are two points 70^0 out of phase (b) What is the phase difference between two displacements at a certain point at times 1.5 ms apart.
16. The displacement of a point at any time is given by $x = Asin(\omega t) + Bcos(\omega t)$. Check whether the motion is simple harmonic. If the motion is simple harmonic, then determine maximum amplitude and maximum velocity when A = 4.5, B = 6.5 and ω = 7.5.
17. The potential energy of a harmonic oscillator of mass 2 kg in its resting position is 5 J, its total energy 9 J and its amplitude 1 cm. Calculate its time period.
18. Two masses 4g and 6g respectively are attached to the ends of a 10cm long light rod of negligible mass and the rod rotates anticlockwise at 2 revolutions per second about an axis passing through its center of mass and perpendicular to its length. Obatin the (a) angular momentum of each mass about the center of mass and (b) the total angular momentum of the system about the center of mass.

(4 x 6 = 24)

Section C

Answer any 2 (10 marks each)

19. Derive the expression for the bending moment. Use it to arrive at the equation for the depression at the end of cantilever. Describe an experiment find the young's modulus of the material of the bar.
20. Obtain the Poiseuille's equation for the volume of liquid flowing through a pipe. Mention the corrections to be applied to this theorem.
21. Setup the differential equation of a damped harmonic oscillation. Hence obtain the general solution of the differential equation and discuss the oscillatory solution.
22. Derive expressions for moments of inertia of hollow cylinder about a) its axis of symmetry, b) about an axis passing through its center and perpendicular to its own axis and c) about an axis passing through its endface and perpendicular to its own axis.

(10 x 2 = 20)