BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – B.Tech.(ME)-2024
Course Name – Introduction to Mechanics
Course Code - BBS00013
(Semester I)

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Brainware University
398, Ramkrishnapur Road, Barasat
Kolkata, West Bengal-700125

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) The moment of inertia of a circular disk is _____.

a) $\frac{2}{3}mr^2$ b) $\frac{2}{5}mr^2$

c) $\frac{1}{2}mr^2$ d) mr^2

(ii) Potential energy and kinetic energy are types of _____ .

a) electrical energy b) magnetic energy
c) thermal energy d) mechanical energy

(iii) A force of 100 N is applied on a body of mass 50 kg. Calculate the acceleration of the body.

a) 5000 ms^{-2} b) 150 ms^{-2}

c) 50 ms^{-2} d) 2 ms^{-2}

(iv) The quality factor Q for an L-C-R circuit is _____.

a) ωR/ L b) ω/ LR
c) ωL/R d) R/Lω

(v) Meniscus of mercury in capillary is _____.

a) concave b) convex
c) plane d) cylindrical

(vi) Identify the property due to which plants get water through the roots.

a) Capillarity b) Viscosity

c) Gravity
d) Elasticity

(vii) Longitudinal strain is possible in the case of _____.

a) gases
b) liquid
c) only solids
d) only gases & liquids

(viii) If the amplitude of a simple harmonic oscillator is doubled, its total energy will _____.

a) remain the same.
b) become half.
c) become double.
d) become four times larger.

(ix) Which physical law explains the recoil of a gun?

a) Law of conservation of energy
b) Newton's first law of motion
c) Newton's second law of motion
d) Newton's third law of motion

(x) Centrifugal force is a _____.

a) real force
b) pseudo force
c) frictional force
d) gravitational force

(xi) What is the phase difference between displacement and velocity for a particle executing SHM?

a) 0
b) $\pi/2$
c) $-3\pi/4$
d) π

(xii) For a particle executing SHM, which of the following statements is true for velocity and acceleration?

a) When velocity is maximum, acceleration is maximum
b) When velocity is maximum, acceleration is zero
c) When velocity is zero, acceleration is zero
d) The acceleration is independent of velocity

(xiii) If $\phi = yz$, then its gradient is

a) $z\hat{j} + y\hat{k}$
b) $y\hat{j} + z\hat{k}$
c) $z\hat{j} - y\hat{k}$
d) 0

(xiv) Determine the constant 'a' so that the vector $\mathbf{A} = (x+3y)\mathbf{i} + (y-2z)\mathbf{j} + (x+az)\mathbf{k}$ is solenoidal.

a) 0
b) 1
c) 2
d) -2

(xv) Angular velocity is measured in which unit?

a) Degree/sec
b) Meters/sec
c) Radians/sec
d) Newton/sec

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Group-B

(Short Answer Type Questions) 3 x 5=15

2. Define impulse of a force. Recognize the well-known physical quantity having same dimension with impulse. (3)

3. Find the relation between linear velocity (v) and angular velocity (ω). (3)

4. What is angular momentum? Explain with units and dimensions. (3)

5. Show that the fluid motion given by the vector $\mathbf{V}=(y+z)\mathbf{i} + (z+x)\mathbf{j} + (x+y)\mathbf{k}$ is solenoidal. (3)

6. Derive the dimension of coefficient of viscosity from Stoke's law. (3)

OR

For a wire of length L , maximum change in length under stress condition is 2 mm. What is the change in length under same conditions when length of wire is halved? (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Explain the stress-strain diagram of an elastic body and from the diagram, mark proportional limit, elastic limit, breaking stress and plastic region. (5)

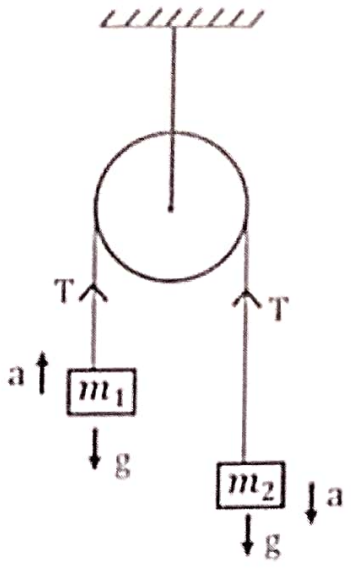
8. Explain co-planar and non-coplanar forces. (5)

9. A nucleus is at rest in the laboratory frame of reference. Show that if it disintegrates into two similar nuclei the products must be emitted in opposite directions. (5)

10. Write a short note on moment of inertia of a body. (5)

11. Establish the differential equation of Simple pendulum. (5)

12. Two masses m_1 and m_2 ($m_2 > m_1$) are tied at the ends of an inextensible string of tension T. The string passes over a light and frictionless pulley as shown below. Mass m_1 moves upward with acceleration a and mass m_2 moves downward with the same acceleration. Find expressions of a and T in terms of m_1 and m_2. (5)



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OR

Show that in a conservative force field, the curl of the force is zero. (5)

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