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

BRAINWARE UNIVERSITY

Term End Examination 2024-2025

Programme – B.Tech.(EE)-2024

Course Name – Engineering Mechanics

Course Code - BES00005

(Semester I)

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) Enumerate the magnitude of smaller force if two forces acting an angle of 120 degree and the greater force is 50 N and their resultant is perpendicular to the smaller force.
 - a) 20
 - b) 30
 - c) 25
 - d) 35
- (ii) Show the condition for the equilibrium in free body diagram for that the calculation of the normal forces will not be formulated.
 - a) $\sum F_x$ is not equal to 0
 - b) $\sum F_y$ is not equal to 0
 - c) $\sum F_z$ is not equal to 0
 - d) $\sum F$ is not equal to 0
- (iii) Recognize a force acting on a body may summarize as
 - a) introduce internal stresses
 - b) balance the other forces acting on it
 - c) retard its motion
 - d) All of these mentioned
- (iv) Define the term Null Vector from the given option
 - a) Negative Vector
 - b) Unit Vector
 - c) Free Vector
 - d) Zero Vector
- (v) Select the scalar quantity from the following options
 - a) Force
 - b) Velocity
 - c) Time
 - d) Moment
- (vi) Identify the following quantity that is usually considered as a Fundamental Quantity.
 - a) Mass
 - b) Time
 - c) Length
 - d) All of these mentioned
- (vii) Define the term Coefficient of friction
 - a) angle between normal reaction and the resultant of normal reaction and the limiting friction
 - b) ratio of limiting friction and normal reaction
 - c) the friction force acting when the body is just about to move
 - d) the friction force acting when the body is in motion

- (viii) Visualize the force that opposes the motion of two surfaces in contact
- a) Gravity
 - b) Friction
 - c) Tension
 - d) Normal Force
- (ix) Calculate the frictional force acting on the crate if A person pushes a 50 kg crate along a floor with a force of 200 N. Take coefficient of kinetic friction between the crate and the floor is 0.3.
- a) 147 N
 - b) 100 N
 - c) 95 N
 - d) 120 N
- (x) Establish a method for calculating the coefficient of static friction between two surfaces using only the angle of repose
- a) $\mu = \tan(\theta)$
 - b) $\mu = \sin(\theta)$
 - c) $\mu = \cos(\theta)$
 - d) $\mu = \theta$
- (xi) Tell how the moment of inertia is affected when the mass of an object is doubled
- a) It remains the same
 - b) It doubles.
 - c) It quadruples
 - d) It decreases by half.
- (xii) List the following shapes in order of increasing moment of inertia about an axis through their centroid: 1.Solid Cylinder 2.Hollow Cylinder 3.Solid Sphere 4.Hollow Sphere
- a) 1, 3, 2, 4
 - b) 3, 1, 2, 4
 - c) 4, 2, 3, 1
 - d) 2, 1, 4, 3
- (xiii) Construct a method to determine the radius of gyration for a composite area
- a) Use the average of all moments of inertia
 - b) Take the square root of the ratio of moment of inertia to the total area
 - c) Find the perpendicular distance to the external axis
 - d) Use the mass moment of inertia of the largest part
- (xiv) Enumerate the main types of motion curves.
- a) Distance-time, velocity-time, and acceleration-time curves
 - b) Distance-displacement, speed-time, and velocity-position curves
 - c) Mass-time, force-displacement, and velocity-mass curves
 - d) Displacement-energy, velocity-displacement, and force-time curves
- (xv) Memorize D'Alembert's principle.
- a) The total external force acting on a system is equal to the mass times acceleration
 - b) The force acting on a body is balanced by an inertial force in the opposite direction
 - c) The acceleration of a particle is proportional to the net force applied
 - d) The energy of a system remains constant in the absence of external forces

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Differentiate between concurrent and non-concurrent forces. (3)
3. Define the term Moment of Inertia. (3)
4. Determine the distance has a car covered since it started driving if the car begins driving from a stationary position. It accelerates at 4 m/s^2 for 10 seconds, then travels at a steady speed for another 10 seconds, all in the same direction. (3)

5. Compute the force that would be required to slide down a body is resting on a plane inclined at an angle 30 degree to horizontal. Take Co-efficient of friction between body and plane is 0.3. (3)
6. Appraise the significance of the Theorem of Pappus in finding centroids. (3)

OR

Connect the concepts of centroid and center of gravity in the context of mechanics. (3)

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Group-C
(Long Answer Type Questions)

5 x 6=30

7. Explain parallel axis theorem in engineering mechanics (5)
8. Calculate the static frictional force acting on a block resting on a horizontal surface if the block has a mass of 10 kg and the coefficient of static friction between the block and the surface is 0.4. Explain the steps taken to arrive at your answer. (5)
9. Explain the following terms (a) Moment of Inertia (b) Polar Moment of Inertia (c) Radius of Gyration (5)
10. Examine the differences between kinetic and potential energy in the context of particle motion. (5)
11. Enumerate the smaller of two forces acting at an angle of 120° . The larger force is 40 N, and the resultant is perpendicular to the smaller force. (5)
12. Analyze the significance of rectangular components in curvilinear motion. (5)

OR

Compare the motion of connected bodies in a pulley system to free-moving particles. (5)

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