

**Indian Maritime University**  
**(A Central University, Govt of India)**  
**End Semester Examinations– June 2025**  
**Programme Name: B Tech (Marine Engineering)**  
**Semester: II**  
**Subject Code: UG11T5204**  
**Subject Name: Engineering Mechanics**

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Date: 12.06.2025

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

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General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective section.

**Section A**

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. Which of the following is the basic law for mechanics?
  - a) Newton's law of viscosity
  - b) Parallelogram law
  - c) Newton's laws of motion
  - d) Hooke's law
  
2. When can two forces be in equilibrium?
  - a) They are equal in magnitude
  - b) They are collinear
  - c) They are opposite in direction
  - d) All of the mentioned
  
3. What is the relationship between each force, if three concurrent forces acting on a body according to Lami's theorem?
  - a) Directly proportional to the sine of the angle between the other two forces
  - b) Inversely proportional to the cosine of the angle between the other two forces
  - c) Directly proportional to the cosine of the angle between the other two forces
  - d) Inversely proportional to the sine of the angle between the other two forces

4. If the sum of all the forces acting on a body is zero, then it may be concluded that the body

- a) must be in equilibrium.
- b) may be in equilibrium
- c) may be in equilibrium provided that the forces are concurrent
- d) may be in equilibrium provided that the forces are parallel.

5. In an ideal machine the mechanical advantage is \_\_\_\_\_ the velocity ratio.

- a) Less Than
- b) Greater Than
- c) Equal to
- d) No relation

6. The centre of gravity is the ratio of \_\_\_\_\_ to \_\_\_\_\_

- a) The product of centroid and weight to the total weight
- b) The addition of centroid and weight to the total weight
- c) The subtraction of centroid and weight to the total weight
- d) The product of centroid and weight to the total mass

7. Coefficient of static friction is always

- a) Equal to the kinetic friction
- b) More than the kinetic friction
- c) Less than the kinetic friction
- d) All of the above

8. The area moment of inertia of an Isosceles triangle about centroidal y-axis is given by

- a)  $b \frac{h^3}{36}$
- b)  $h \frac{b^3}{36}$
- c)  $h \frac{b^3}{48}$
- d) None

9. The time of flight of a projectile on the downward inclined plane depends on

- a). Angle of Projection
- b). Angle of inclination of the plane
- c). Both (a) and (b)
- d). None of These

10. The forces, which meet at one point, but their lines of action do not lie in a plane, are called

- A. Coplanar non-concurrent forces
- B. Non-coplanar concurrent forces
- C. Non-coplanar non-concurrent forces

D. Intersecting forces

**Section B**

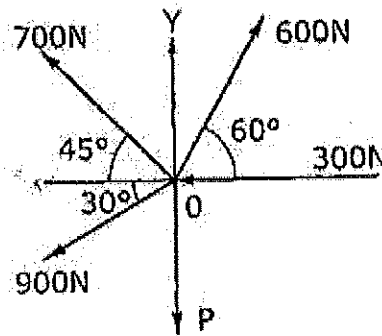
Five Questions of 02 Marks each

11. Define parallelogram law of forces
12. Explain the cone of friction.
13. State Perpendicular Axis theorem
14. Define D'Alembert's Principle
15. What is projectile motion?

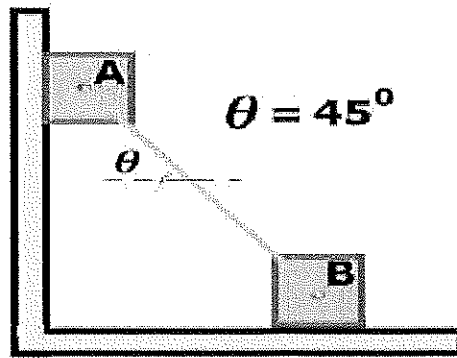
**Section C**

Seven Questions of 10 Marks each of which any 05 questions to be answered.

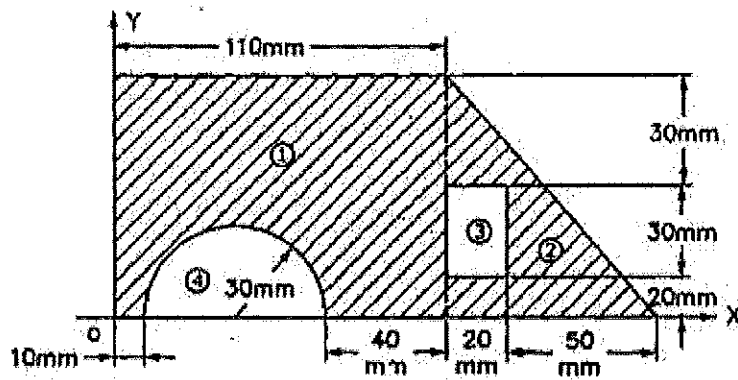
16. Five forces are acting on a particle. The magnitude of the forces are 300N, 600N, 700N, 900N and P and their respective angles with the horizontal are  $0^\circ$ ,  $60^\circ$ ,  $135^\circ$ ,  $210^\circ$  and  $270^\circ$ . If the vertical components of the forces is -1000N, find the value of the P. Also calculate the magnitude and the direction of the resultant, assuming that the first force acts towards the point, while all the remaining forces act away from the point.



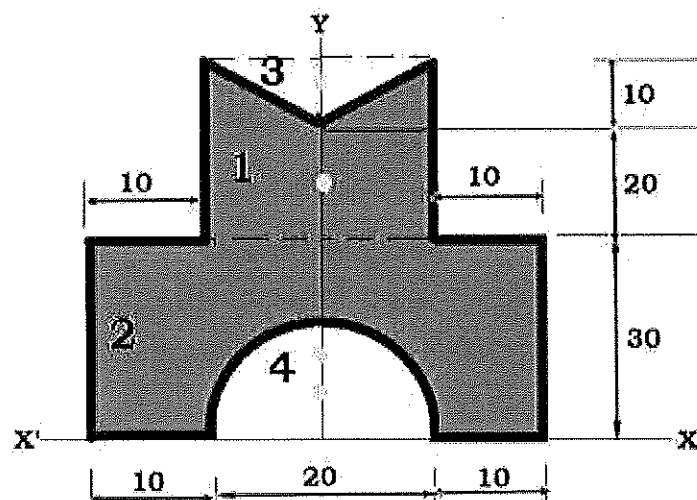
17. Two identical blocks A and B of weight W are connected by a rod and rest against vertical and horizontal planes respectively as shown in below fig. If sliding impends when the angle is 45 degrees determine coefficient of friction assuming it to be same at both floor and wall.



18. Locate the centroid of the sectioned area shown in the figure.

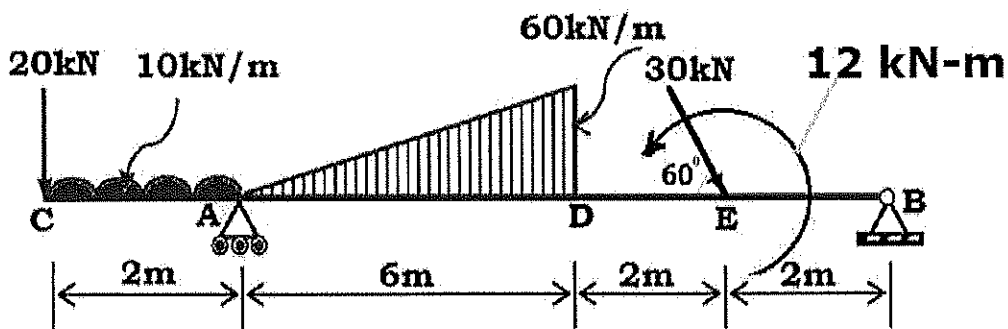


19. Determine the moment of inertia and radius of gyration of the composite section as shown in below fig. about centroidal z-axis.



20. The equation of motion of a particle moving in a straight line with variable acceleration is given by,  $S = 15t + 3t^2 - t^3$  in which, 's' is the distance measured in 'm' and the time 't' is measured in seconds. Calculate (i) the velocity and acceleration at start, (ii) the time at which the particle attains its maximum velocity, (iii) the maximum velocity of the particle

21. Find the support reactions at roller support at A and hinge at B for the force system shown in below fig.



22. The guns are pointed at each other, one upward at an angle of elevation of  $30^\circ$  and the other at the same angle of depression, the point of projections being 30 meters apart. If the guns are shot with velocities of 350 m/s upwards and 300 m/s downwards respectively, find when and where they will meet. Take  $g = 9.8 \text{ m/s}^2$ .

