

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – June 2026
Programme Name: B Tech (ME)
Semester: II
Subject Code: UG11T5204
Subject Name: Engineering Mechanics

Date: 08.06.2026

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

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. If a number of forces are acting simultaneously on a particle, then the resultant of these forces will have the same effect as produced by the all the forces. This is known as

- (a) Principle of physical independence of forces.
- (b) Principle of transmissibility of forces.
- (c) Principle of resolution of forces.
- (d) None of the above.

2. If a number of coplanar forces are acting simultaneously on a particle, the algebraic sum of the moments of all forces about any point is equal to the moment of their resultant force about the same point. This principle is known as

- (a) Principle of moments
- (b) Principle of levers
- (c) (a) & (b)
- (d) None of the above

3. Mechanical Advantage (MA) is defined as:

- (a) Effort / Load
- (b) Load / Effort
- (c) Distance / Time
- (d) Work / Power

4. The Lami's Theorem is applicable only for

- (a) Two forces act
- (b) Three concurrent forces act
- (c) Four forces act
- (d) Parallel forces act

5. A body starts from rest with acceleration 2 m/s^2 . Velocity after 5 s:

- (a) 5 m/s
- (b) 20 m/s
- (c) 15 m/s
- (d) 10 m/s

6. A circular hole of radius (r) is cut out from a circular disc of radius ($2r$) in such a way that the diagonal of the hole is the radius of the disc. The centre of gravity of the section lies at

- (a) Centre of a disc
- (b) Centre of the hole
- (c) Somewhere in the disc
- (d) Somewhere in the hole

7. The moment of inertia of a triangular section of base (b) and height (h) about an axis passing through its vertex and parallel to the base is as that passing through its C.G. and parallel to the base.

- (a) twelve times
- (b) nine times
- (c) six times
- (d) four times

8. Normal acceleration acts:

- (a) Along tangent
- (b) Towards center of curvature
- (c) Opposite motion
- (d) Vertically

9. The maximum efficiency of a lifting machine is

- (a) $1/m$
- (b) $V.R./m$
- (c) $m/V.R.$
- (d) $1/(m \times V.R.)$

10. Two forces 3 N and 4 N act at 90° . Resultant is:

- (a) 5 N
- (b) 1 N
- (c) 7 N
- (d) 25 N

Section B

Five Questions of 02 Marks each

11. Define polygon law of forces.

12. Two trains move at 40 km/h and 60 km/h in opposite directions. Find relative velocity.

13. Using the parallel axis theorem, find the area moment of inertia 50 mm away from the centroidal axis, given that the moment of inertia about the centroidal axis is $6.67 \times 10^7 \text{ mm}^4$ and area 20000 mm^2

14. State and explain parallelogram law of forces.

15. Define the laws of static friction.

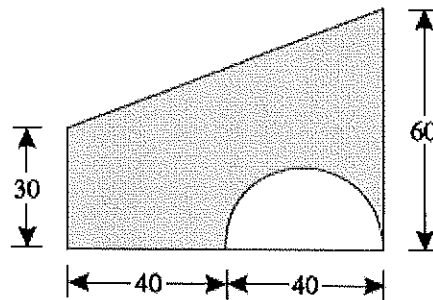
Section C

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

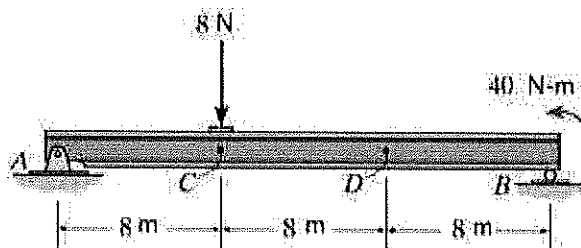
16. A lifting machine has a velocity ratio of 40. An effort of 150 N is required to lift a load of 5 kN. Calculate: Mechanical Advantage and Efficiency of the machine

and determine whether the machine is reversible or self-locking. Find the maximum load that can be lifted if the effort applied is increased to 200 N, assuming the same efficiency. (10)

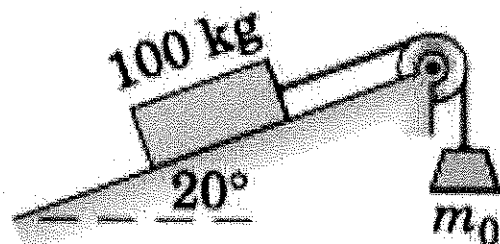
17. A semi-circular area is removed from a trapezium as shown in Figure (dimensions in mm). Determine the centroid of the remaining area (shown hatched). (10)



18. Determine the bending moment in the beam at points C and D. Assume the support at B is a roller. Point C is located just to the right of the 8 N load as shown in the figure.

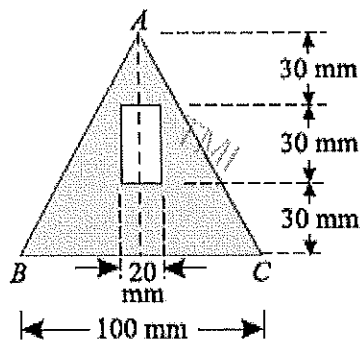


19. Determine the range of values that the mass m_o may have so that the 100-kg block shown in the figure will neither start moving up the plane nor slip down the plane. The coefficient of static friction for the contact surfaces is 0.30.



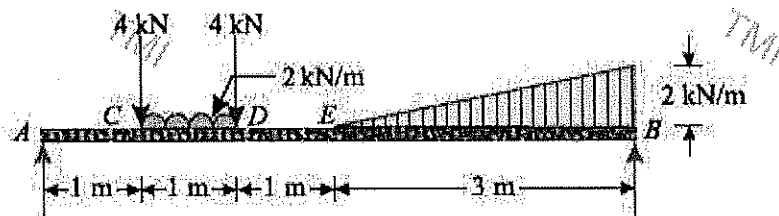
(10)

20. A rectangular hole is made in a triangular section as shown in Figure. Determine the moment of inertia of the section about X-X axis passing through its centre of gravity and the base BC. (10)



21. (a) A man, running eastwards with a speed of 6 kilometres per hour, feels the wind to be blowing directly from North. On doubling his speed, he feels the wind to blow from the North-east. Find the actual direction and velocity of the wind.

(b) A simply supported beam AB of 6 m span is subjected to loading as shown in Figure. Find the support reactions at A and B. (3+7)



22. A projectile fired from the edge of a 120 m high cliff with an initial velocity of 180 m/s at an angle of elevation of 45° with the horizontal. Neglecting air resistance, find the greatest elevation above the ground reached by the projectile and horizontal distance from the gun to the point, where the projectile strikes the ground. (10)

