

**INDIAN MARITIME UNIVERSITY**  
(A Central University , Government of India)

**END SEMESTER EXAMINATION December 2017**

**Programme:** B.Tech (Marine Engineering)

**Subject Name:** Engineering Mechanics - I

**Date:** 14.12. 2017

**Time:** 3 HRS

**Semester:** I

**Subject Code:** UG11T3105/  
UG11T2105/ UG11T1105

**Maximum Marks:** 100

**Pass Marks:** 50

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**PART – A**

**(10x3 = 30 marks)**

**All questions are compulsory**

1.
  - a) Define free body diagram.
  - b) What is statically indeterminate structure ?
  - c) State and explain Lami's theorem.
  - d) State and Explain D' Alembert's principle.
  - e) Define Mechanical Advantage, Velocity ratio and Ideal Machine
  - f) A Ship 'A' travels in the north making an angle of  $45^\circ$  to west with velocity of 18 km / hr and Ship 'B' travels in the East with a velocity 9 km/hr. find the relative velocity of Ship B w.r to Ship A
  - g) Define rectilinear motion, curvilinear motion and projectile motion.
  - h) Define work and energy
  - i) Write down the position of centroids of the following plane geometrical figures  
i) Square ii) Right angle triangle c) semi-circle from base.
  - j) Explain the method of section for trusses

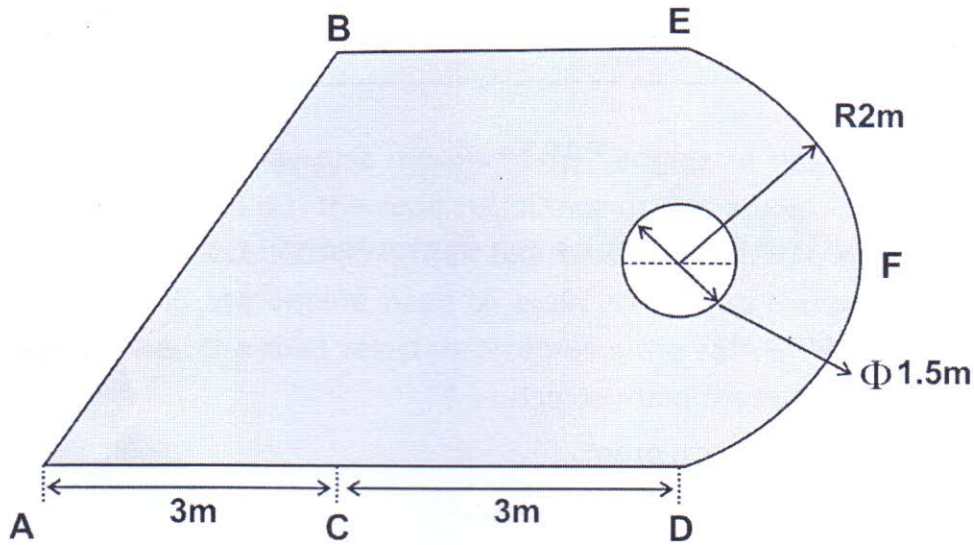
**PART B**

(5 x 14 = 70 marks)

**Answer any five of the following**

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- a) Three plates ABC, BCDE and DEF are welded together as shown in Fig.1 A circle of 1.5 m diameter is cut from the composite plate. Determine the centroid of the remaining area. (10 Marks)

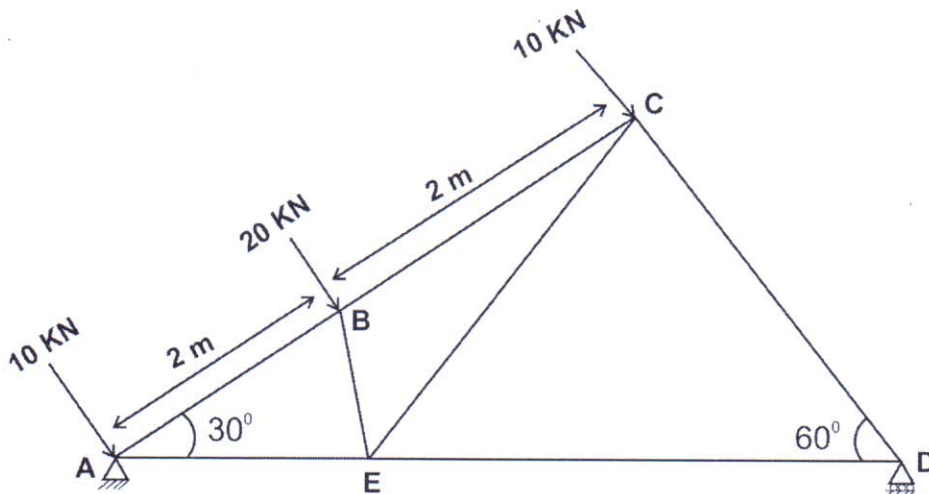


**Fig. 1**

- b) Explain the following (4 Marks)
- Pappu's Theorem
  - Centroids of volume

3. Determine the support and forces in the members. AE, BC and EC of Fig. (2)

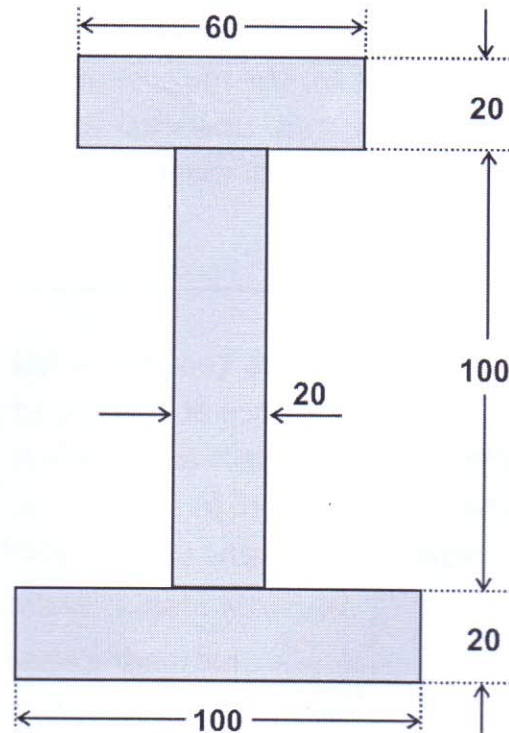
( 14 Marks)



**Fig. 2**

4. An I section is made up of 3 rectangles as shown in Fig. 3. Find the moment of Inertia of the section about the horizontal axis passing through the C.G. of the section (All dimensions are in mm)

(14 Marks)



**Fig. 3**

- 5 a) What load can be lifted by an effort of 120 N if the velocity ratio is 18 and efficiency of the machine at this load is 60%  
Determine the law of the machine, if it is observed that an effort of 200 N is required to lift a load of 2600 N and find the effort required to run the machine at a load of 3.5 kN
- (8 Marks)
- b) An aeroplane is flying horizontally at a height of 800m. A bomb is released from the aeroplane when the speed of aeroplane is 600 kmph. Determine the time required for the bomb to reach the ground and horizontal distance travelled by the bomb during flight.
- (6 Marks)
6. A metallic particle is subjected to the influence of magnetic field such a that it travels vertically downwards through a fluid that extends from plate 'A' to plate 'B' If the particles is released from rest at 'C'.  $S=100\text{mm}$  and the acceleration is measured as  $a = (4S) \text{ m/s}^2$  where  $S$  is in metres, Determine the velocity of the

particle when it reaches plate 'B' i.e. at  $s=200\text{mm}$  and the time needed from C to plate 'B'

(14 Marks)

7. a) Two guns are pointed at each other one upward at an angle of  $30^\circ$  and the other at the same angle of depression, the muzzles being  $30\text{m}$  apart. If the guns are shot with velocities of  $350\text{ m/s}$  upwards and  $300\text{ m/s}$  downwards respectively find when and where they will meet ?

(8 Marks)

- b) A truck weighing  $6\text{ KN}$  just moves freely (engine is not running) at  $36\text{ Kmph}$  down a slope of  $1$  in  $40$ , the road resistance at this speed just being sufficient to prevent any acceleration. Find the road resistance per  $\text{KN}$  weight of trucks. What power will the engine have to exert to run up the same slope at double the speed, when the road resistance remains the same?

(6 Marks)

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