

**INDIAN MARITIME UNIVERSITY**  
**Time Bound Assignment**  
**B Tech (ME) Arrear Examinations**  
**September/October 2020**  
**UG11T3105**  
**Engineering Mechanics-I**

Date: 17/09/2020  
Duration: 3 Hrs

Max Marks: 70  
Pass Marks: 35

**Part – A (compulsory)**

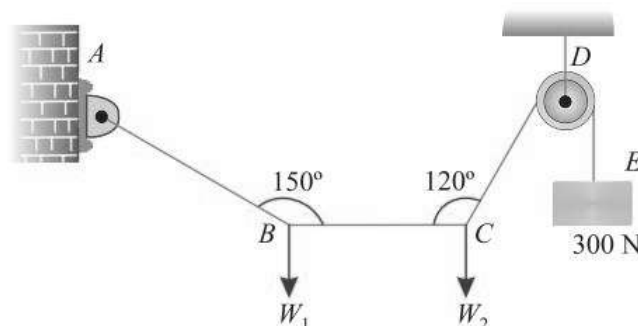
**Answer the following (10x2=20 Marks)**

1. What is Lami's Theorem? Write its mathematical expression?
2. State clearly the difference between a perfect frame and an imperfect frame?
3. What is the principle of Virtual Work?
4. What do you understand by Machine Law? What is the use?
5. Define Centroid and Center of gravity?
6. What is the Routh's rule for finding out the moment of inertia of an area?
7. State D'Alembert's principle?
8. Define range of projectile and condition for maximum range?
9. What do you understand by Angular Momentum?
10. Define amplitude, time period, and frequency of periodic motion?

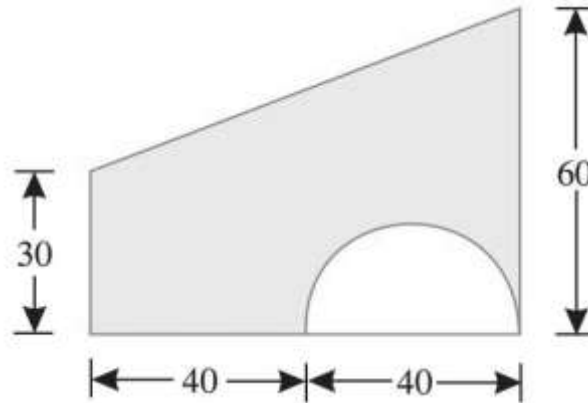
**Part – B**

**Answer any 5 out of 7 questions (5 x 10= 50 marks)**

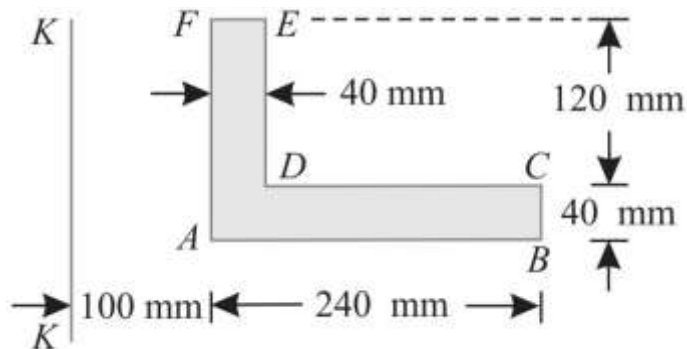
11. A light string ABCDE whose extremity A is fixed, has weights  $W_1$  and  $W_2$  attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown in Figure. If in the equilibrium position, BC is horizontal and AB and CD make  $150^\circ$  and  $120^\circ$  with BC, find Tensions in the portion AB, BC and CD of the string and magnitudes of  $W_1$  and  $W_2$ .



- 12.** 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.
- 13.** A semicircular area is removed from a trapezium as shown in Figure. Determine the centroid of the remaining area (shown hatched) (dimensions in mm).



- 14.** Figure shows an area ABCDEF. Compute the moment of inertia of the above area about axis K-K.



- 15.** A projectile is aimed at a mark on the horizontal plane through the point of projection. It falls 12 meters short when the angle of projection is  $15^\circ$ ; while it overshoots the mark by 24 meters when the same angle is  $45^\circ$ . Find the angle of projection to hit the mark. Assume no air resistance.
- 16.** The equation of motion of a particle moving in a straight line is given by  $s = 18t + 3t^2 - 2t^3$ . where (s) is in meters and (t) in seconds. Find (a) velocity and acceleration at start, (b) time, when the particle reaches its maximum velocity, and (c) maximum velocity of the particle.
- 17.** A bullet of mass 30g is fired into a body of mass 10 kg, which is suspended by a string 0.8 m long. Due to this impact, the body swings through an angle  $30^\circ$ . Find the velocity of the bullet.