



PAPER ID-411433

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Subject Code: KME402

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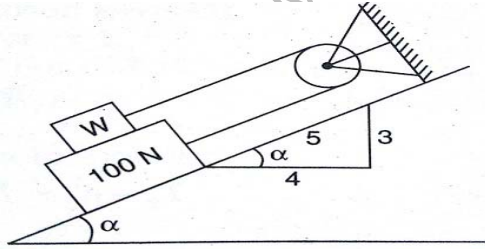
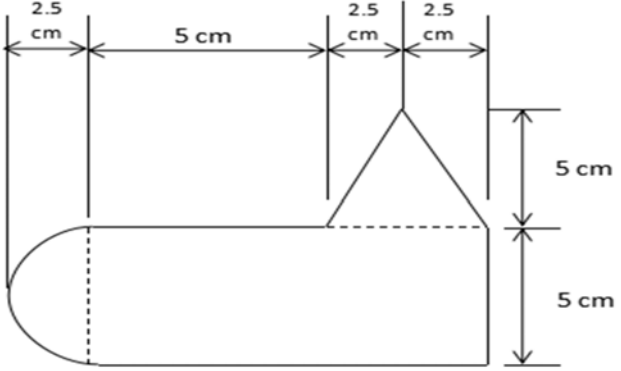
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BTECH
(SEM IV) THEORY EXAMINATION 2023-24
ENGINEERING MECHANICS

TIME: 3 HRS**M.MARKS: 100****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

a.	Define law of transmissibility of forces.
b.	If resultant of two forces of magnitude P has magnitude P, then determine the angle between the forces.
c.	What distinguishes a roller support from a hinged support?
d.	What do you understand by the term point of contraflexure?
e.	Define the terms centroid and centre of gravity.
f.	What is meant by polar moment of inertia?
g.	What do you mean by line of symmetry?
h.	Distinguish between relative velocity and resultant velocity.
i.	What are the assumptions of bending equation?
j.	What is meant by pure torsion?

SECTION B**2. Attempt any three of the following:****10x3=30**

a.	In the figure, the coefficient of friction is 0.2 between the rope and the fixed pulley, and between the other surfaces of contact, $\mu = 0.3$. Determine the minimum weight W to prevent the downward motion of the 100 N body. 
b.	Draw Shear force and bending moment diagram for a simply supported beam subjected to UDL.
c.	Determine the center of gravity of the plane uniform lamina shown in figure below. 



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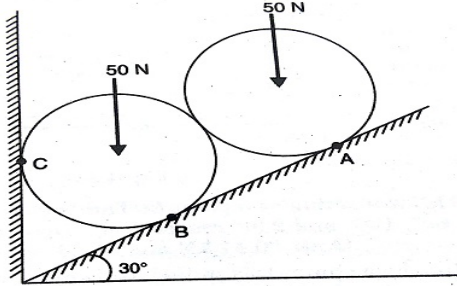
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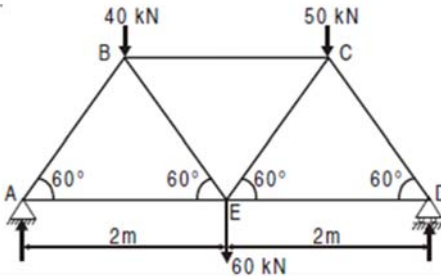
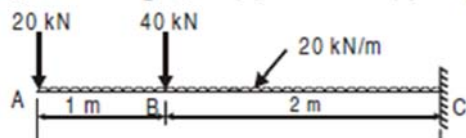
d.	Two ships, S_1 and S_2 , at a given instant are 3 km apart; S_2 being south-east of S_1 . The ship S_1 is travelling 12 km/hr due east and ship S_2 is travelling 20 km/hr due north. Make calculations for: (i) The velocity of ship S_2 relative to ship S_1 (ii) The shortest distance between the two ships (iii) The time when the two ships are nearest.
e.	Deduce the Bending equation stating the assumptions made.

SECTION C

3. Attempt any one part of the following:**10x1=10**

a.	Two identical rollers, each of weight 50 N, are supported by an inclined plane and a vertical wall as shown in fig. Find the reactions at the point of supports A, B and C. Assume all the surfaces to be smooth. 
b.	Two forces P_1 and P_2 are inclined to each other at an angle θ and their resultant is at right angle to force P_1 . There is another set of forces P_1 and P_3 with the angle of inclination θ and with their resultant at right angles to force P_3 . Show that the force P_1 is geometric mean between P_2 and P_3 .

4. Attempt any one part of the following:**10x1=10**

a.	Determine the forces in all the members of the truss shown in Fig. 3.9(a) and indicate the magnitude and nature of forces on the diagram of the truss. All inclined members are at 60° to horizontal and length of each member is 2 m. 
b.	Draw shear force and bending moment diagram for the cantilever beam shown in figure. 



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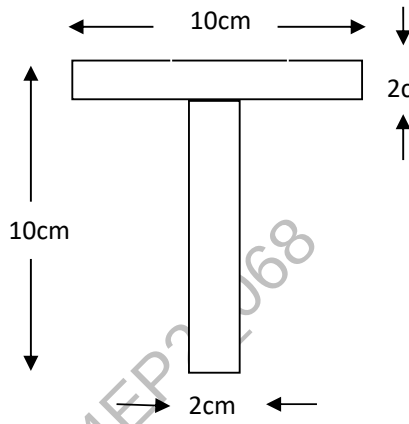
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TIME: 3 HRS**M.MARKS: 100****5. Attempt any one part of the following:****10x1=10**

a.	Locate the centre of gravity of a solid hemisphere of radius R. How this value would be affected if the hemisphere is hollow with negligible thickness.
b.	Figure 5 shows a T-section of dimensions 10 x 10 x 2 cm. Determine moment of inertia of the section about the horizontal and vertical axes, passing through the center of gravity of the section. Also find the polar moment of inertia of the given section. 

6. Attempt any one part of the following:**10x1=10**

a.	Explain D'Alembert's principle. Determine the acceleration produced in a body of 50 kg mass when it is acted upon by a force of 125 N. Use D'Alembert's principle.
b.	A wooden block weighing 750 N is placed on an inclined plane which makes an angle of 30° with the horizontal. What work will be done if the block is to be moved upwards the plane for 2.5 meter distance and the (a) plane is smooth, (b) plane is rough with coefficient of friction 0.2

7. Attempt any one part of the following:**10x1=10**

a.	Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 30 mm and length 1.5 m if the longitudinal strain in a bar during a tensile stress is four times the lateral strain. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 N/mm ² . Take $E = 1 \times 10^5 \text{ N/mm}^2$.
b.	A hollow steel shaft transmits 200 kW of power at 150 rpm. The total angle of twist in a length of 5 m of the shaft is 30°. Find the inner and outer diameter of the shaft if the permissible shear stress is 60 MPa. Take $G = 80 \text{ GPa}$