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BTECH
(SEM IV) THEORY EXAMINATION 2024-25
ENGINEERING MECHANICS

TIME: 3 HRS

M.MARKS: 100

Note: Attempt all Sections. In case of any missing data; choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

Q No.	Question	CO	Level
a.	State and explain the principle of transmissibility of forces.	CO-1	K2
b.	Define angle of repose. How is it related to coefficient of friction?	CO-1	K2
c.	What are the characteristics of a perfect, deficient, and redundant truss?	CO-2	K1
d.	What is point of contraflexure? Where does it occur?	CO-2	K1
e.	Define centroid and state any one method to determine it.	CO-3	K1
f.	Define and differentiate between polar and product moment of inertia.	CO-3	K2
g.	What is D'Alembert's principle?	CO-4	K1
h.	Explain the concept of relative velocity with example.	CO-4	K2
i.	Define resilience and modulus of resilience.	CO-5	K1
j.	What do you understand by pure torsion?	CO-5	K2

SECTION B**2. Attempt any three of the following:****10 x 3 = 30**

a.	<p>A lever is hinged at point C and attached to a control cable at point A as shown in Figure 1. Determine:</p> <p>(i) The tension in the cable AD</p> <p>(ii) The reaction at hinge point C</p>	CO-1	K4
<p style="text-align: center;">Fig.1</p>			
b.	A ladder rests against a vertical wall with both wall and floor having coefficients of friction as 0.25. Determine the least angle with the horizontal so that the ladder does not slip.	CO-2	K4
c.	A simply supported beam of length 6 meters carries a point load of 20 kN at 3 meters from the left end. Draw the shear force and bending moment diagrams.	CO-3	K3
d.	A long rod AB is supported at the upper edge of a wall of height 1.5 m and on a horizontal floor as shown in fig. 2. If the lower end of the rod moves with a velocity $V_A = 2$ m/s find the velocity of the contact point C of the rod and the angular velocity of the rod, when the rod is 60° to the horizontal.	CO-4	K4



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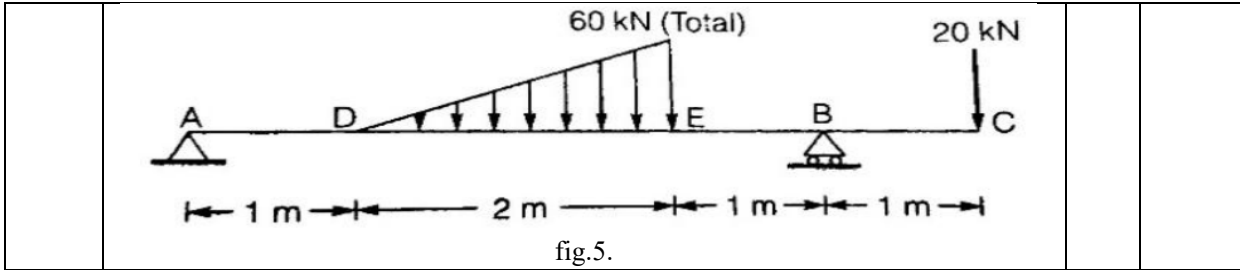
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5. Attempt any one part of the following:

10 x 1 = 10

a.	A semicircular area is removed from a trapezium as shown in fig.6. determine the centroid of the remaining area.	CO-3	K2
<p>fig.6.</p>			
b.	Determine the centroid of a U-shaped wire composed of two vertical 20 cm arms and a semicircular arc of 10 cm radius connecting them at bottom.	CO-3	K4

6. Attempt any one part of the following:

10 x 1 = 10

a.	Calculate the centroid of a composite section consisting of a rectangle and a semicircle.	CO-4	K4
b.	A 10 kg object is falling at 20 m/s. Determine the force required to stop it in (i) 2 seconds, and (ii) 2 meters of travel, If gravity is considered in both case	CO-4	K4

7. Attempt any one part of the following:

10 x 1 = 10

a.	A disc of mass 10 kg and radius 0.5 meters rotates at 30 rad/s. Find the mass moment of inertia and its kinetic energy.	CO-5	K4
b.	Derive the bending equation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ and explain the significance of the neutral axis.	CO-5	K4