PAPER ID-421627

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM IV) THEORY EXAMINATION 2021-22
ENGINEERING MECHANICS

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If you require any missing data, then choose suitably.

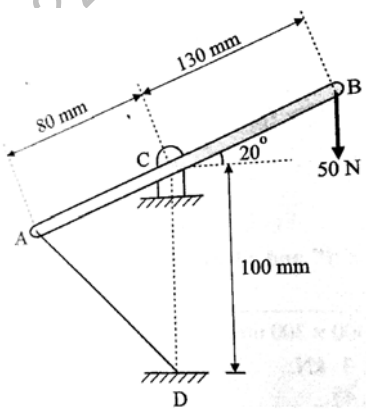
SECTION A

1. Attempt *all* questions in brief. 2x10 = 20

Qno	Questions	CO
(a)	State the principle of transmissibility of force.	1
(b)	What is a free body diagram?	1
(c)	List the assumptions used in the analysis of a truss.	2
(d)	Define point of contraflexure. In what type of beams this point occurs.	2
(e)	What is the importance of axis of symmetry in determination of centre of gravity of a body?	3
(f)	Explain the term radius of gyration	3
(g)	What do you mean by general plane motion?	4
(h)	Find the work done in pulling a weight 500 N through a distance of 5 m along a horizontal surface by a force of 200 N, whose line of action makes an angle of 30^0 with the horizontal.	4
(i)	Differentiate between resilience and toughness.	5
(j)	What do you understand by term pure bending?	5

SECTION B

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

Qno	Questions	CO
(a)	A lever is hinged at C and attached to a control cable at A (fig. 1) determine (i) tension in the cable (ii) The reaction at C  Fig. 1	1
(b)	Define shear force and bending moment. Derive the relation between load, shear force and bending moment.	2
(c)	Determine the mass moment of inertia of cone about its central axis. Take mass of cone as M and radius as R.	3
(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 60^0 to the horizontal.	4

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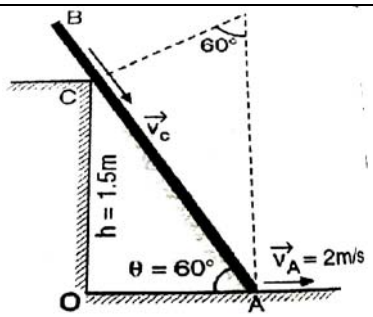
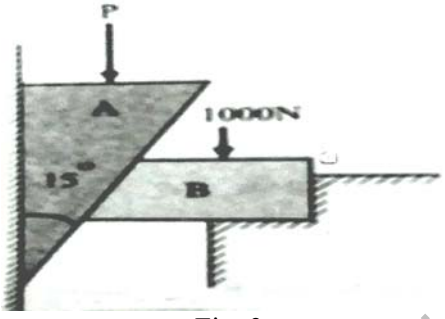
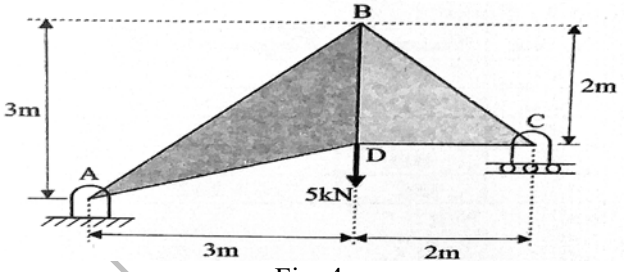
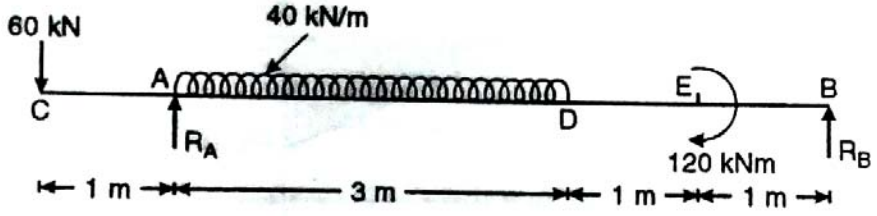
	 Fig. 2	
(e)	A timber beam 15 cm wide and 20 cm deep carries a uniformly distributed load over a span of 4 m and is simply supported. If the permissible stress is 30 N/mm^2 calculate the maximum load which can be carried by the timber beam.	5

SECTION C

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

Qno	Questions	CO
(a)	State and prove Varignon's theorem also list the applications of Varignon's theorem	1
(b)	A 15^0 wedge of negligible weight is to be driven to tighten a body B which is supporting a vertical load of 1000 N. If the coefficient of friction for all surfaces of contact is to be 0.25. Find minimum force P required to drive the wedge shown in fig.3.  Fig. 3	1

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

Qno	Questions	CO
(a)	Find out forces in all the members of given truss shown in fig. 4.  Fig. 4	2
(b)	Draw the SFD and BMD for the beam shown in fig. 5  Fig. 5	2

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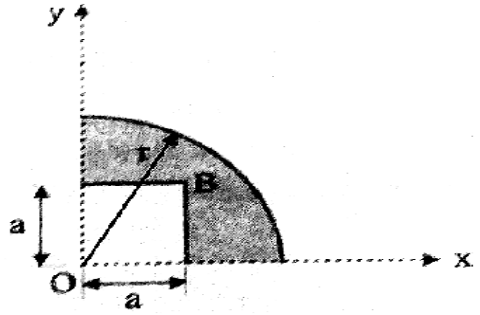
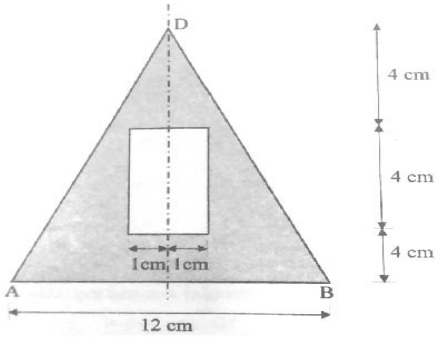
5. Attempt any *one* part of the following: 10x1 = 10

Qno	Questions	CO
(a)	Determine ratio of a to r for which the centroid of the area is located at point B shown in fig. 6.  Fig. 6	3
(b)	Find the moment of inertia of shaded area shown in fig. 7 about centroidal x-axis and also about axis AB.  Fig. 7	3

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

Qno	Questions	CO
(a)	A train starts from rest and moves along a curved track of radius 750 m with a uniform acceleration until it attains a velocity of 80 km/hr at the end of third minute. Determine the tangential, normal and total acceleration in m/s^2 of the train at the end of second minute.	4
(b)	Two blocks weighing 100 N and 40 N are supported at the ends of a rope of negligible weight which is passing over the rough surface of a pulley mounted on a horizontal axle. The pulley may be assumed as a solid disc with a weight of 50 N. Friction in the bearings of the pulley may be neglected. Find the tension on the two parts of the two rope and the linear acceleration of the blocks.	4

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

Qno	Questions	CO
(a)	The modulus of rigidity of a material is 24.8 kN/mm^2. A 10 mm diameter rod of the material is subjected to an axial tensile force of 5 kN and change in its diameter is observed to be 0.0032 mm. Calculate Poisson's ratio and modulus of elasticity of the material.	5
(b)	Derive the pure torsion equation where symbols has usual meaning $$\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{L}$$	5