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.
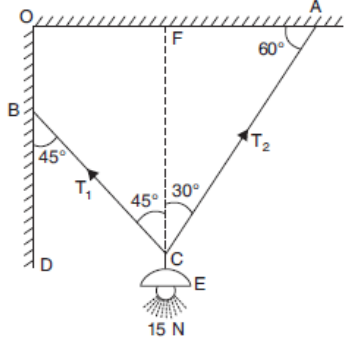
SECTION A

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

Q no	Questions	CO
(a)	What is the difference between collinear and concurrent forces?	1
(b)	Define the Limiting angle of friction.	1
(c)	Define the angle of repose	2
(d)	Explain the types of beams.	2
(e)	What is the difference between mass moment of Inertia and area moment of Inertia	3
(f)	Define the Poler moment of Inertia.	3
(g)	Explain D'Alembert's principle.	4
(h)	What do you understand by relative velocity?	4
(i)	Define the longitudinal stress	5
(j)	Define the shaft and its applications.	5

SECTION B

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

Qno	Questions	CO
(a)	An electric light fixture weighing 15 N hangs from a point C, by two strings AC and BC. AC is inclined at 60° to the horizontal and BC at 45° to the vertical as shown in Fig. determine the forces in the strings AC and BC.	1
(b)	Find the forces in the members AB, AC and BC of the truss shown in Fig.	2

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(c)	Determine the moment of inertia of the 'T' section with respect to centroidal X-X axis. Section as shown in figure. 	3
(d)	The equation of motion of a particle moving in a straight line is given by: $s = t + 2.5t^2 - 1.5t^3$, where s is the total, distance covered from the starting point in meters at the end of t seconds. Find the following: (i) the velocity and acceleration at start, (ii) the time, when the particle reaches its maximum velocity	4
(e)	What do you mean by 'simple bending' or 'pure bending'? What are the assumptions made in the theory of simple bending?	4

SECTION C

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

Qno	Questions	CO
(a)	Determine the magnitude, direction, and position of a single force P, which keeps in equilibrium the system of forces acting on the corners of a rectangular block as shown in Fig. The position of force P may be stated by reference to axes with origin O and coinciding with the edges of the block.	1

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(b)	Four parallel forces of magnitudes 100 N, 150 N, 25 N and 200 N are shown in Fig. Determine the magnitude of the resultant and the distance of the resultant from point A.	1

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

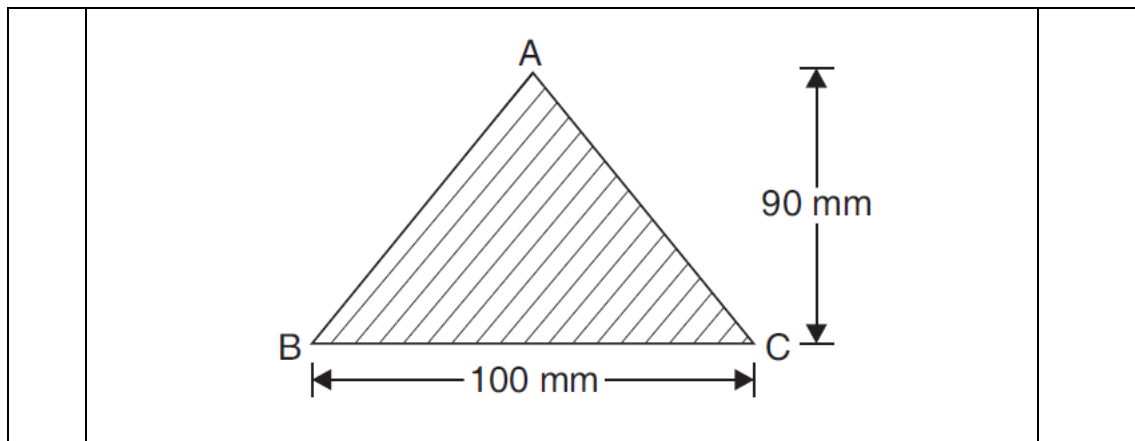| Qno	Questions	CO
(a)	Draw the shear force & bending moment diagram for a loaded beam as shown in figure.	2
(b)	Derive the relationship between Load intensity, Shear force and Bending moment for a beam.	2

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

Qno	Questions	CO
(a)	Derive an expression for mass moment of inertia about axis of symmetry for a right solid circular cylinder.	3
(b)	Determine the moment of inertia of the section about an axis passing through the base BC of a triangular section shown in Fig.	3

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

Q no	Questions	CO
(a)	Two bodies A and B of masses 5 kg and 20 kg are connected by an inclined string. A horizontal force P of 100 N is applied to block B. Calculate the tension in the string and acceleration of the system. Take coefficient of friction for all surfaces as 0.25. Refer figure.	4
(b)	Two bodies directly in line and 10 m apart are held stationary on an inclined plane having inclination of 20°. The co-efficient of friction between the plane and lower body is 0.08 and that between the plane and the upper body is 0.05. If both the bodies are set in motion at the same instant, calculate the distance through which each body travels before they meet together.	4

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

Qno	Questions	CO
(a)	Derive the relation for a circular shaft when subjected to torsion as given below. $$T/J=G\emptyset/L=\intercal/R$$ were T = Torque transmitted, J = Polar moment of inertia, T= Max. shear stress, R = Radius of the shaft, G = Modulus rigidity, Ø= Angle of twist, and L = Length of the shaft.	5
(b)	A solid shaft of 150 mm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced to the shaft is 45 N/mm^2.	5