Paper Id: | **140101** | **Roll No:** | | | | | | | | | | | | |

B. TECH.
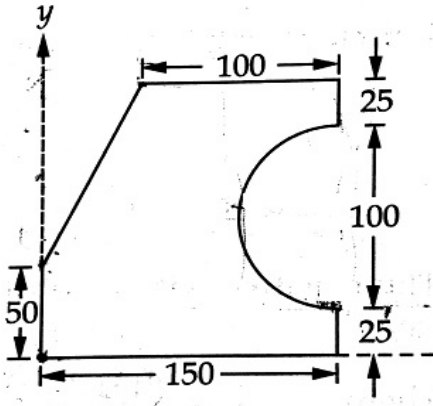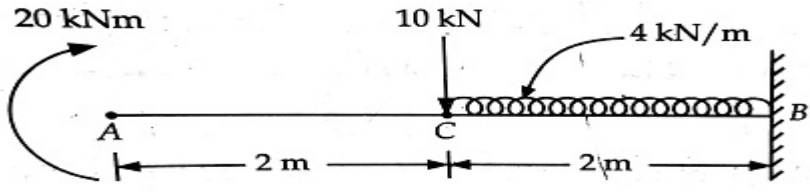### (SEM-I) THEORY EXAMINATION 2019-20
ELEMENTS OF MECHANICAL ENGINEERING

Time: 3 Hours   *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt** *all* **questions in brief.**   **2 x 7 = 14**

a.	State varignon's theorem.
b.	Write the expression for MOI of rectangle and triangle about their centroidal axes.
c.	What do you mean by elasticity and plasticity?
d.	Define modulus of rigidity and poisons ratio.
e.	Write the differences between work and heat.
f.	State Zeroth law of thermodynamics with example.
g.	Differentiate between heat and work?

SECTION B

2. **Attempt any** *three* **of the following:**   **7 x 3 = 21**
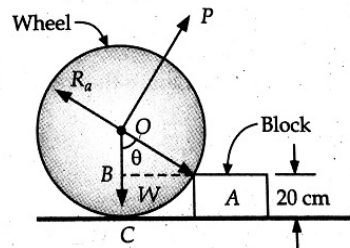
|	
a.	Locate the centroid ot the area shown in fig. All the dimensions are in mm.
b.	Draw shear force and bending moment diagram for a given cantilever beam.
c.	Explain stress strain diagram for mild steel in detail.
d.	Discuss Babcock and Wilcox boiler with suitable diagram.
e.	Show that the Kelvin–Planck and the Clausius statement of the second law of Thermodynamics are equivalent.

SECTION C

3.   **Attempt any _one_ part of the following:** **7 x 1 = 7**

| (a)	A uniform wheel of 50 cm diameter and 1 KN weight rests against a rigid rectangular block of thickness 20 cm. Considering all surfaces smooth; determine the least pull to be applied through the centre of wheel to just turn it over the corner of the block and reaction of the block.
(b)	Determine the moment of inertia of the area shown shaded in fig. about the axis passing through its base.
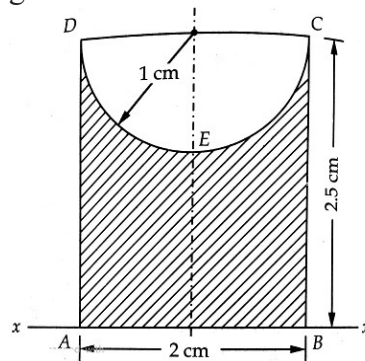
4.   **Attempt any _one_ part of the following:** **7 x 1 = 7**

(a)	A Truss is shown in figure . Find the forces in all the members of the truss with their nature.
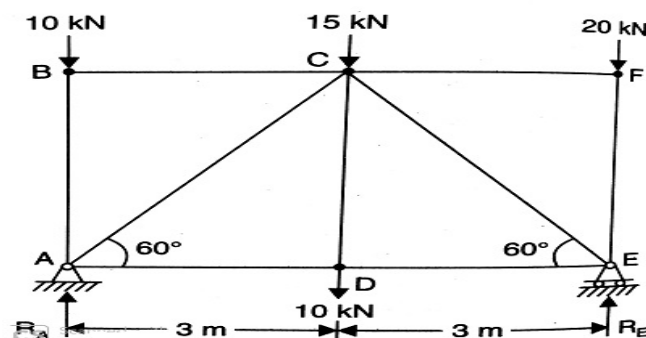
(b)	Find reactions and draw shear force and bending moment diagram for a given simply supported beam.
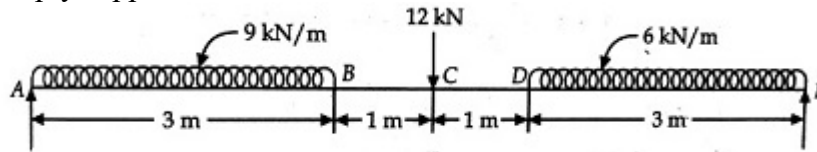
5.   **Attempt any *one* part of the following:**   **7 x 1 = 7**

(a)	A rectangular beam with depth 150 mm and width 100 mm is subjected to a maximum bending moment of 300 kNm. Determine (i) Maximum stress in the beam, (ii) Radius of curvature when the bending is maximum, and (iii) Bending stress at a distance of 40 mm from the top of the surface of the beam. Take modulus of elasticity of the beam material E = 200 GPa
(b)	Write short notes on composite materials and their applications.

6.   **Attempt any *one* part of the following:**   **7 x 1 = 7**

(a)	A stone of 20 kg mass and a tank containing 200 kg water comprise a system. The stone is 15 m above the water level initially. The stone and water are at the same temperature initially. If the stone falls into water, then determine change in energy ΔU, change in potential energy ΔPE, change in kinetic energy ΔKE, heat Q and work done W, when (i) the stone is about to enter the water, (ii) the stone has come to rest in the tank, and (iii) the heat is transferred to the surroundings in such an amount that the stone and water come to their initial temperature.
(b)	Define the following terms- (i) Microscopic and macroscopic approach (ii) Quasi static process (iii) Concept of continuum

7.   **Attempt any *one* part of the following:**   **7 x 1 = 7**

(a)	A Carnot cycle operates between source and sink temperatures of 250°C and – 15°C. If the system receives 90 kJ from the source, find : (i) Efficiency of the system ; (ii) The net work transfer ; (iii) Heat rejected to sink.
(b)	With the help of Diesel cycle explain the working of 4 stroke diesel engine.