

**B. TECH.**  
**(SEM-III) THEORY EXAMINATION 2019-20**  
**ENGINEERING MECHANICS**

Time: 3 Hours

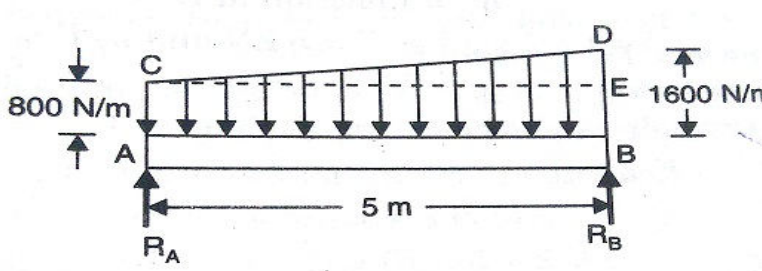
Total Marks: 100

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

**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

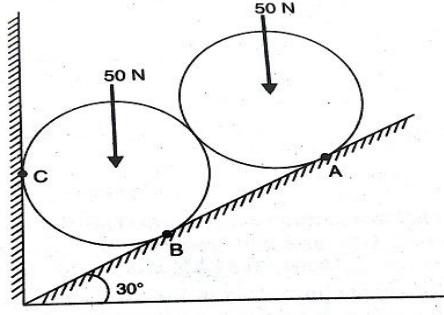
Q no.	Question	Marks	CO
a.	The resultant of two forces $F_1$ and $F_2$ is at right angle to $F_1$ . Find the angle between the forces.	2	
b.	State and explain the principle of transmissibility of forces.	2	
c.	The force required to pull a body of weight 50 N on a rough horizontal surface is 15 N. Calculate the coefficient of friction if the force is applied at an angle of $15^\circ$ with the horizontal.	2	
d.	What do you understand by point of contraflexure?	2	
e.	Calculate the bending moment at centre of a simply supported beam carrying uniformly distributed load.	2	
f.	State the law of conservation of momentum.	2	
g.	Define D'Alembert's principle.	2	
h.	What is energy? Explain the various forms of mechanical energies.	2	
i.	Find the minimum diameter of a steel wire, which is used to raise a load of 4000 N if the stress in the rod is not to exceed $95 \text{ MN/m}^2$ .	2	
j.	Define modulus of rigidity and bulk modulus.	2	

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

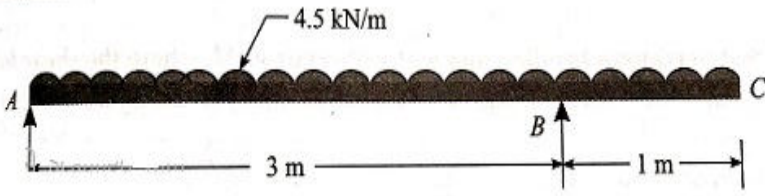
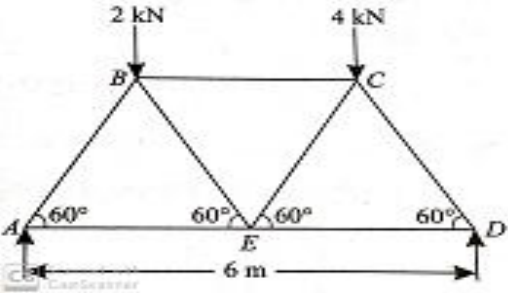
Q no.	Question	Marks	CO
a.	A body resting on a horizontal surface required a pull of 24 N inclined at $30^\circ$ to the horizontal just to move it. It was also found that a push of 30 N at $30^\circ$ to the plane was just enough to cause the motion to impend. Make calculation for weight of the body and coefficient of friction	10	
b.	A simply supported beam of length 5 m carries a uniformly increasing load of 800 N/m at one end to 1600 N/m at the other end as shown in figure 2. Calculate the reaction at both the ends. 	10	
c.	Define moment of inertia, state and prove parallel axis theorem.	10	
d.	A body of mass 5 kg is initially at rest on a rough horizontal surface ( $\mu = 0.2$ ) and is acted upon by a 20 N pull applied horizontally. Calculate (i) The work done by the net force on the body in 5 seconds. (ii) Change in kinetic energy of the body in 5 seconds.	10	
e.	Explain stress strain diagram for ductile material in detail.	10	

**SECTION C**

**3. Attempt any one part of the following: 1 x 10 = 10**

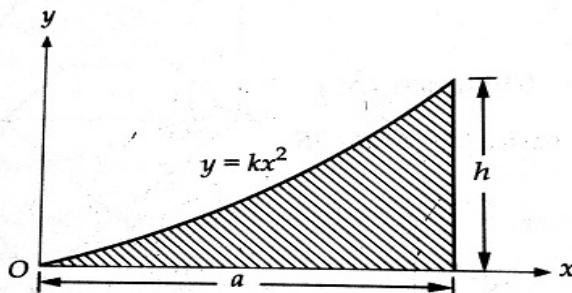
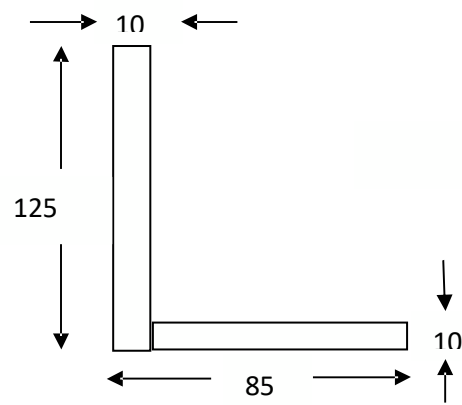
Q no.	Question	Marks	CO
a.	ABCD is a square, each side being 20 cm and E is the middle point of AB. Forces of 7, 8, 12, 5, 9 and 6 KN act on the lines of direction AB, EC, BC, BD, CA and DE respectively. Find the magnitude direction and position of the resultant.	10	
b.	Two identical rollers, each of 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.  	10	

**4. Attempt any one part of the following: 1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Draw shear force and bending moment diagram for given overhanging beam as shown in fig.  	10	
b.	Figure shows a Warren girder consisting of seven members each of 3 m length freely supported at its end points. Find the forces in all the members of the girder.  	10	

**5. Attempt any one part of the following:**

**1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Locate the centroid of the area of the parabolic shaded portion shown in figure .  	10	
b.	Determine the polar moment of inertia of the L-section as shown in fig.  	10	

**6. Attempt any one part of the following:**

**1 x 10 = 10**

Q no.	Question	Marks	CO
a.	A stone is dropped from the top of a tower 50 m high. At the same time, another stone is thrown upwards from the foot of the tower with a velocity of 25 m/s. When and where the two stone cross each other?	10	
b.	The motion of a particle is given by $a = t^3 - 3t^2 + 5$ , where 'a' is acceleration in $m/s^2$ and 't' is time in seconds. The velocity of the particle at $t = 1$ second 6.25 m/s and the displacement is 8.8 m. Calculate the displacement and velocity at $t = 2$ seconds.	10	

**7. Attempt any one part of the following:**

**1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Define stress and its types, strain and its types. What do you mean by strain energy?	10	
b.	Determine the diameter of a solid shaft which will transmit 300 KW at 250 rpm. The maximum shear stress should not exceed $30 N/mm^2$ and twist should not be more than $1^\circ$ in a shaft length of 2 m. take modulus of rigidity $= 1 \times 10^5 N/mm^2$ .	10	