Printed Pages:04 **Sub Code: KME402**

Paper Id: 238348 **Roll No.** | | | | | | | | | | |

B. TECH
(SEM IV) THEORY EXAMINATION 2022-23
ENGINEERING MECHANICS

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

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

SECTION A

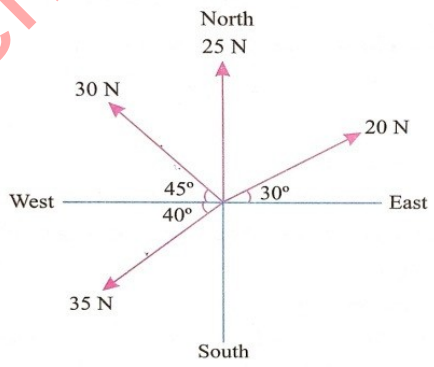
1. Attempt *all* questions in brief. **2 x 10 = 20**

(a) State and explain the principle of transmissibility of forces.
(b) Explain the following terms.
  (i) Coefficient of friction.
  (ii) Angle of repose.
(c) Define and explain the term: perfect, deficient and redundant frame.
(d) Define point of contraflexure.
(e) Define radius of gyration.
(f) Define polar moment of inertia.
(g) State and explain D'Alembert's principle.
(h) Explain rectilinear motion.
(i) State Hook's Law.
(j) Define the term: strain energy and resilience.

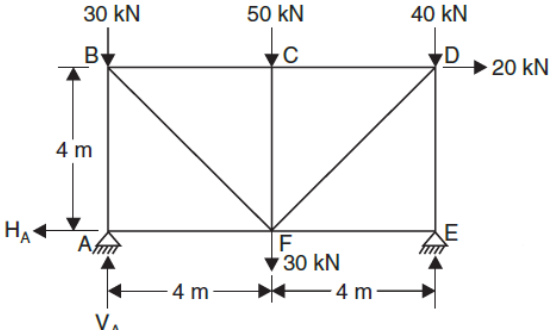
SECTION B

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

(a) The following forces act at a point as shown in figure, find out the magnitude and direction of resultant force.

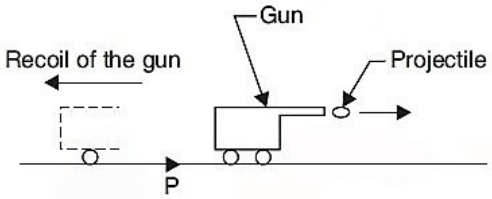


(b) Determine the forces in the members of truss shown in the figure below.



(c) State and prove the following theorems of moment of inertia:
(i) Perpendicular axis theorem.
(ii) Parallel axis theorem.

(d) A gun of mass 3 × 104 kg fires projectile of mass 45.6 kg with a velocity of 305 m/s as shown in below figure. Determine **(i)** with what initial velocity will the gun recoil; **(ii) if the recoil is overcome by an average force of 60 kN, how far will the** gun travel and how long will it take.



(e) **Define pure torsion? List the assumptions made in torsion theory. Derive the** torsion equation.

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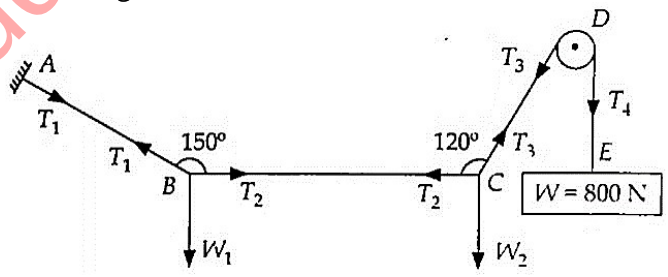
where,
T = Maximum twisted torque.
R = Radius of shaft.
I_p = Polar moment of inertia.
= Shear stress.
C = Modulus of rigidity.
= The angle of twist (radians), and
= Length of shaft.

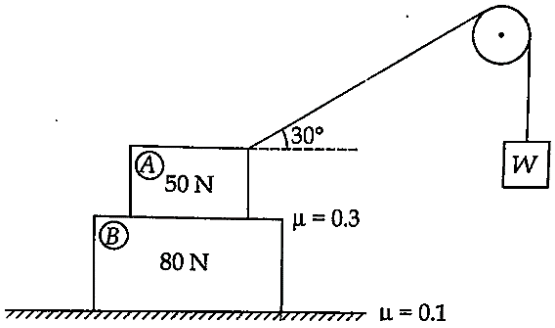
SECTION C

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

(a) A string **ABCDE whose extremity A is fixed has weights W**$_1$ and W_2 attached to it **at B and C, and passes round a smooth peg at D carrying a weight of 800 N at the** free end E as shown in below figure. If in a state of equilibrium, BC is horizontal and AB and CD makes angle of 150° and 120° respectively with BC, make calculations for:
(i) The tensions in portions AB, BC, CD and DE of the string.
(ii) The values of weights W_1 and W_2.

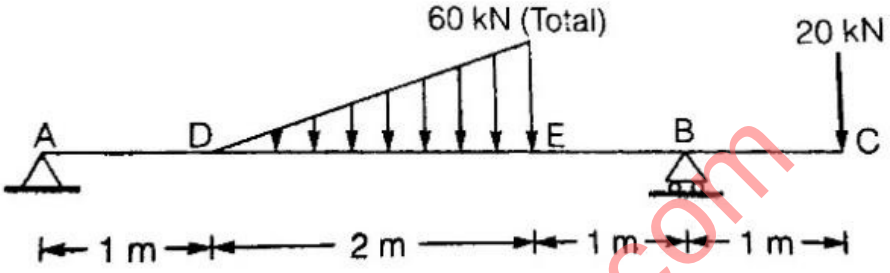


(b) Two block A and B weighting 50 N and 80 N **respectively are positioned as shown** in below figure. The coefficient of friction between ground and block B is 0.1 and that between block B and block A is 0.28. State whether B is stationary with respect to ground and A moves or B is stationary with respect to A. Proceed to determine the minimum value of weight W in the pan so that motion starts.

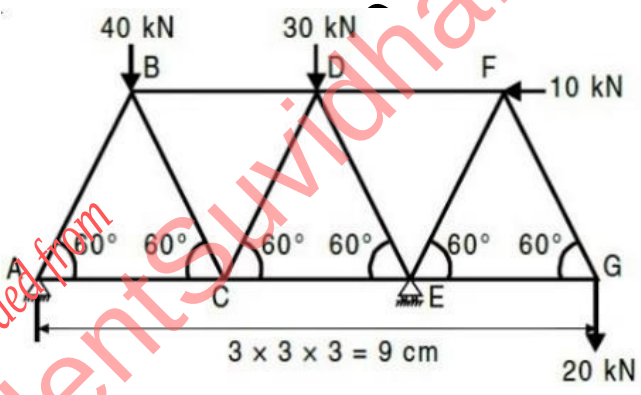


4. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Draw the bending moment and shear force diagram for overhanging beam shown in the figure below.

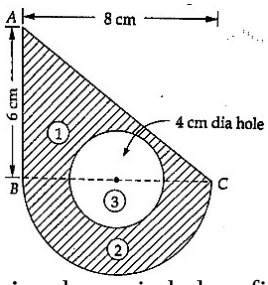


(b) Analyze the forces in each member of truss shown in figure below. All the members are of 3 m length.

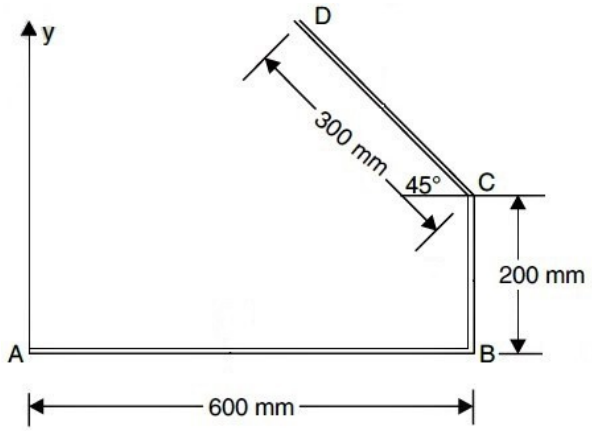


5. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Find the moment of inertia about the centroidal horizontal axis of the area shown shaded in the below figure. The section consists of triangle ABC, semi-circle on BC as diameter, and a circular hole of diameter 4 cm with its center on BC.



(b) Determine the centroid of the wire shown in below figure.

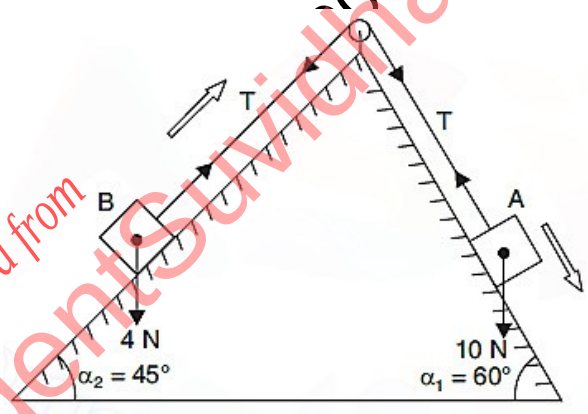


6. Attempt any *one* part of the following: **10 x 1 = 10**

(a) At a certain instant a body of mass 10 kg falling freely under the force of gravity, was found to be falling at the rate of 20 m/s. what force will stop the body in

i) 2 seconds and
ii) 2 meters

(b) Blocks A and B weighing 10 N and 4 N respectively are connected by a weightless rope passing over a frictionless pulley and are placed on smooth inclined planes making 60° and 45° with the horizontal as shown in figure below. Determine: **(i)** The tension in the string and **(ii)** Velocity of the system 3 seconds after starting from rest.



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

(a) **Define pure bending? List the assumptions made in bending theory. Derive the** bending equation.

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where,

M = Moment of resistance.
I = Moment of inertia of the section about neutral axis.
E = Young's modulus of elasticity.
R = Radius of curvature of neutral axis, and
= Bending stress.

(b) Illustrate the stress and strain diagram for ductile and brittle material. Also derive the relation for strain energy.