END TERM EXAMINATION

SECOND SEMESTER [B.Tech] MAY-JUNE 2025

Paper Code: ES-114   Subject: Engineering Mechanics

Time: 3 Hours   Maximum Marks: 60

Note: Attempt five questions in all including Q. No. 1 which is compulsory. Select one question from each unit. Assume missing data, if any.

(2x10=20)

Q1   Attempt all parts:-
(a) State the principle of Transmissibility of forces.
(b) Explain Free Body Diagram with the help of two examples.
(c) State the Assumptions for a Perfect Truss.
(d) State Varignon's Theorem.
(e) Explain (i) Coefficient of Friction (ii) Cone of Friction.
(f) Explain Radius of Gyration.
(g) Describe relation between Impulsive force and Momentum.
(h) What is meant by ICR and how to determine it?
(i) State PAPPUS and GULDINUS Theorem.
(j) Explain the coefficient of restitution, what is its value for perfect elastic impact?

UNIT-I

Q2   (a) A bar AB of weight 100 N is hinged at A and the pulley by a cable attached at B by a force F. Find the force F and the magnitude and direction of the reaction at A if the bar is in equilibrium position as shown in the Fig.1.   (5)

(b) Determine the centroid of the parabolic spandrel about X-axis as shown in Fig.2. The equation of the parabola is given by $y = kx^2$.   (5)
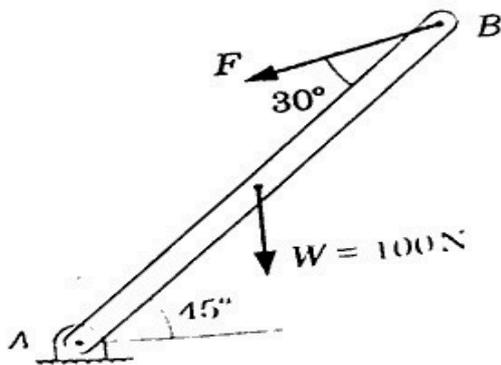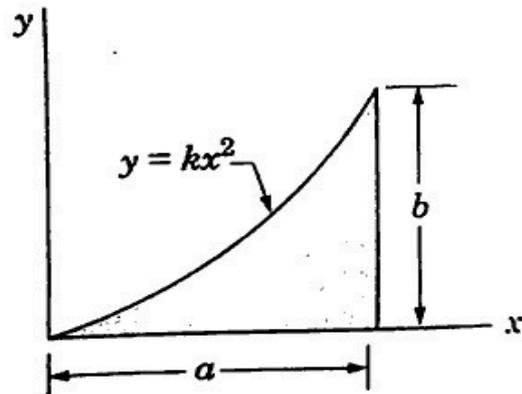

Fig.1.

Fig.2.

OR

Q3   (a) A crane is pivoted at the end B and is supported by a guide at A, as shown in Fig.3. Determine the reaction produced at A and B by a vertical load W= 5kN applied at C.   (5)

(b) Determine the Moment of inertia of the cross section as shown in Fig.4 with respect to centroidal axis.   (5)
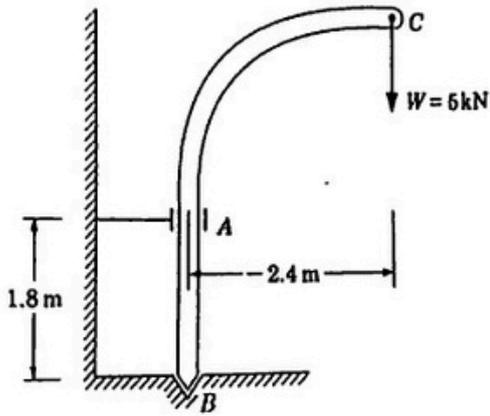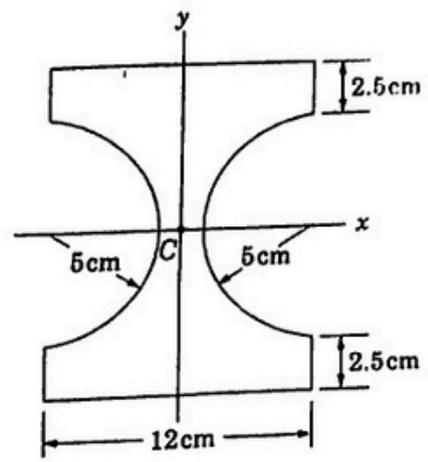
P.T.O.

Fig.3.

Fig.4.

UNIT-II

Q4 Find the axial forces in the members BD, CD and CE of truss loaded as shown in Fig.5. **(10)**
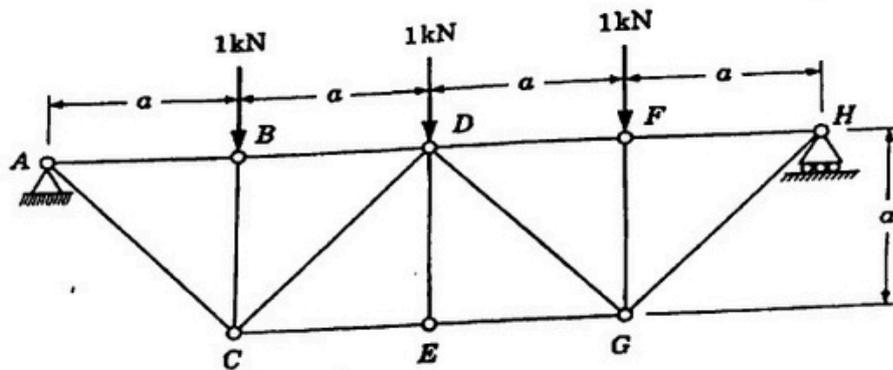

Fig.5.

OR

Q5 A horizontal bar 1m long and of negligible weight rests on rough inclined planes as shown in Fig.6. Determine the minimum value of x at which the load Q = 100N may be applied before slipping impends. Coefficient of friction between the horizontal bar and the rough inclined planes is 0.2. **(10)**

Fig.6.

P.T.O.

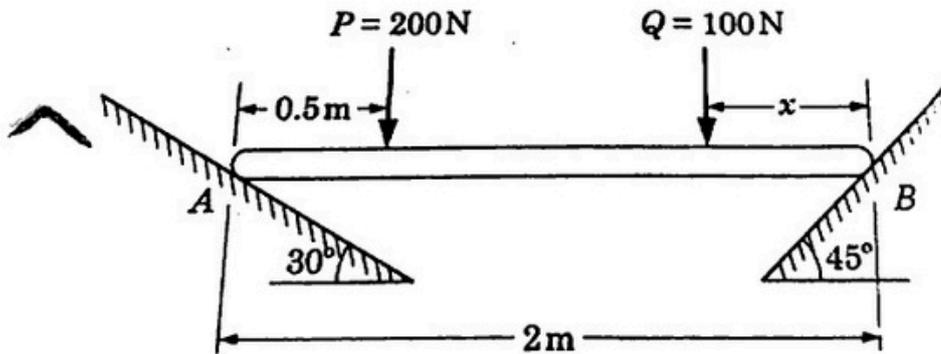## UNIT-III

Q6 Three weights A, B and C are connected as shown in Fig.7. Determine the acceleration of each weight and tension in the string. Given, W_A = 150 N, W_B = 450 N, W_C = 300 N. **(10)**
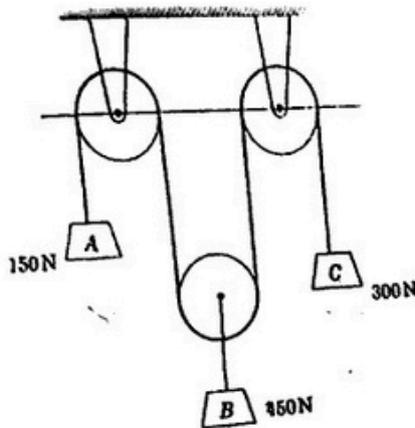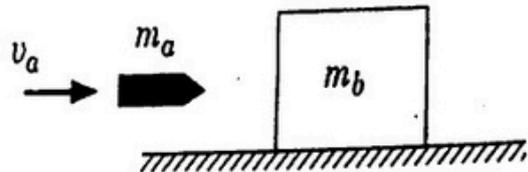

Fig.7.

Fig.8.

OR

Q7 A bullet travelling horizontally with a velocity of 600 m/s and weighting 0.25 N strikes a wooden block of weight 50 N resting on a horizontal floor and gets buried inside the block as shown in Fig.8. The coefficient of friction between the floor and the block is 0.5. Find the distance through which the block is displaced from its initial position. **(10)**

UNIT-IV

Q8 In a four bar mechanism ABCD, the bar AB rotates clockwise with an angular velocity of 5 rad/s as shown in Fig.9. Find the angular velocities of the bars BC and CD when the bar AB makes an angle of 30° with the horizontal, bar CD makes an angle of 60° and the bar BC is horizontal. **(10)**
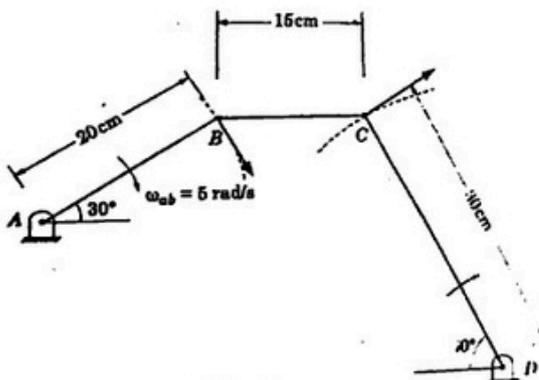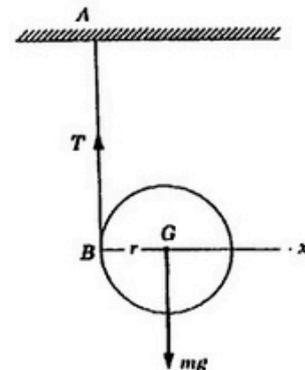

Fig.9

Fig.10.

OR

Q9 A right circular cylinder of mass 10 kg and radius 15cm is suspended from a cord that is wound around its circumference. If the cylinder is allowed to fall freely, find the acceleration of its mass centre G and the tension in the cord as shown in Fig.10. **(10)**

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