Total No. of Questions : 6]

SEAT No. :

PE-12178

[Total No. of Pages : 7

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F.E.

ESC-104-CVL : ENGINEERING MECHANICS

(2024 Pattern) (Semester - I/II)

Time : 2½ Hours] *[Max. Marks : 60*

Instructions to the candidates :

1) *All questions are compulsory.*
2) *Neat sketches must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary and mention it clearly.*
5) *Use of electronic pocket calculator is allowed.*
6) *Use of cell phone is prohibited in the examination hall.*

Q1) Write the correct option for the following multiple choice questions : **[10]**

i) The parallel axis theorem states that Moment of inertia about any axis is equal to : **[2]**

a) Centroidal Moment Plus Area

b) Centroidal Moment Plus mass

c) Centroidal Moment Plus Product of Area and square of distance

d) Centroidal Moment Minus Product of Area and square of distance

ii) A hinged (Pinned) support provides **[2]**

a) One Reaction force

b) Two reaction force and one moment

c) Two reaction force and No moment

d) One reaction force and one moment

iii) If the angle of repose is 30°, the coefficient of friction is : **[2]**

a) 0.25 b) 0.50

c) 0.57 d) 0.87

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iv) The normal (Centripetal) component of acceleration in curvilinear motion with velocity equal to 20 m/sec and having 20 m radius of curve is **[2]**

a) 20 m/sec^2 b) 40 m/sec^2

c) 400 m/sec^2 d) None of these

v) The work done by centripetal force in circular motion is **[2]**

a) Maximum b) Minimum

c) Positive d) Zero

Q2) **Solve Any Two of the following :**

a) Three coplanar forces act at a point as shown in Fig. 2a, determine the value of angle 'α' such that the resultant of the three forces will be vertical, Also find the magnitude of resultant. **[5]**

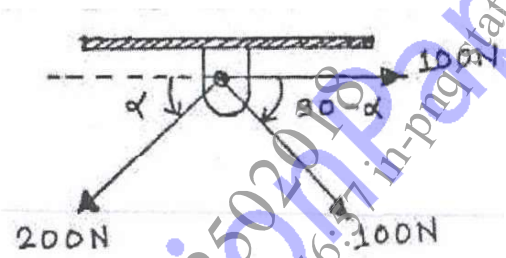


Fig 2a

b) Determine magnitude, direction and point of application of the resultant with respect to Point P for the force system shown in the Fig. 2b. **[5]**

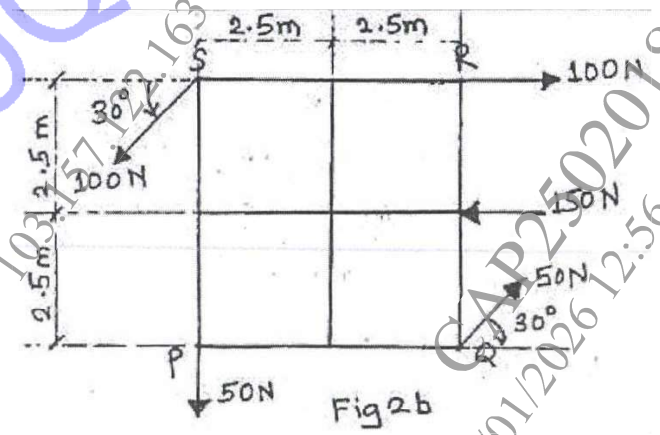


Fig 2b

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c) Determine the Moment of Inertia of I section as shown in the Fig. 2c about centriodal X-X and Y-Y axis. **[5]**

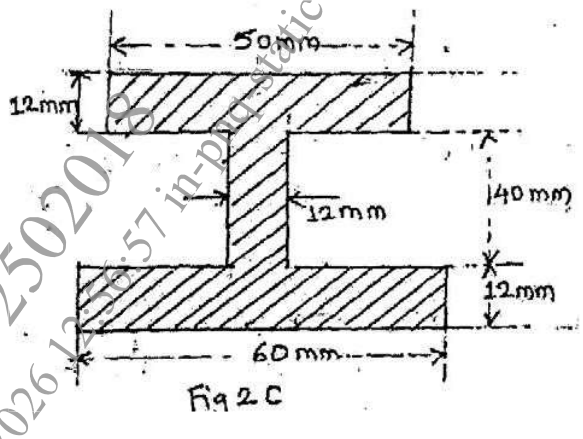


Fig 2C

d) Determine the X and Y coordinate of centroid of the shaded area as shown in Fig. 2d. **[5]**

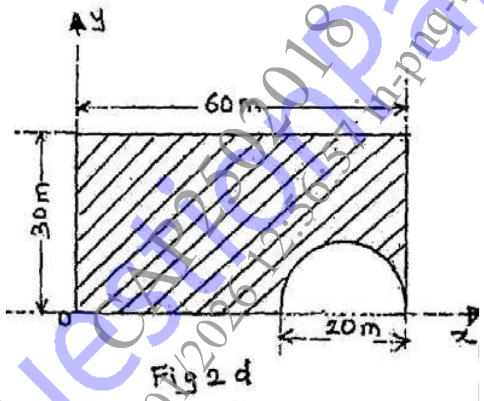


Fig 2 d

Q3) **Solve Any Two of the following :**

a) Calculate Tension in the string CB and reaction at Hinge A for rod if Force P is 1000 KN as shown in Fig. 3a. **[5]**

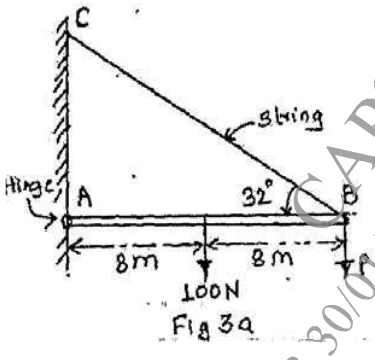


Fig 3a

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b) A sphere weighing 50 N is placed as Shown in Fig. 3b Find the reactions at the point of contacts. **[5]**

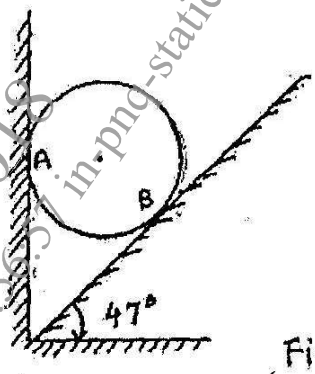


Fig 3b

c) Determine Support Reactions for beam loaded and supported as shown in the Fig. 3c. **[5]**

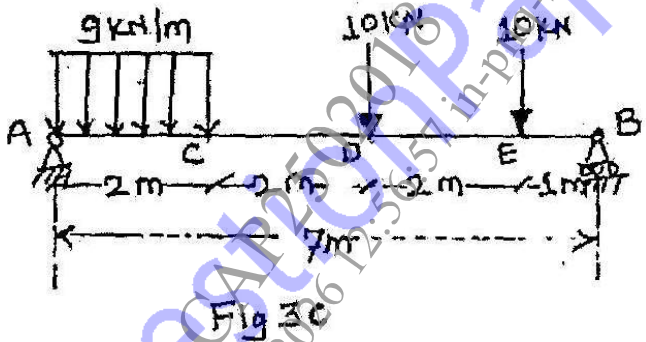


Fig 3c

d) A weight of 100 kg tied to the end of a cord of length 5 m, determine the magnitude of force F to pull the weight at an angle β is 30° as shown in Fig. 3d and also calculate tension in the cord. **[5]**

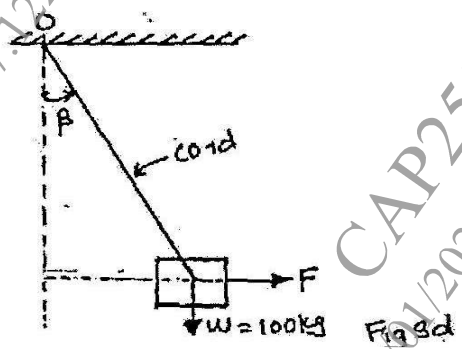


Fig 3d

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Q4) **Solve Any Two of the following :**

a) Calculate force in the members FE, BE, BC of truss shown in Fig. 4a. **[5]**

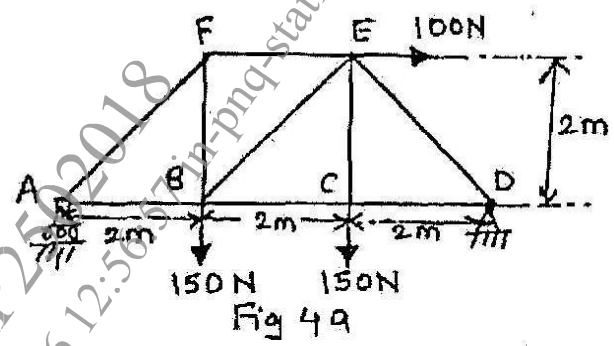


Fig 4a

b) Determine range of 'P' to maintain the equilibrium of the system as shown in Fig. 4b. The coefficient of friction between rope and pulley is 0.2 and between 100 N block and inclined surface is zero. **[5]**

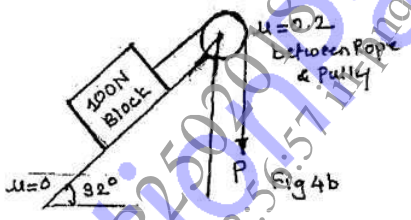


Fig 4b

c) A uniform ladder of length 5 m and weighing 25 N is placed against a smooth vertical wall with its lower end 5m away from the wall as show in Fig. 4c if the ladder is just to slip determine the coefficient of friction between the ladder and floor. Also calculate frictional force acting on the ladder at the point of contact between ladder and floor. **[5]**

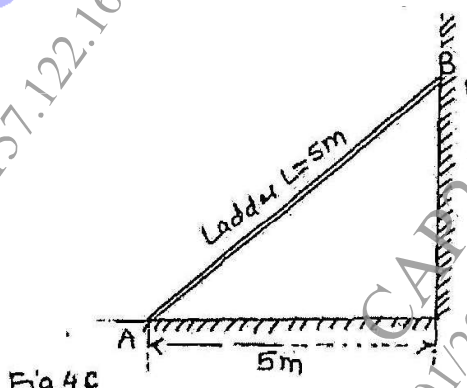


Fig 4c

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d) Analyze the Truss shown in Fig. 4d by method of joints. **[5]**

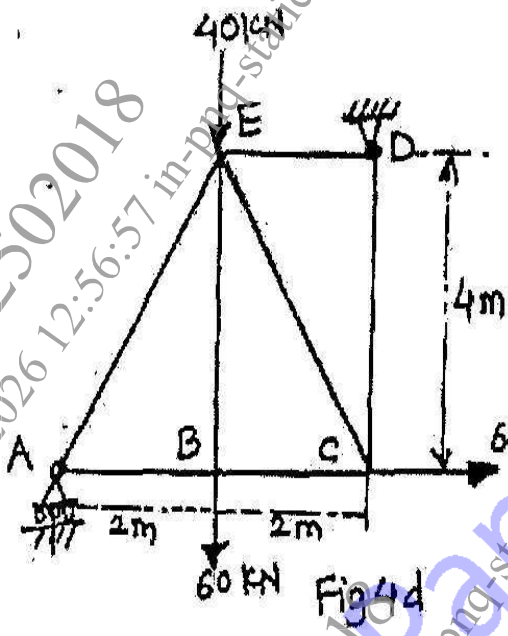


Fig 4d

Q5) **Solve Any Two of the following :**

a) A particle travels in a straight line such that for a short time t = 10 sec to 12 sec, it is motion described by v = (10/a) m/sec, where 'a' is in m / sec^2. If v = 15 m/sec when t = 10 sec determine the particle acceleration when t = 11 sec. **[5]**

b) A stone is dropped from top of tower 100 m high, at the same time another stone is thrown vertically upward from top of tower with velocity of 50 m/sec. When and where the two stones cross each other. **[5]**

c) An object is projected at an angle of 40° with horizontal, if horizontal range of object is 2.5 km, calculate velocity of projection and the maximum height attained by the object. **[5]**

d) A man drives automobile which starts from rest and increases the speed uniformly to 100 kmph in 10 sec on a curved road of radius 500 m determine the magnitude of total acceleration 5 sec after start. **[5]**

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Q6) **Solve Any Two of the following :**

a) An automobile is moving on a curve with radius 25 m, along a road at speed of 35 kmph, knowing that coefficient of friction between tyres and road surface is 0.3 determine acceleration in tangential direction produced when breaks are suddenly applied. **[5]**

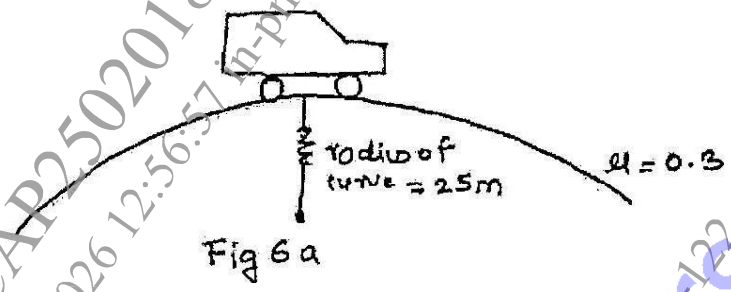


Fig 6 a

b) A car is pulled with constant acceleration of 0.5 m/sec using cable that makes angle of 10° with horizontal as shown in Fig. 6b if the force in the cable is 50 KN determine mass of the car by using Newton's 2nd law of motion. **[5]**

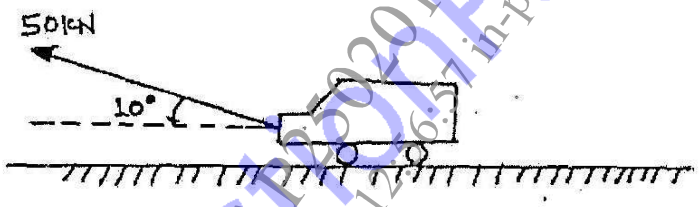


Fig 6 b

c) A 1 kg stone is dropped from height 'h' m and strikes the ground with velocity of 25m/sec, using work energy principle find kinetic energy of the stone as it strikes the ground and height 'h' from which it was dropped. **[5]**

d) Prove that the coefficient of restitution e = 1 for perfectly elastic collision and Solve following numerical in which 'A ball is dropped from unknown height on a horizontal floor from which it rebounds to height of 10 m, if e = 0.75 calculate the height from which the ball is dropped'? **[5]**

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