

Printed Pages : 7



EAG202

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 180214**

Roll No.

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**B. Tech.**

(SEM. II) THEORY EXAMINATION, 2014-15  
ENGINEERING MECHANICS

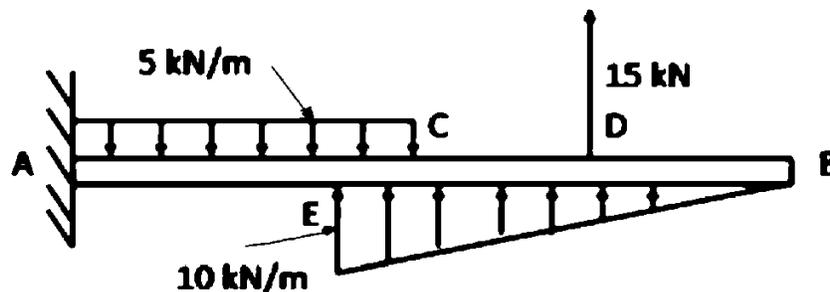
Time : 3 Hours]

[Total Marks : 100

- Note :**
- (i) Attempt all questions.
  - (ii) All questions carry equal marks.
  - (iii) Assume missing data suitably, if any.

1 Answer any two parts of the following.  $10 \times 2 = 20$ 

- (a) Draw the free body diagram and determine the reaction components of the loaded beam shown in figure. Take span  $AB = 2.5$  m,  $AC = 1.5$  m,  $CD = 0.5$  m and  $EB = 1.5$  m.

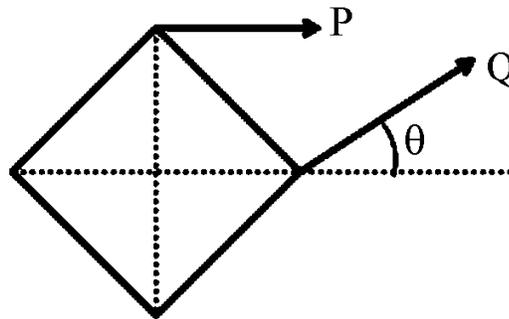


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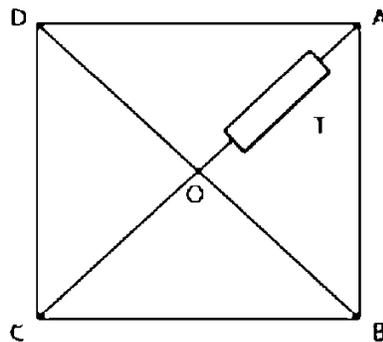
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- (b) Describe Varignon's theorem for a coplanar concurrent force system. Two forces  $P$  and  $Q$  are applied to the corners of a  $100 \text{ mm}^2$  square plate as shown in figure. Find forces  $P$ ,  $Q$  and angle  $\theta$  if resultant of two forces has a magnitude of  $140 \text{ N}$ , passing through the centroid of the plate and making an angle of  $30^\circ$  with positive  $x$ -axis.

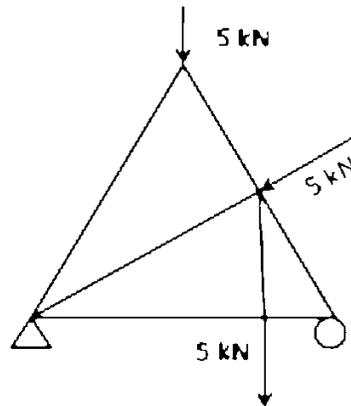


- (c) A tensile force of  $T = 800 \text{ N}$  is produced using a turnbuckle in one of the radial bars of regular square in which all joints are hinged, shown in figure. Determine the forces produced in all other bars.

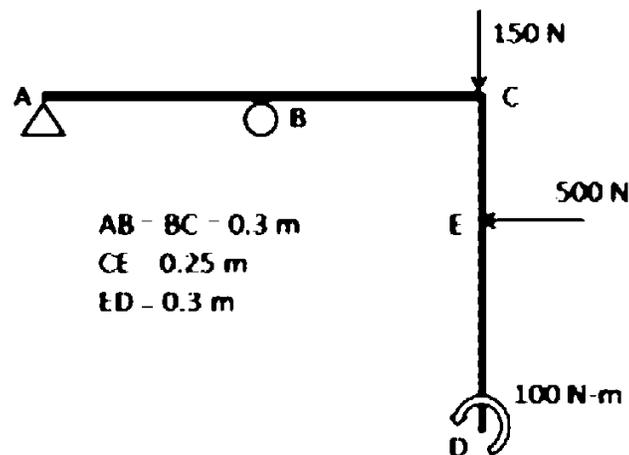


2 Answer any two parts of the following.  $10 \times 2 = 20$

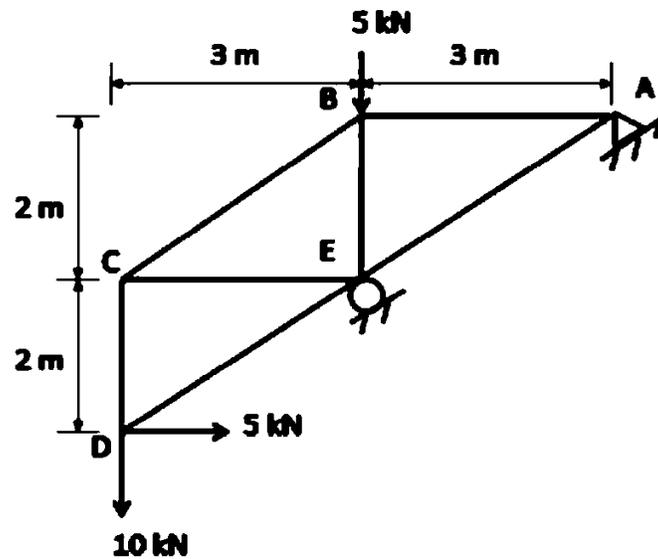
- (a) Determine forces in all the members of truss shown in figure. The size of the each arm of the triangular truss is 2 m.



- (b) An angle bracket is supported on a hinge and a roller support as shown in figure. Draw the free body diagram of the system and calculate the reactions at A and B.

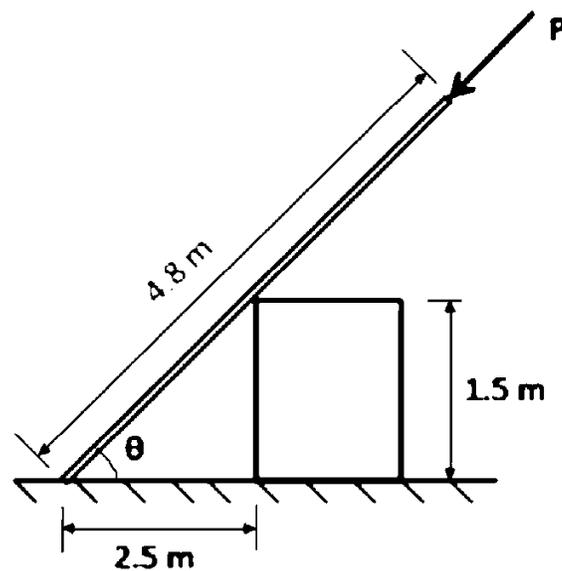


- (c) For the overhanging truss shown in figure, determine the forces in members BC, CE and DE.



- 3 Answer any two parts of the following.  $10 \times 2 = 20$

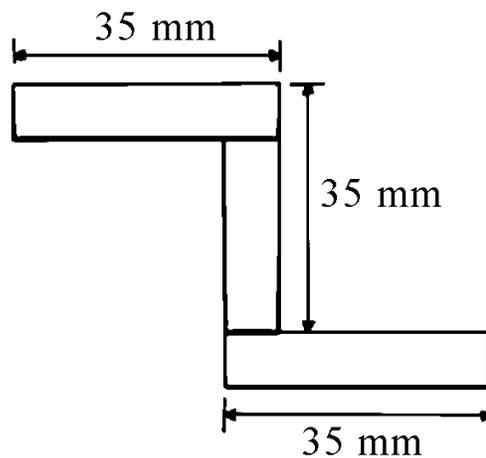
- (a) Determine the force  $P$  required to move the uniform 800 N plank from its position of rest as shown in figure, if the coefficient of friction at both contact location is 0.4.



- (b) A screw jack has square thread of mean diameter of 100 mm and a pitch of 12.5 mm. Determine the force that must be applied to the end of 500 mm lever (i) to raise (ii) to lower a load of 60 kN. Also, find the efficiency of the jack and state whether it is self locking.
- (c) Discuss the reversibility of machines and self locking machines. If a machine whose velocity ratio is 6 and an effort of 20 N is able to lift a load of 200 N. Determine (i) mechanical advantage of the machine, (ii) efficiency of the machine and (iii) effort lost in friction.

4 Answer any two parts of the following.  $10 \times 2 = 20$

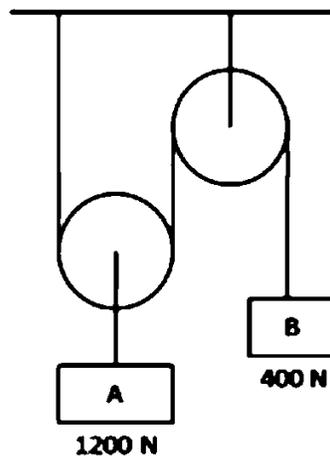
- (a) Find area moment of inertia of the z section about centroidal axes. The thickness of each section is 5 mm.



- (b) A car starts from rest on a curved road of 200 m radius and accelerates at a constant angular acceleration of  $0.5 \text{ m/s}^2$ . Determine the distance and time which the car will travel before the total acceleration attained by it becomes  $0.75 \text{ m/s}^2$ .
- (c) The acceleration of a particle is defined by the relation  $a = 21 - 12s^2$ , where  $a$  is acceleration in  $\text{m/s}^2$  and  $s$  is in meters. The particle starts with  $s = 0$ . Determine (i) velocity of the particle when  $s = 1.5 \text{ m}$ , (ii) the position where the velocity is again zero, and (iii) the position where the velocity is maximum.

5 Answer any two parts of the following.  **$10 \times 2 = 20$**

- (a) Determine the tension in the string and acceleration of the blocks A and B connected by a string as shown in figure. Assume pulleys are weightless and friction less.



- (b) Explain the law of work and energy and the law of conservation of energy. A wagon weighing 100 kN moving at 18 kmph strikes a pair of buffer springs. If the stiffness of each spring is 600 kN/m, determine the maximum compression of the spring before the wagon comes to rest.
- (c) Explain the following:
- (i) Momentum and principle of conservation of momentum
  - (ii) Principle of virtual work
  - (iii) D'Alembert's principle.
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