Seat No. | | | | | | |

AOI 1317(1)

Engineering Mechanics
(Old) (1060)

P. Pages: 5 **Max. Marks: 100**

Time: Three Hours

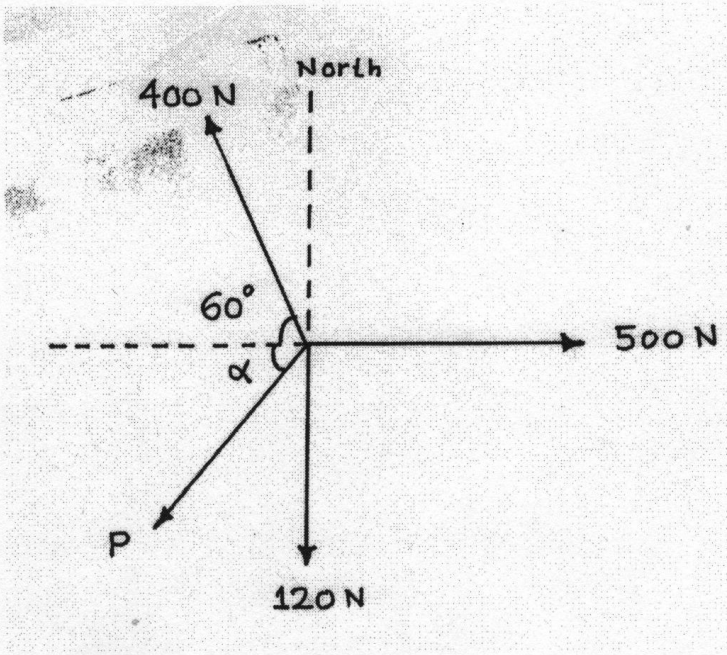
Instructions to Candidates:

1. Do not write anything on question paper except seat number.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Student should note, no supplement will be provided.
4. Figures to the right indicate full marks.
5. Solve any two questions from each unit.
6. Use of non-programmable electronic calculator is allowed.

Unit I

1 a. (i) State concept of FBD and give its examples. **4**
(ii) Explain principles of statics.

b. The resultant of given concurrent force system acts due North, away from the point of magnitude 300 N. Find the magnitude and direction of unknown force '**P**'. **6**



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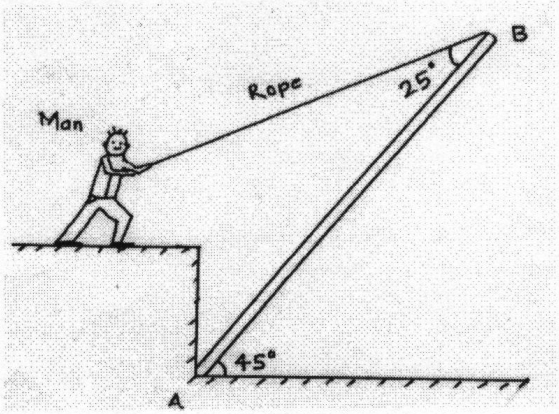
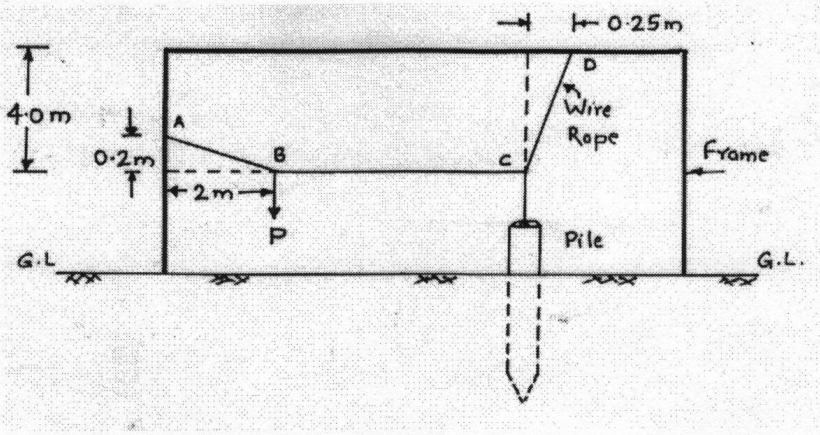
2 A man raises a 150 N joist of 4 m length by pulling on a rope attached to the joist as shown in figure. At this instant, find the tension in the rope and reaction at end A of joist. **10**



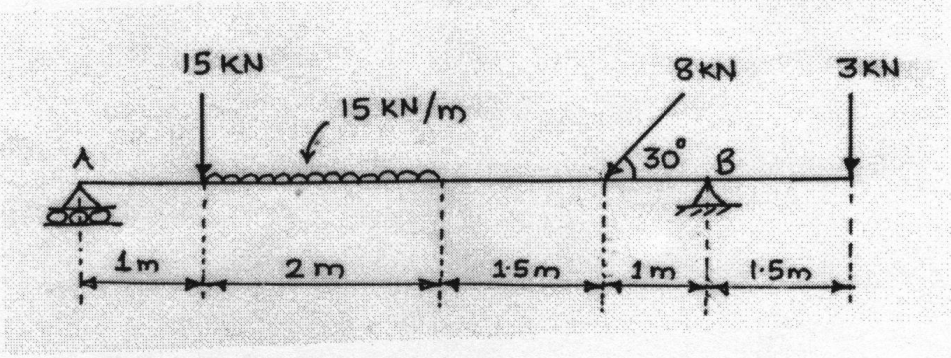
3 For extracting a pile driven in to the ground arrangement as shown in the figure is used. Calculate the maximum force **P** to be applied to extract the pile, whose pull out resistance is 200kN. **10**



Unit II

4 (a) Derive Perpendicular Axis Theorem. **4**

(b) Determine reactions at support for the following simply supported beam. **6**



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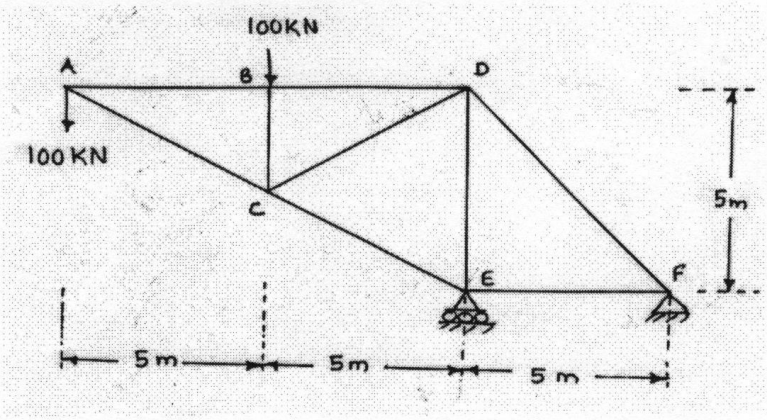
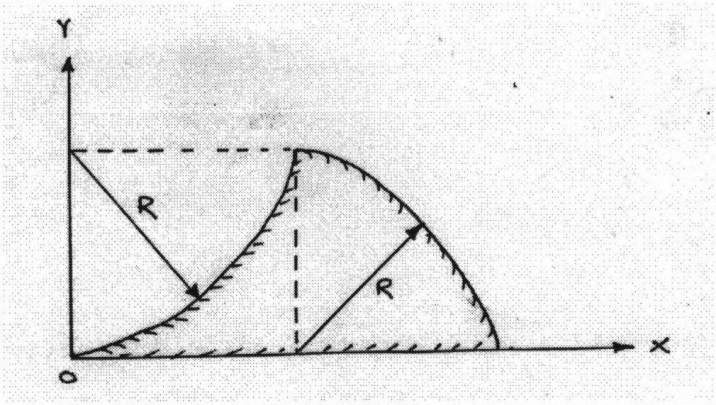
5 Determine forces in all the members of the truss. **10**



6 Determine the co-ordinates of centroid of the plane area as shown in figure with respect to given axes OX and OY, if the radius of semi circle 'R' =40 mm. **10**



Unit III

7 (a) Derive the basic equations of rectilinear motion with constant acceleration. **4**

(b) State and explain relative motion. **4**

(c) Differentiate between distance and displacement. **2**

8 A stone is projected vertically upward from the ground with a velocity of 40m/s. When the stone has reached the highest point of its travel, a second stone is thrown upward with a velocity of 30m/s from the same point. When and where the two stone will meet. **10**

9 Two rough planes inclined at 30° and 60° with respect to horizontal are placed back to back. The block of weight 80 N and 180 N are placed on the faces and connected by string running parallel to the planes and passes over frictionless **10**

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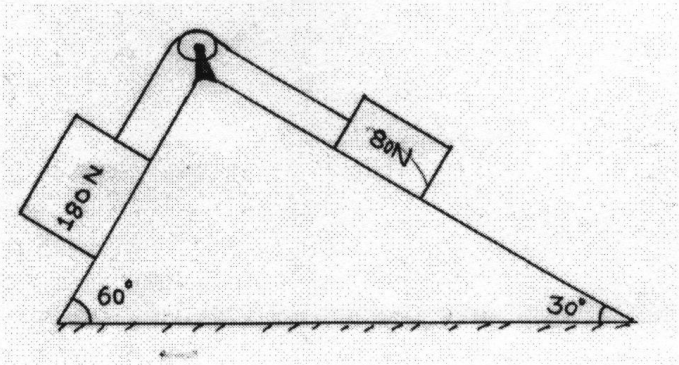
pulley. If $\mu = 1/3$, find resultant acceleration and tension in the string.



Unit IV

10 (a) Explain: **6**

(i) D'Alembert's Principle applied to the rigid bodies.

(ii) Work-Energy Principle applied to the rigid bodies.

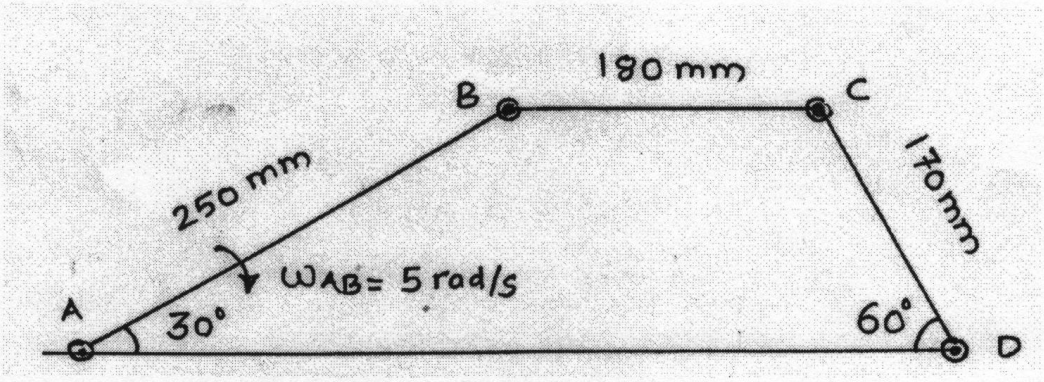
(b) Define: **4**

(i) Angular velocity and Angular acceleration.

(ii) Instantaneous Centre of Rotation.

11 A fly wheel having rotational moment of Inertia of 20kg.m^2 is rotating at a speed of 12 rad/sec at an instant of time. Fine the angular velocity of fly wheel after it has rotated through 2Π rad. A constant moment of 300 N.m is applied to the fly wheel. **10**

12 In a bar mechanism ABCD the bar AB rotates clockwise with angular velocity of 5 rad/sec. Find angular velocity of BC and CD, when bar AB makes an angle of 30° with respect to horizontal, bar CD makes an angle of 60° and the bar BC is horizontal. **10**



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Unit V

13 The horizontal range of particle in 350m and time of flight is 12 sec. **10**

Find (i) Velocity of projection
(ii) Angle of projection
(iii) Vertical height
(iv) Maximum horizontal range.

14 (a) Derive equations for Projectile motion of the particle for time of flight, horizontal range and maximum height. **6**

(b) Express velocity and acceleration in rectangular co-ordinate system. **4**

15 A particle moving in first quadrant along a curve of equation $x=0.64y^2$ has a law of motion $x= 4t^2$. Find displacement of particle from origin, the velocity of particle and its acceleration when **10**

(i) t=3 sec,
(ii) x=18m
(iii) y=10m.