Paper / Subject Code: 58502 / Engineering Mechanics.

F.E. (Sem-I) (All Branches) (CBSGS)
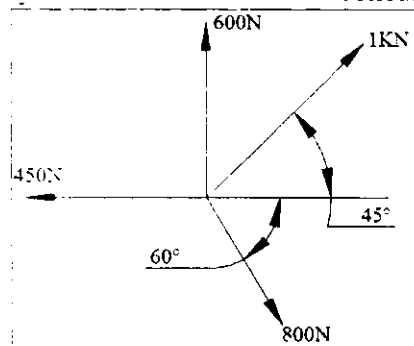
(3 Hours)   **Total Marks: 80**

N.B.1. Question No. 1 is Compulsory.
2. Attempt any 3 more questions from remaining five.
3. Assume suitable data if necessary, and mention the same clearly.
4. Figures to the right indicate full mark.
5. Take g= 9.81m/s²

Q1 a) Determine analytically the resultant of the four concurrent forces shown in fig.   [4]

b) A cylinder with *500 N* weight is resting in an unsymmetrical groove as shown in figure. Determine the reactions at the points of contacts.   [4]
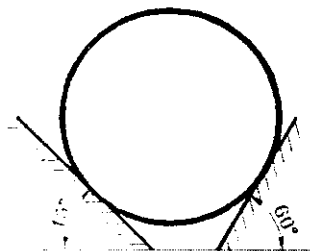
**c)** Explain Angle of friction and cone of friction.   [4]

d) The motion of a particle is defined by the relation $v = 6t^2-5t-2$ where v is in m/s and t is in sec. If the displacement x = 2m at t=0 determine the displacement and acceleration at t=2 sec.   [4]

e) A car travelling at a speed of 25m/s suddenly applies brakes and comes to stop after skidding 68 m. Determine
(i) Time need to stop the car
(ii) Coefficient of friction between the tyre and the road   [4]

Q2a) Find the tension in the cable at C and the reaction at the hinge A. Hanging weight is 20N.   [8]

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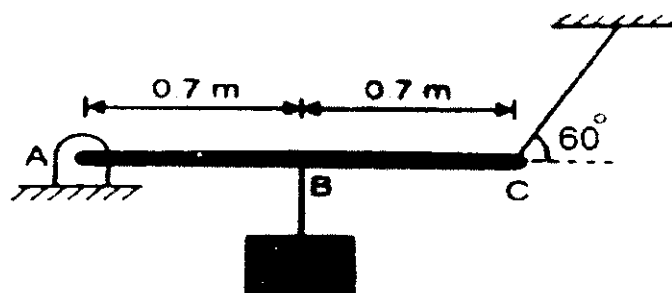
b) Determine the resultant of a given system of forces shown in figure. Find the point of application of the resultant on the horizontal bar AD (length=8m), with respect to point A. Inclined force 100KN is perpendicular to bar DE(length=4m). [6]
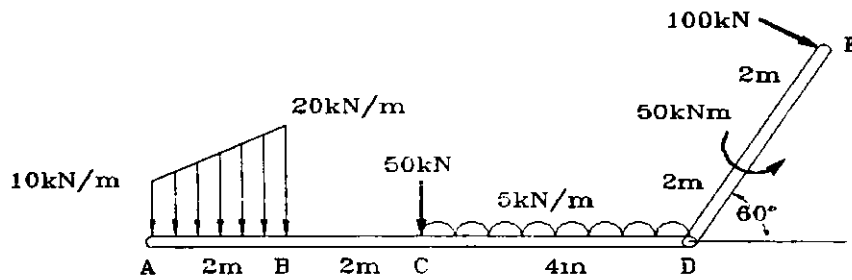

c) If a ball is thrown vertically down with a velocity of 10m/s from a height of 3m. find the maximum height it can reach after hitting the floor, if the coefficient of restitution is 0.5. [6]

Q3 a) A circular hole of radius 30mm, with centre 70mm away from y-axis is removed from the given thin plate. Determine centroid of the remaining portion of the plate. Plate is symmetrical about X-axis. [8]
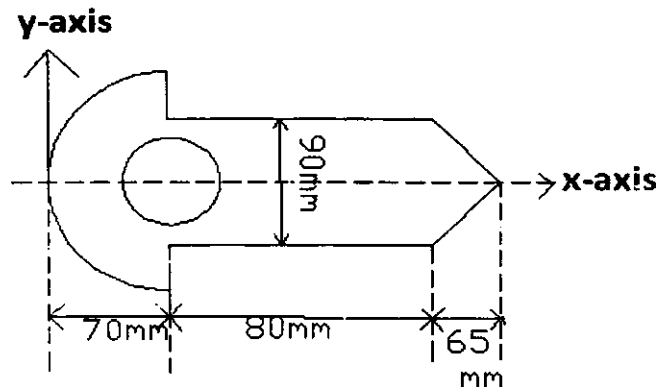

b) The 10kg mass slides from rest at A along the frictionless rod. Determine the speed at B. Stiffness of the spring K= 80 N/m. Unstretched length of spring is 0.3m. [6]
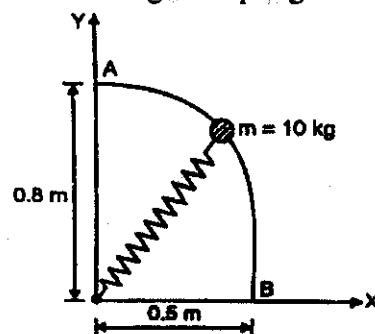
c) A force of magnitude 50N acts along AB where A(2,1,0) and B(3,3,-1). Find the moment of this force about origin. [6]

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Q4 a) A 10m long beam *ABCDE* is supported and loaded as shown in the figure. Determine the value of W so that the reactions at *A* and *D* are equal. [8]
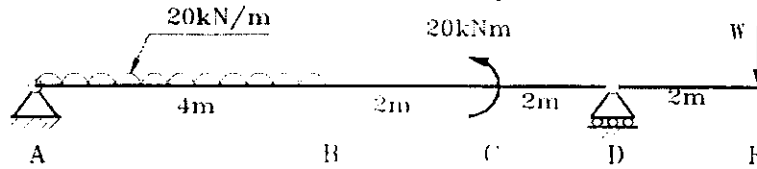
b) From the top of a tower 25m high (above ground) a ball is thrown up with a velocity of 50m/s at an angle of 30^0 with respect to horizontal. At what distance it would hit the ground from the foot of the tower. Also find the maximum height attained above ground and velocity with which it hits the ground.

[6]

c) A wheel of radius 0.5m rolls without slipping on a horizontal stationary surface to the right. Determine the velocities of the points P and Q when the velocity of centre of the wheel is 20m/s to the right. [6]
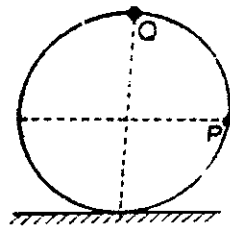

Q5a) For the truss shown in Fig, length of BD=DE=8m. Determine
(i)Force in member BC by method of sections only. [2]
(ii)Force in all other members by method of joints [6]
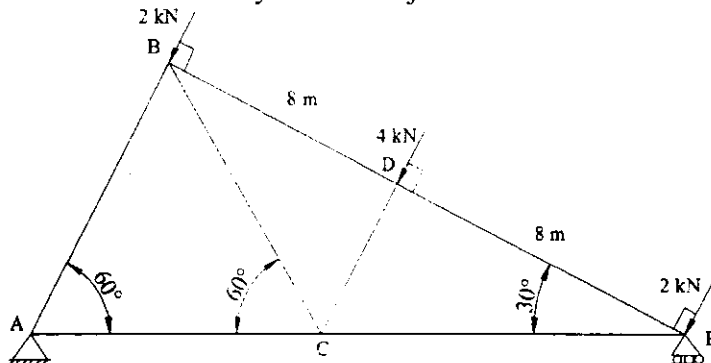
b) In a 100m Asian games event an athlete accelerates uniformly from the start to his maximum velocity in a distance of 4m and runs the remaining distance with that velocity. If the athlete completes the race in 10.4 sec, determine his initial acceleration and his maximum velocity. Also draw v-t graph and x-t graph for his motion. [6]

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c) In the slider crank mechanism shown in fig, the crank OA of length 200mm rotates anticlockwise with an angular velocity of 100rad/sec. The slider at B is constrained to move along a horizontal line. At the instant shown, find the angular velocity of connecting rod AB and velocity of slider at B. [6]
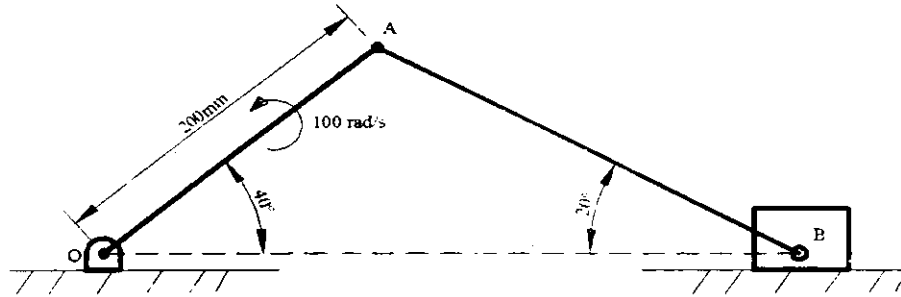
Q6 a) Two identical blocks A & B are connected by rod & rest against vertically & horizontal planes resp. as shown in fig. If sliding impends when $\theta=45°$, determine the coefficient of static friction (μ), assuming it to be same at both floor and wall. [8]
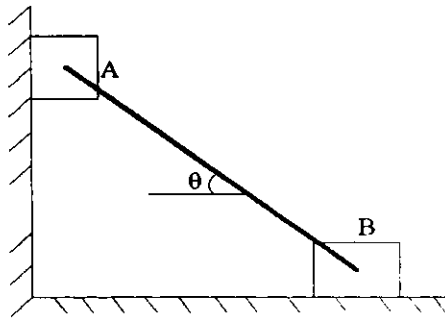
b) The tripod shown in fig supports a vertical load W=100KN. Find the compressive force acting on each member. All joints are ball and socket type. [6]
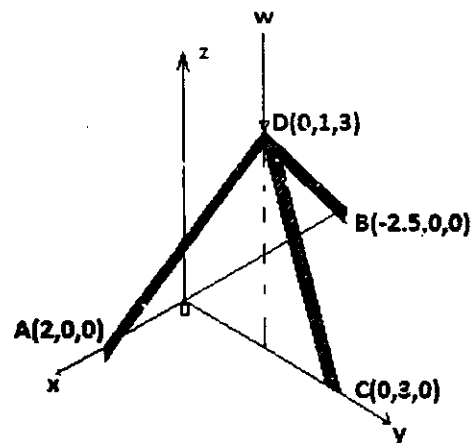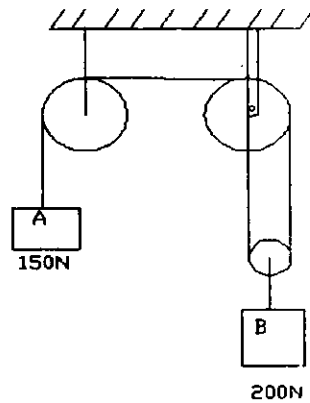
c) A particle moving along a curved path has a velocity of 3m/s and total acceleration 1.6m/s,^{2} when at point A. Acceleration at A is in the direction 20^0 to the tangent to the path at A. Determine the radius of curvature of the path at A.
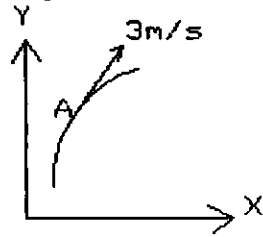
OR

c) Blocks A=150N and block B=200N are connected by inextensible string as shown in fig. Determine the accelerations of block A and block B. Pulleys are frictionless.   [6]

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