

(3 Hours)

(Total Marks : 80)

N.B.: 1. Question No. 1 is compulsory.

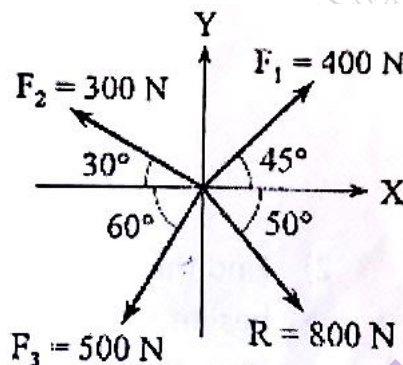
2. Attempt any 3 more questions from remaining five.

3. Assume suitable data if necessary, and mention the same clearly.

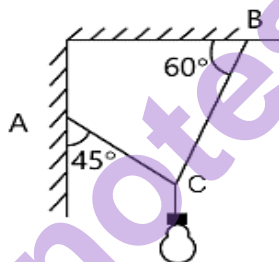
4. Figures to the right indicate full mark.

5. Take $g = 9.81 \text{ m/s}^2$.

1. a) Forces F_1, F_2, F_3 and F_4 are acting on a particles. Find the force F_4 so as to give the resultant of system of concurrent forces $R = 800 \text{ N}$ as shown in figure. [4]

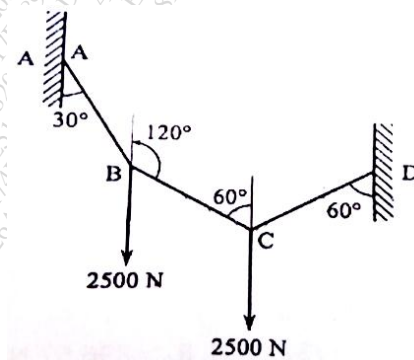


- b) A light fixture weighing 24 N is hung by a string as shown in figure. Determine the tensions in AC and BC of the string. [4]



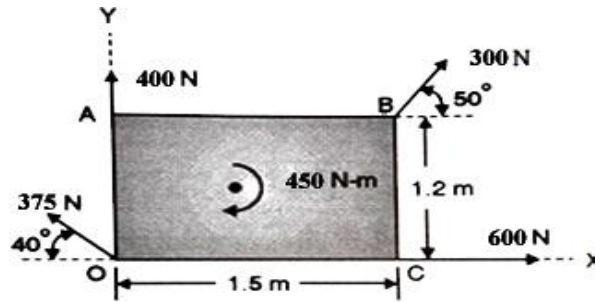
- c) State various laws of friction. [4]
 d) The motion of a particle is defined by the relation $\mathbf{v} = 4t^2 - 3t - 1$ where v is in m/s and t is in sec. If the displacement $x = -4 \text{ m}$ at $t = 0$, determine the displacement and acceleration at $t = 3 \text{ sec}$. [4]
 e) A car travelling at a speed of 60 m/s is braked and comes to rest in 10 seconds after the brakes are applied. Find the minimum coefficient of friction between the wheels and the road. [4]

2. a) Two equal loads of 2500 N are supported by the flexible string ABCD at point B and C. Find the tension in the portion AB, BC and CD of the string. [8]



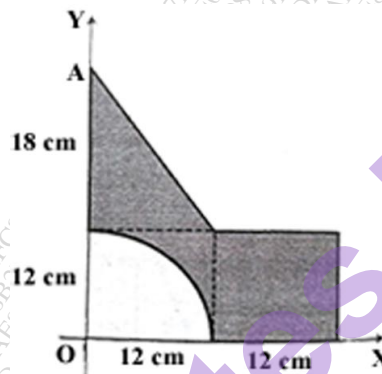
- b) Find the resultant of the force system on a body OABC as shown in figure. Also find the

points where the resultant will cut the X and Y axis.

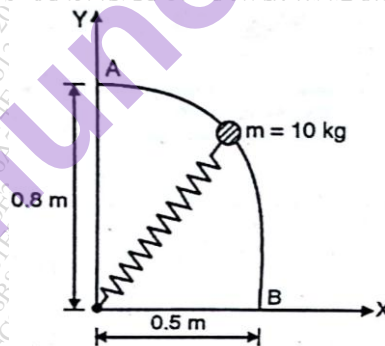


- c) If a ball is thrown vertically down with a velocity of 10m/s from a height of 3m. Find the maximum height it can reach after hitting the floor, if the coefficient of restitution is 0.7.

3. a) Determine the Centroid of the shaded area.

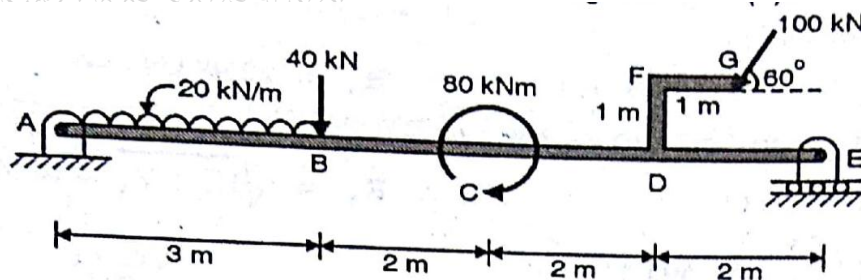


- b) The 10kg mass slides from rest at A along the frictionless rod. Determine the speed at B. Stiffness of the spring $K = 80 \text{ N/m}$. Unstretched length of spring is 0.3 m.



- c) A force $\mathbf{F} = 80\mathbf{i} + 50\mathbf{j} - 60\mathbf{k}$ passes through a point A (6,2,6). Compute its moment about origin.

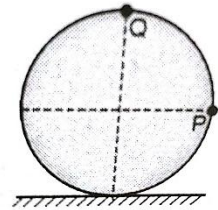
4. a) Find support reactions at A and E for the beam loaded as shown in fig.



- b) An aero plane flying horizontally with a velocity of 100m/s releases a packet which lands to the ground after 8 seconds. Find the velocity with which the packet lands.

Also find the height from which it was released.

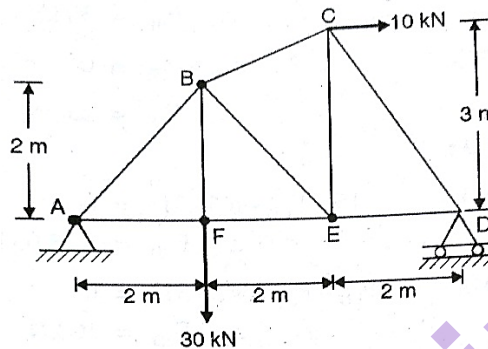
- c) A wheel of radius 0.75m rolls without slipping on a horizontal stationary surface to the right. Determine the velocities of the points P and Q when the velocity of centre of the wheel is 25 m/s to the right.



[6]

5. a) For the truss shown in Fig, determine :

- Forces in members AB, BF and EF by method of sections only.
- Forces in all other members by method of joints.



[3]

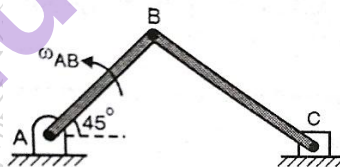
[5]

- b) A motorcycle starts from rest and accelerates at 2m/s^2 till velocity reaches 10m/s . Then it accelerates at 1m/s^2 till velocity reaches 15m/s and continues at uniform velocity of 15m/s till it covers a total distance of 300m . Find the total time taken to cover this distance. Draw the v-t and x-t graph for this motion.

[6]

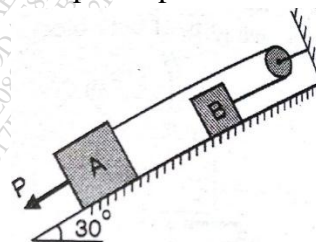
- c) In the slider crank mechanism shown in fig, the crank AB of length 10 cm rotates anti-clockwise with an angular velocity of 6 rad/sec. The connecting rod BC is 45 cm in length and the slider at C is constrained to move along a horizontal line. At the instant shown, find the angular velocity of rod BC and velocity of slider at C.

[6]



6. a) Determine the force P to cause motion to impend. Take masses of blocks A and B as 8kg and 4kg respectively. Coefficient of static friction between sliding surfaces is 0.2. Assume smooth pulley. The force P and the rope are parallel to the inclined plane.

[8]



- b) Explain conditions for equilibrium for different system of forces in space.

[4]

- c) A car starts from rest and moves along a circular path having a radius of 25m. Its speed increases at a uniform rate of 0.5m/s^2 . Find the time from the start and distance travelled

when its resultant acceleration becomes 1.5 m/s^2 .

- d) Blocks $P_1 = 4\text{N}$ and $P_2 = 8\text{N}$ are connected by inextensible string. Find acceleration of the blocks. The coefficient of kinetic friction is 0.15 , pulley is frictionless. [4]

