F.E. (Sem-I) (All Branches) (CBSGS)

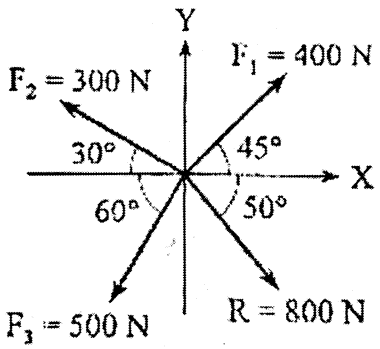
Paper / Subject Code: 58502 / Engineering Mechanics.

Date - 19/11/19

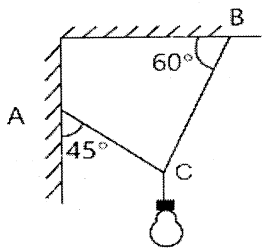
(3 Hours) **(Total Marks : 80)**

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**.

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 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]**

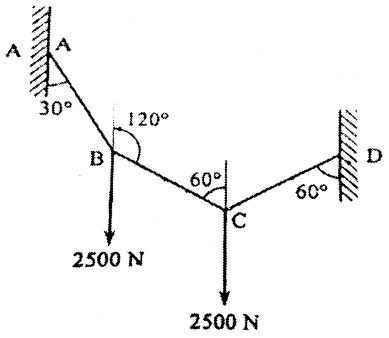


c) State various laws of friction. **[4]**

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 = - 4m at t = 0, determine the displacement and acceleration at t = 3 sec. **[4]**

e) A car travelling at a speed of 60m/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]**

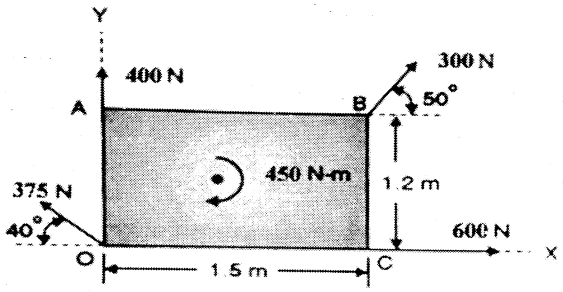
2. a) Two equal loads of 2500 N are supported by the flexible string ABCD at point B and C. Find the tension in the portion AB, BC and CD of the string. **[8]**



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

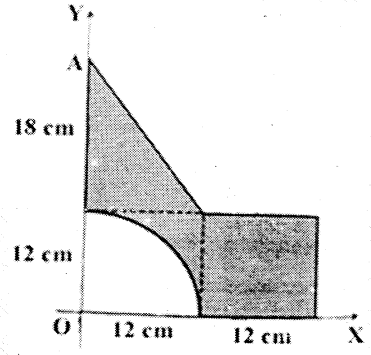
2FC8B81F0F26A74E5132017E089F3B9A

points where the resultant will cut the X and Y axis. [6]

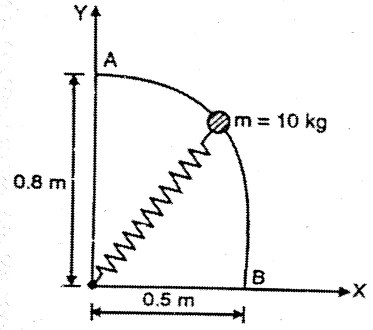


c) If a ball is thrown vertically down with a velocity of 10m/s from a height of 3m. Find the maximum height it can reach after hitting the floor, if the coefficient of restitution is 0.7. [6]

3. a) Determine the Centroid of the shaded area. [8]

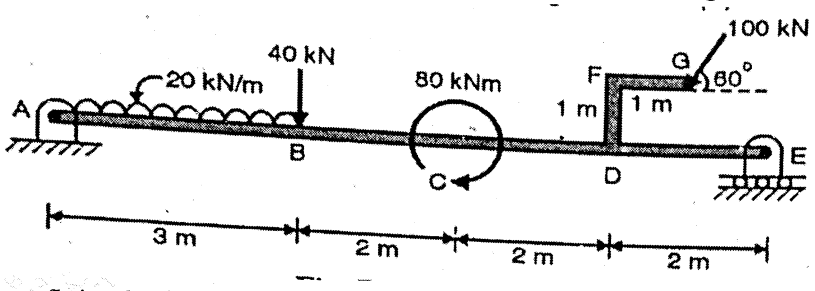


b) The 10kg mass slides from rest at A along the frictionless rod. Determine the speed at B. Stiffness of the spring K = 80 N/m. Unstretched length of spring is 0.3 m. [6]



c) A force **F = 80i + 50j – 60k** passes through a pont A (6,2,6). Compute its moment about origin. [6]

4. a) Find support reactions at A and E for the beam loaded as shown in fig. [8]

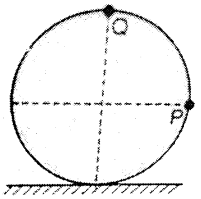


b) An aero plane flying horizontally with a velocity of 100m/s releases a packet which lands to the ground after 8 seconds. Find the velocity with which the packet lands. [6]

2FC8B81F0F26A74E5132017E089F3B9A

Also find the height from which it was released.

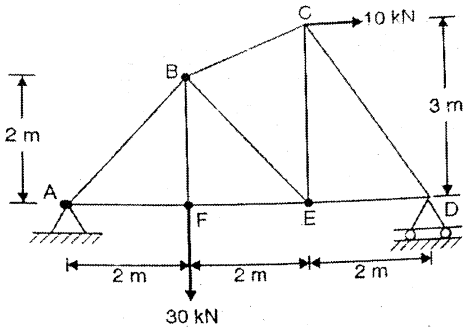
c) A wheel of radius 0.75m rolls without slipping on a horizontal stationary surface to the right. Determine the velocities of the points P and Q when the velocity of centre of the wheel is 25 m/s to the right. **[6]**



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

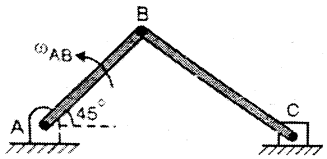
i) Forces in members AB, BF and EF by method of sections only. **[3]**

ii) Forces in all other members by method of joints. **[5]**

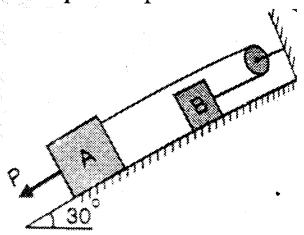


b) A motorcycle starts from rest and accelerates at $2m/s^2$ till velocity reaches 10m/s. Then it accelerates at $1m/s^2$ till velocity reaches 15m/s and continues at uniform velocity of 15m/s till it covers a total distance of 300m. Find the total time taken to cover this distance. Draw the v-t and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



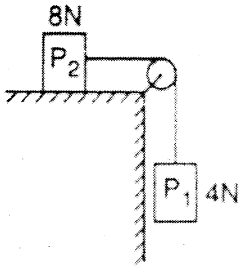
b) Explain conditions for equilibrium for different system of forces in space. **[4]**

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 $0.5\ m/s^2$. Find the time from the start and distance travelled

2FC8B81F0F26A74E5132017E089F3B9A

when its resultant acceleration becomes 1.5 m/s^2. **[4]**

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



****

2FC8B81F0F26A74E5132017E089F3B9A