Code No: R13110 **R13** SET - 1

**I B. Tech I Semester Supplementary Examinations, July/August - 2021**

**ENGINEERING MECHANICS**

(Com. to CE,ME,CSE,PCE,IT,Chem E, Aero E, AME, Min E, PE, Metal E, Textile Engg)

Time: 3 hours Max. Marks: 70

Note: 1. Question paper consists of two parts (**Part-A** and **Part-B)**
2. Answering **ALL** the questions in **Part-A** is Compulsory
3. Answer any **THREE** Questions from **Part-B**

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## PART –A

1. a) Define the terms "coefficient of friction" and "angle of friction". (4M)

   b) Write a short note on free body diagram with the help of an example. (4M)

   c) Find the centroid of a rectangle by graphical method. (4M)

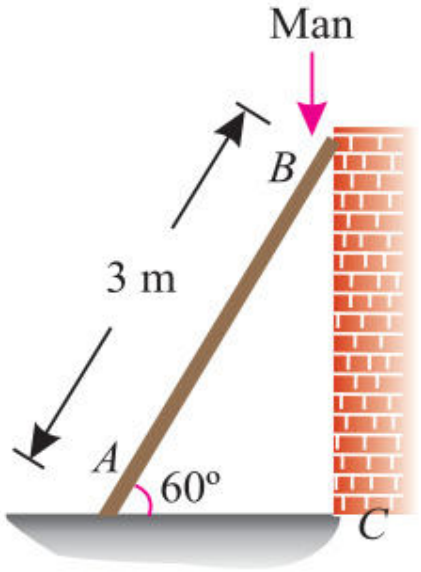
   d) Define mass moment of inertia of a body about an axis. (4M)

   e) Write the equations of plane motion. Give examples of plane motion. (3M)

   f) Give examples of rectilinear and curvilinear motions. (3M)

## PART -B

2. a) A uniform ladder 3 m long weighs 200 N. It is placed against a wall making an angle of 60° with the floor as shown in figure. The coefficient of friction between the wall and the ladder is 0.25 and that between the floor and ladder is 0.35. The ladder, in addition to its own weight, has to support a man of 1000 N at its top at B. Calculate: (10M)
   (i) The horizontal force P to be applied to ladder at the floor level to prevent slipping. (ii) If the force P is not applied, what should be the minimum inclination of the ladder with the horizontal, so that there is no slipping of it with the man at its top.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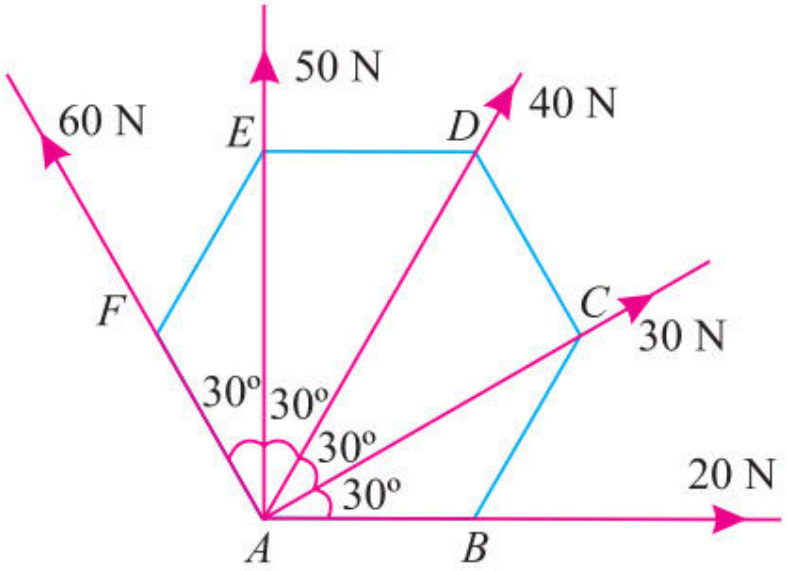
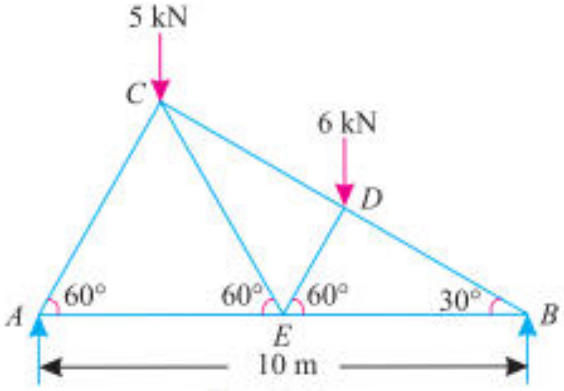
b) Find the magnitude and direction of the resultant of system of forces shown in the figure. (6M)

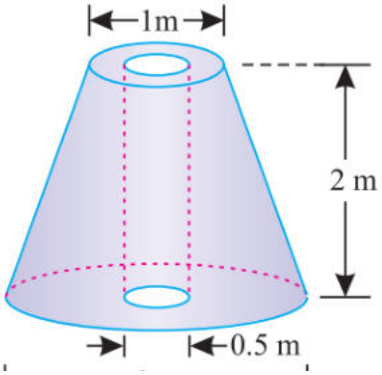



3. a) State and prove Lami's theorem. (8M)

b) A truss of span 10 meters is loaded as shown in Figure. Find the forces in all the members of the truss. (8M)




4. a) A frustum of a solid right circular cone has an axial hole of 50 cm diameter as shown in figure. Determine the centre of gravity of the body. (8M)



b) Derive centriod for triangle. (8M)

5. a) State and prove Parallel axis theorem. (8M)

b) Determine the area moment of inertia about y- axis. (8M)

6. a) A particle of mass *m* falls vertically from rest in a medium whose resistance is proportional to the velocity. Determine the velocity and the distance travelled by the particle after a time *t*. (8M)

b) A car enters a curved portion of the road of radius 200 m travelling at a constant speed of 35 kmph. Determine the components of velocity and acceleration of the car in the x and y directions 10 seconds after it has entered the curved portion of the road. Also express the velocity and the acceleration of the car in terms of normal and tangential components. (8M)

7. a) A block of mass 5 kg resting on a $30^0$ inclined plane is released. The block after travelling a distance of 0.5 m along the inclined plane hits a spring of stiffness 15 N/cm. Find the maximum compression of spring. Assume the coefficient of friction between the block and the inclined plane is 0.2. (8M)

b) A rotor of weight 400 lb and radius of gyration 5 in is mounted on a horizontal shaft and set in rotation by a falling weight of $W = 400$ lb as shown in the figure. If the system is released from rest, find the velocity of the block after it has fallen through a distance of 10 ft. (8M)