Code No: RA13210 **R13** **RA**

**I B. Tech II Semester Supplementary Examinations, April/May - 2018**
**ENGINEERING MECHANICS**
(Com. to CE, ME)

Time: 3 hours Max. Marks: 70

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

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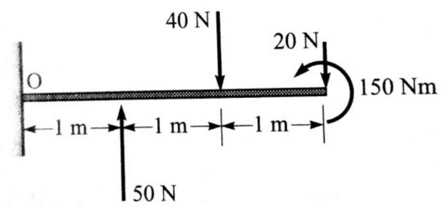
**PART –A**

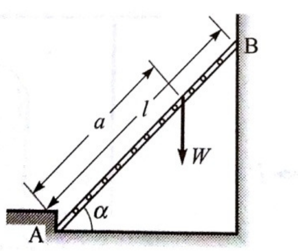
1. a) State the laws of friction. (3M)
   b) Define the free body diagram of a body in an equilibrium system, and explain its importance. (4M)
   c) State Pappus theorems. Give its applications. (4M)
   d) Differentiate between polar moment of inertia and product of inertia. (4M)
   e) Distinguish between different types of rigid body motions. (4M)
   f) Explain the work energy equation for translation. (3M)

**PART -B**

2. a) Define moment of force about a point and show that the algebraic sum of the moments of two coplanar forces about a point is equal to the moment of their resultant about that point. (7M)
   b) The three parallel forces and a couple act on a cantilever beam as shown in the figure. Determine the resultant of the three forces and the couple. (9M)




3. a) Three concurrent forces have magnitudes of 80 N, 120 N and 100 N, respectively. Determine the angles among them that will produce a state of equilibrium. (7M)
   b) On a ladder supported at A and B, as shown in the figure, a vertical load W can have any position as defined by the distance *a* from the bottom. Neglecting friction, determine the magnitude of the reaction at B. Neglect the weight of the ladder. (9M)




4. a) Determine the centroid of the quarter-circle whose radius is R. (8M)
   b) Discuss the procedure to find the location of the centre of gravity of a composite body. (8M)
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5. a) Find moment of inertia values of circle of radius 25mm about its centroidal XX and YY axes. (8M)

   b) Find the moment of inertia of an aluminum pipe of 150mm outer diameter and 120mm inner diameter and 3.5m height about its longitudinal axis YY.(density, $\rho$=2560 kg/m$^3$). (8M)

6. a) A train weighing 4500 kN has a frictional resistance of 5 N/kN of weight. Determine the steady pull that the locomotive must exert if the speed of the train is to be increased from 15 kmph to 60 kmph within a period of 2 minutes. (8M)

   b) A particle undergoing central force motion has a tangential velocity of 20m/s while at a distance of 300m from the central point. Using the fact that the areal velocity of the particle must be constant, find its tangential velocity when it is 400m away from central point. (8M)

7. A 20 kg block starting from rest slides up a $30^0$ inclined plane under the action of a 175 N force directed along the inclined plane. The coefficient of kinetic friction between the block and the plane is 0.2. Determine the (i) speed of the block after it slides 4.5 m and (ii) the distance travelled by the block when its speed becomes 4.5 m/s. (16M)