1128
B.E. (Mechanical Engineering)
First Semester
ME-101: Engineering Mechanics – I

Time allowed: 3 Hours   Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. I (Part-A) which is compulsory and selecting two questions each from Part B-C. Assume any missing data suitably. Supplement your answer with neat and labeled sketch wherever required.*

x-x-x

Part-A

1 (i) Describe the methodology used to formulate and solve statics problems.   (2)

   (ii) Differentiate between *translational* equilibrium, *rotational* equilibrium and *complete* equilibrium by giving real life examples.   (2)

   (iii) What is meant by line of action of a force? Give examples.   (2)

   (iv) Draw and explain the concept of rolling resistance and its application.   (2)

   (v) Differentiate between free-body-diagram versus active-force-diagram by giving an example. (2)

Part-B

2   Three couples are formed by the three pairs of equal and opposite forces as drawn in next   (10)
   figure. Determine the resultant **M** of the three couples.
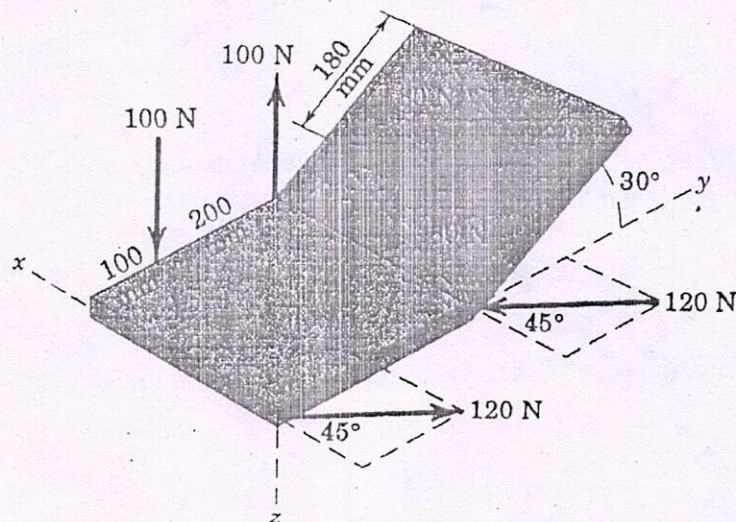
3   Three identical steel balls, each of mass *m*, are placed in the cylindrical ring which rests on   (10)
       a horizontal surface and whose height is slightly greater than the radius of the balls. The
       diameter of the ring is such that the balls are virtually touching one another. A fourth
       identical ball is then placed on top of the three balls. Determine the force *P* exerted by the
       ring on each of the three lower balls.

4   For a given force P on the handle of the toggle clamp the clamping force C increases to   (10)
very large values as the angle θ decreases. For $P = 30$ lb determine the relationship
between C and θ and plot it as a function of θ from $\theta = 2°$ to $\theta = 30°$. Assume that the shaft
slides freely in its guide.
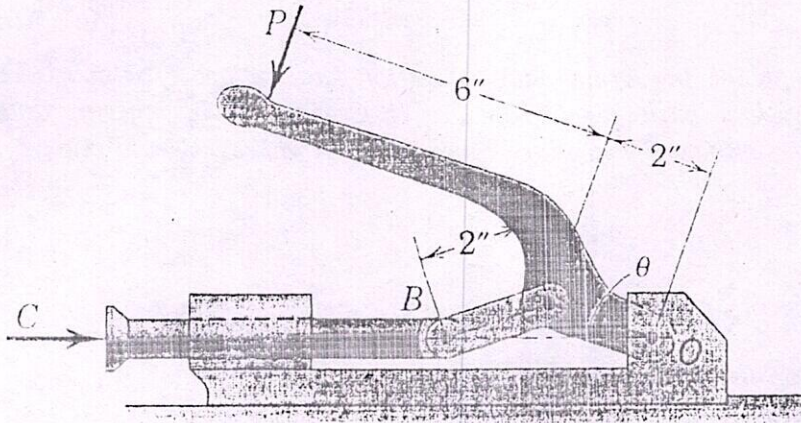
PART-C

5   Determine the tension in each segment of the cable shown in next figure.   (10)
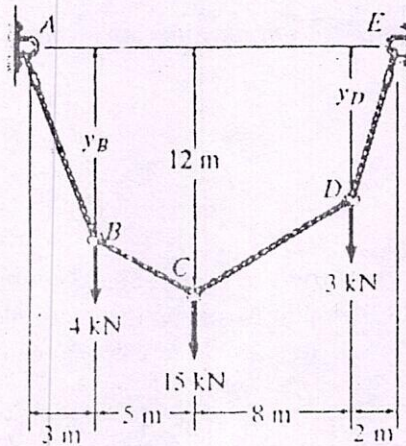
6   Differentiate between following three types of friction problems by giving examples: (10)
     (i) friction problems involving no apparent impending motion
     (ii) friction problems involving impending motion at all point of contacts
     (iii) friction problems involving impending motion at some point of contacts

7   Determine the centroid of the shaded area shown in next figure.   (10)