1ST SEM./ COMMON/ 2024(W)NEW

TH4(b) Engineering Mechanics

Full Marks: 70 **Time- 3 Hrs**

Answer any four Questions including Q No.1& 2.
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

   a. Define Force. Write its SI unit.

   b. Differentiate between scalar quantity and vector quantity.

   c. Illustrate Free Body Diagram.

   d. Differentiate between hinged support and roller support.

   e. Define angle of friction. Write the relation between 'angle of friction' and 'co-efficient of friction'.

   f. Differentiate between static and dynamic friction.

   g. Define rigid body and flexible body.

   h. Define Simple lifting machine.

   i. State law of Polygon of forces.

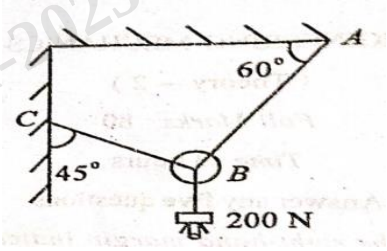
   j. Define Centroid.

2. Answer **Any Six** Questions 5 X6

   a. The following forces act at a point
      i) 40N inclined at 40° towards north of east
      ii) 30N towards north-west
      iii)15N towards south
      Calculate the magnitude and direction of the resultant force.

   b. i) Define centre of gravity. 2+3
      ii) Calculate the centre of gravity of a cuboid of length 15m, width 8m and height 4m.

   c. An electric light fixture of weight 200N is Supported as shown in the figure. Determine the tensile forces in the wires BA & BC.



   d. Explain Laws of friction.

   e. Derive the relation between mechanical advantage, velocity ratio and efficiency of a Simple lifting machine.

f. Find out the angle between two equal forces of magnitude 'P' when the resultant of the two forces is also equal to the forces and has a magnitude 'P'.

g A single purchase crab winch has 300mm long handle and 120mm diameter drum. Number of teeth on the pinion is 25 and that on wheel is 130. If an effort of 20N lifts a load of 300N then calculate the MA, VR and efficiency of the crab winch.

Answer **Any Two** Questions

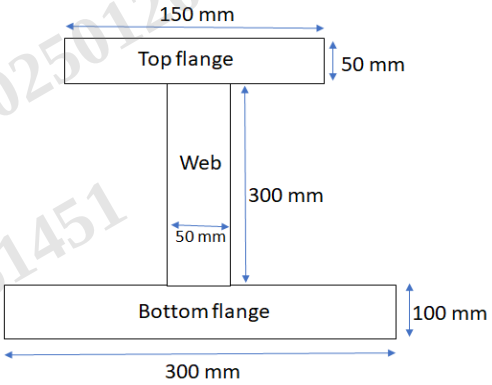
3. A simply supported beam having a length of 10m has UDL of 25KN/m throughout its length. Point loads of 80KN and 120KN are acting at 3m and 8m from the left support. Calculate the support reactions. 10

4. In a lifting machine, a load of 15KN is raised by an effort of 350N. On the same machine a load of 35KN is raised by an effort of 600N. Find the law of machine. Also calculate the effort required to lift a load of 50KN. 10

5. An I-section has the following dimensions in mm units 10

Bottom flange = 300 x 100
Top flange = 150 x 50
Web = 300 x 50

Determine the Centroid of the given section



6. a) Define Limiting friction. 2+8 =10

b) A body of weight 600 N is placed on a plane inclined at an angle 30°. It is supported by an effort "P" parallel to the plane as shown in figure. Determine the minimum & maximum values of "P" for which equilibrium can exist.
Take the co-efficient of friction as 0.35.