Paper Code: RME-101	**Roll No.**									

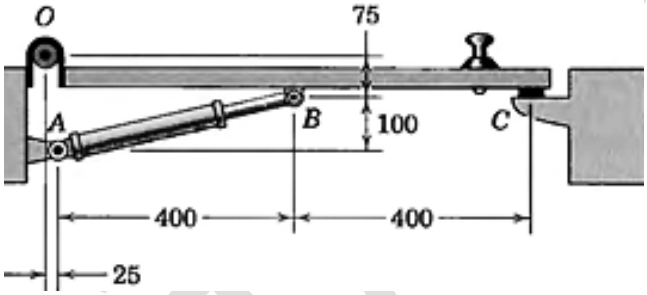
B.Tech.
FIRST SEMESTER EXAMINATION, 2016-17
ELEMENTS OF MECHANICAL ENGINEERING

[Time: 3 Hours] [Max. Marks: 70]

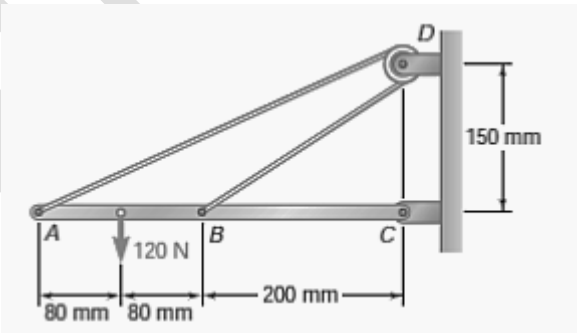
Note: Attempt all questions. Marks are indicated against each question. Assume any missing data suitably.

1. Answer any two parts of the following:- **[7x2=14]**

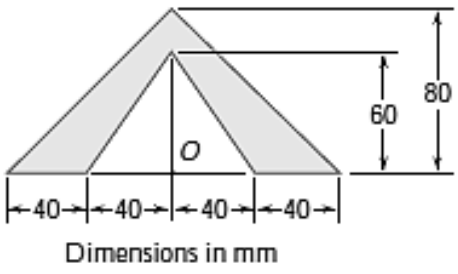
(a) The force exerted by the plunger of the cylinder AB on the door is 40N directed along the line AB, and this force tends to close the door closed as shown. Calculate the moment of this force about the hinge O. What force F normal to the plane of the door at the door stop at C exerts on the door so that the combined moment about O of the two forces is zero.



(b) Neglecting friction and the radius of the pulley determine (a) the tension in the cable ADB and (b) the reaction at C.

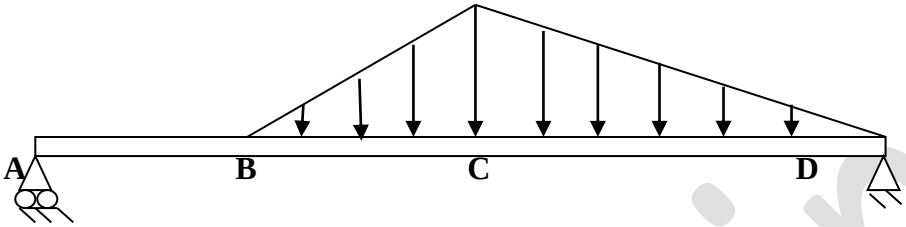


(c) Determine the polar moment of inertia of the area shown with respect to (a) point O and (b) centroid of the area.

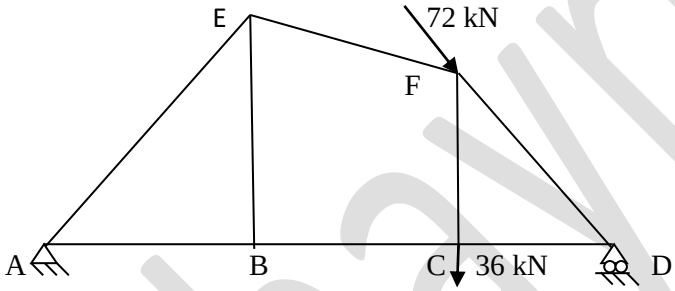


2. Attempt any Attempt any two parts of the following: - **[7x2=14]**

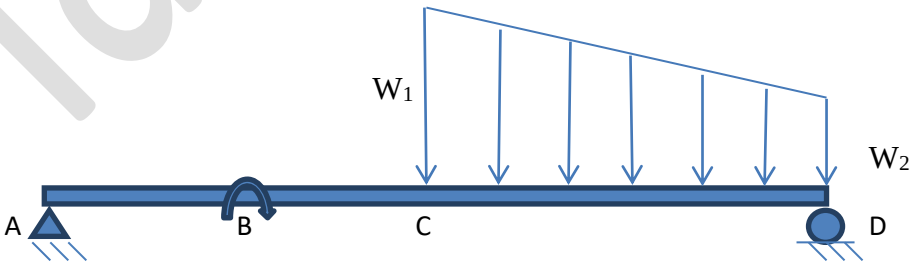
(a) For the beam shown in figure find the equations for shear force and bending moment after taking origin at A **(express all the equations as a polynomial of the form $a_0x^n+a_1x^{n-1}+\ldots..a_{n-1}x+a_n$ and encircle/underline the equations).** Draw SFD and BMD for the beam. Take AB=2m, BC=2m, CD=4m. The maximum intensity at C is 10 kN/m.



(b) Discuss various types of truss.For the truss shown in figure find the forces in all members. Take the length AB=BC= CF=3m, CD=2 m, and BE=4m. Also find the force in member in all the members of the truss.



(c) For the beam shown below, determine the equations for shear force and bending moment after taking origin at point A **(express all the equations as a polynomial of the form $a_0x^n+a_1x^{n-1}+\ldots..a_{n-1}x+a_n$ and encircle/underline the equations).** Also draw the shear force and bending moment diagram for the beam. The value of clockwise couple at B is 40kNm.Take the value of intensity of forces as W_1 =10 kN/m and W_2 =6 kN/m. The distances are AB=BC=2m and CD=4m.



3. Attempt any Attempt any two parts of the following: - **[7x2=14]**

(a) Draw tensile test diagram for mild steel and highlight salient points. As the point of fracture is below ultimate point, does it indicate that the object fails at lower stress? What is necking and why does it take place?

(b) A simply supported beam 6 m long carries a concentrated load P at 2 m from left end. The beam cross section is 100mm by 300mm. Find the maximum value of P such that flexure stress does not exceed 9 MPa. Recalculate the value of P if the weight of the beam is twice the externally applied load (2P).

(c) Attempt part (i) and any two parts of the following:
(i) Compare Elasticity with Creep and Malleability with Ductility.
(ii) Write a note on Brasses and Bronzes.
(iii) Write a note on types of Carbon Steels and their uses.
(iv) Write a note on importance and classification of Engineering Materials

4. Attempt any Attempt any two parts of the following: - **[7x2=14]**

(a) Air is compressed from 1 bar and 40ºC to 10 bar isothermally in a flow process. Assume the air is flowing in the pipe with constant velocity. Determine the work transfer in the process. Take R=287 KJ/kg. Explainthe concept of continuum and Zeroth law of thermodynamics.

(b) Air flows steadily at the rate of 0.5kg/s through an air compressor entering at 7 m/s velocity, 100 kPA pressure and 0.95 m^3/kgvolume and leaving at 5 m/s, 700kPA and 0.19 m^3/kg. The internal energy of the air leaving is 90kJ/kg greater than that of the entering leaving is 90 kJ/kg greater than that of the air entering. Cooling water in the compressor jackets absorbs heat from the air at the rate of 58 kW. Compute the rate of shaft work input to the air in kW.

(c) A system undergoes a thermodynamic cycle comprising of constant volume, constant pressure and adiabatic processes, in that order. During the constant volume process,85 kJ of heat is supplied to the system. It is followed by the constant pressure process when the system rejects 90 kJ of heat and 20 kJ of work done on it. Determine the amount of work and its direction during the adiabatic process when the system is brought to its original state.

5. Attempt any Attempt any two parts of the following: - **[7x2=14]**

(a) Three reversible engines of Carnot type are operating in series between the limiting temperatures of 1100K and 300K.If the work output from engines is in proportion of 3:2:1, determine the intermediate temperature.

(b) List the difference between SI and CI engines. A Heat Pump working on reversed Carnot cycle absorbs 10 kW from ambient air at 5ºC and delivers heat to a building maintained at 30ºC. Determine the rate of heat derived to the building.

(c) Discuss the following:
(i) 2^{nd} law of thermodynamics
(ii) Carnot theorem and its corollaries
(iii) Clausius inequality