(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2289826   Roll No. ☐☐☐☐☐☐☐☐☐☐

B.TECH.

Regular Theory Examination (Odd Sem-I), 2016-17

ELEMENTS OF MECHANICAL ENGINEERING

Time : 3 Hours   *Max. Marks : 100*

SECTION - A

1. **Attempt all parts. Write answer of each part in short.**
   (10×2=20)

   a) State Varignon's theorem of moments.

   b) List the various types of loads to which the beam can be subjected.

   c) Define Strength, Hardness, Stiffness and Toughness?

   d) Differentiate between macroscopic and microscopic point of view, giving some example.

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e)   Define thermodynamic System, Surrounding and Universe.

f)   Define the importance of the concept of "Continuum" in engineering thermodynamics.

g)   Explain first Law of thermodynamics?

h)   State Zeroth Law of thermodynamics and explain its importance in measurement of temperature.

i)   What do you understand by COP and state the relation of COP for a refrigerator?

j)   State parallel axis theorem.

SECTION - B

2.   **Attempt any five questions from this section :**
                                                    (5×10=50)

a)   A roller of radius r = 300 mm and weighing 2000 N is to be pulled over a curb of height 150 mm [fig.1] by horizontal force F applied to the end of a string wound tightly around the circumference of the roller. Find the magnitude of F required to start the roller move over the curb. What is the least F through the center of the roller to just turn it over the curb?
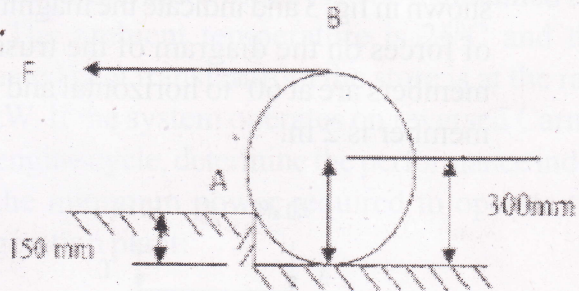
Fig. 1

b) Determine the moment of inertia of the L section shown in fig. 2 about its centroidal axis parallel to the legs. Also find the polar moment of inertia.
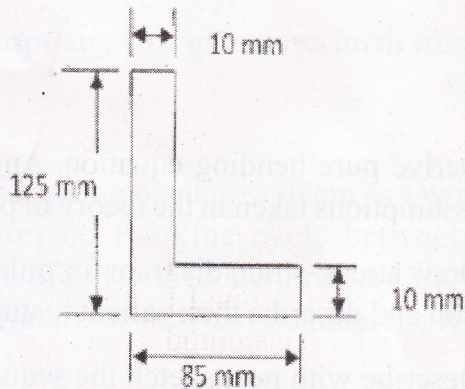

Fig.2

c) Determine the forces in all member of the truss shown in fig. 3 and indicate the magnitude and nature of forces on the diagram of the truss. All inclined members are at 60^0 to horizontal and length of each member is 2 m.

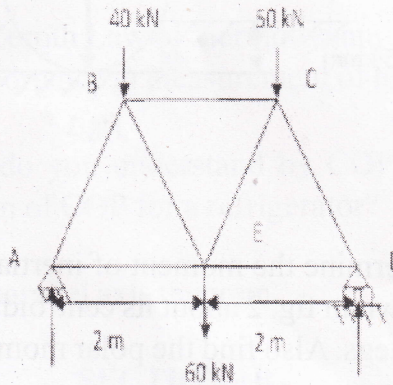Fig.3

d) Derive pure bending equation. And describe the assumptions taken in the theory of pure bending.

e) Draw stress -strain diagram for mild steel and cast iron and describe their salient features.

f) Describe with neat sketch the sequence of events in the working of four stroke petrol/diesel engine.

g) What is heat pump? How does it differ from a refrigerator? It is proposed to design a refrigeration plant for a food store which is to be maintained at -5^0C. The ambient temperature is 25^0C and the estimated heat transfer from the store is at the rate of 5kW. If the system operates on reversed Carnot heat engine cycle, determine the performance index and the minimum power required to operate the refrigeration plant:

h) Show Otto and Diesel cycle on p-V and T-s diagram. How does two stroke engine differ from a four stroke engine?

SECTION - C

Note: **Attempt any two questions form this section**
$$(2\times15=30)$$

3. A power generating plant uses steam as a working fluid and operates on Rankine cycle between a source temperature of 311.1^0C (boiler pressure 100 bar) and a sink temperature of 32.9^0C (Condenser pressure 0.05 bar)

i) Determine the cycle efficiency and work ratio if all the processes are reversible. Also determine the rate of steam generation if the power output of the plant is 1 MW.

ii) How the cycle efficiency and work ratio would be affected if isentropic efficiency of turbine is 0.8 and the saturated liquid coming out of the condenser is compressed to the boiler pressure with an isentropic efficiency of 0.9.

4. A bar of uniform thickness t tapers from a width of b_1 at one end to b_2 at other end in a length L. Find the expression for its extension under the action of axial force P. A steel flat of thickness 10 mm tapers uniformly from 60 mm at one end to 40 mm at other end in a length of 600 mm. If a bar is subjected to a load of 80 kN. Find its extention. Take E = 2×10^5 MPa. What is the percentage error if average area is used for calculating extention?

5. For the beam shown in fig.4 Draw the shear force and bending moment diagram.
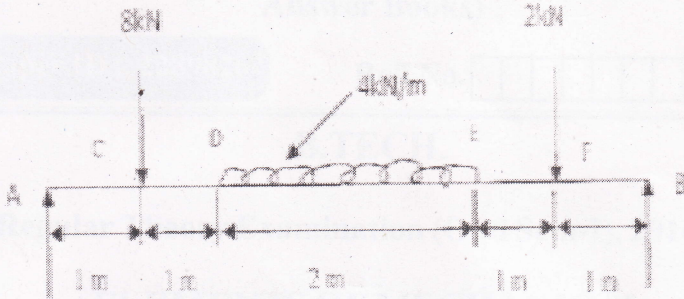
Fig 4

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