Printed Pages: 03 **Sub Code: RME201**

Paper Id: 140208 **Roll No.** | | | | | | | | | | |

B. TECH.

(SEM II) THEORY EXAMINATION 2017-18

ELEMENTS OF MECHANICAL ENGINEERING

Time: 3 Hours ***Total Marks: 70***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. State and explain Perpendicular axis theorem.

b. Explain conditions of equilibrium of coplanar concurrent and non-concurrent forces.

c. Differentiate between statically determinate and indeterminate beam.

d. Differentiate between centroid and centre of gravity.

e. Differentiate between Intensive and extensive properties.

f. Describe Clausius inequality.

g. Write down the SFEE for compressor and boiler.

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. State and prove parallel axes theorem also describe radius of gyration.

b. Define truss, types of truss and write down the assumptions taken while analyzing a truss.

c. Sketch the Otto cycle on P-V and T-S diagram and show in the relevant diagram, the heat supplied and work done in various processes. Also derive the efficiency expression

d. Define the following terms: -

(i) PMM1 and PMM2

(ii) Pure substance

(iii) Carnot cycle and Carnot theorem

e. Draw simple Rankine cycle on P-V and T-S diagram. Steam enters at 80 bar and 450^{o}C in a steam turbine and expands isentropically up to condenser pressure of 0.1 bar. Find the stage of steam at turbine exit and power developed by the turbine. If the mass flow rate of steam is 5 kg/s.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Two smooth spheres **P** and **Q** each of radius **25 cm** and weight **500N**, rest in a horizontal channel having vertical walls, the distance between the walls is **90 cm**. Find the reactions at the points of contacts **A, B, C and D** shown in figure 1.

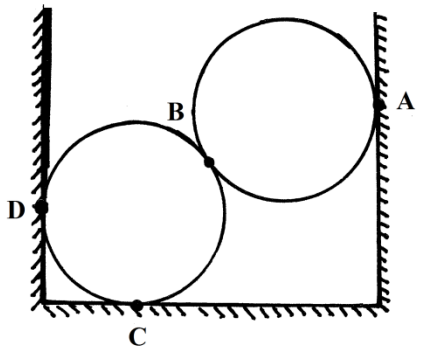

Figure:-1

(b) Find the moment of inertia about the axis OX for the lamina as shown in figure.

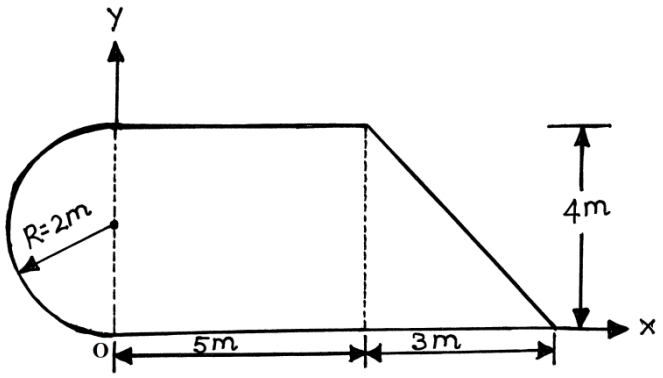

Figure:-2

4. Attempt any *one* part of the following: **7 x 1 = 7**

(a) Determine the forces in each member of the truss as shown in figure 3.

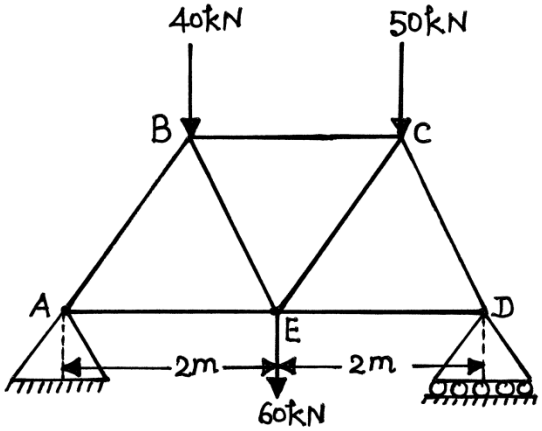

Figure:-3

(b) Draw SFD and BMD of the beam as shown in figure 4. Also find out the point of contraflexure if any and calculate maximum bending moment.

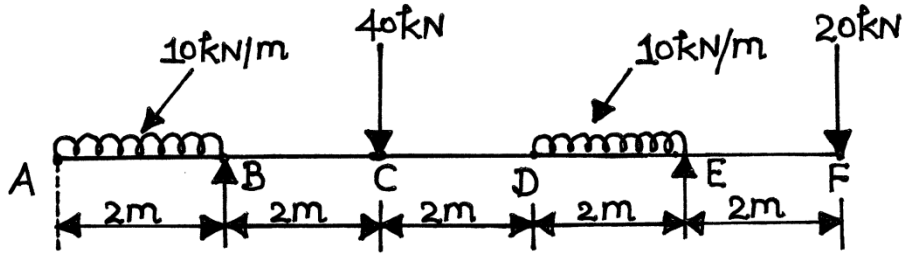

Figure:-4

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) Define the following term
- **(i)** Shear modulus
- **(ii)** Young's modulus
- **(iii)** Poisson's Ratio
- **(iv)** Bulk modulus

(b) What is meant by pure bending? List the assumptions made for the theory of pure bending. Also derive bending equation.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) Derive the steady flow energy equation.

(b) A heat engine operating between two reservoirs at 1000 K and 300K is used to drive a heat pump which extracts heat from the reservoir at 300 K at a rate twice that at which the engine rejects heat to it. I f the efficiency of the engine is 40% of the maximum possible and the COP of the heat pump is 50% of the maximum possible, What is the temperature of the reservoir to which the heat pump rejects heat? What is the rate of heat rejection from the heat pump if the rate of heat supply to the heat engine is 50 kW?

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Explain the working of 4 stroke Petrol engine with the help of neat and clean diagrams with proper labeling showing all the major components of engine.

(b) Distinguish between enthalpy and internal energy. Two Carnot engines work in series between the source at temperature 500 K and sink at temperature 300 K. If both develop equal power, determine the intermediate temperature.