Printed Pages:02 **Sub Code:RME-101**

Paper Id: 233181 **Roll No.** | | | | | | | | | | |

B.TECH
(SEM I) THEORY EXAMINATION 2022-23
ELEMENTS OF MECHANICAL ENGINEERING

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

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

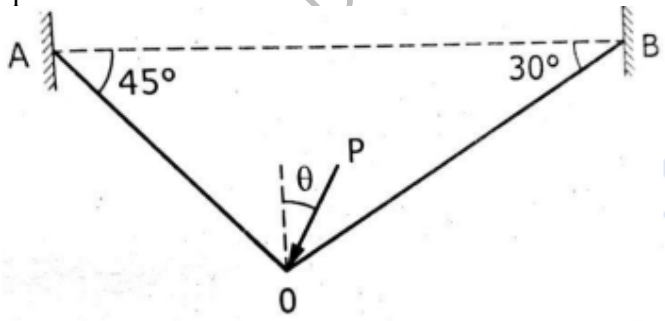
1. Attempt *all* questions in brief. **7 x 2 = 14**

(a) State Lami's theorem with a neat sketch?
(b) What is moment of inertia?
(c) Define Truss and free body diagram.
(d) List the different types of beams?
(e) Write the importance of engineering materials.
(f) Explain Zeroth law of Thermodynamics
(g) Define Kelvin Planck Statement.

SECTION B

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

(a) A force P is applied at 'O' to the string AOB as shown in fig. If the tension in each part of string is 50 N, Find the direction and magnitude of force P for equilibrium conditions.



(b) Explain the procedure to find forces in members of truss by using method of joints.

(c) Classify and explain engineering materials in details.

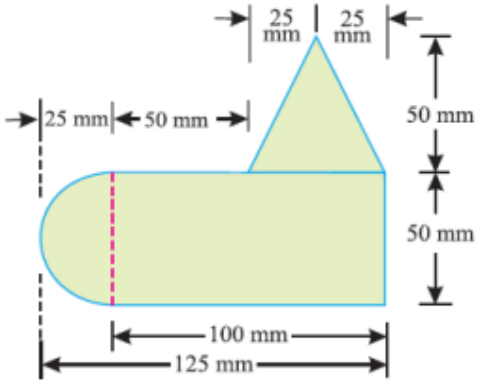
(d) Explain the state of equilibrium. Also discuss thermal, chemical and mechanical equilibrium with suitable examples.

(e) A reversible heat engine operates between two reservoirs at temperatures of 600°c and 40°c. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 40°c and -20°c. The heat transfer to the heat engine is 2000KJ and net work output of the combined engine refrigerator plant is 360KJ.Evaluate the heat transfer to the refrigerant and the net heat transfer to the reservoir at 40°c.

SECTION C

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

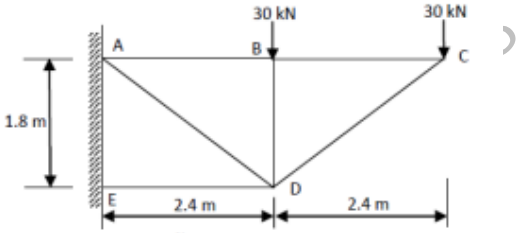
(a) A uniform lamina shown in Fig. consists of a rectangle, a circle and a triangle. Determine the center of gravity of the lamina. All dimensions are in mm.



(b) Prove the parallel axis theorem in the determination of moment of inertia of areas with the help of a neat sketch.

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

(a) Find the forces in the members of a truss as shown in fig.



(b) Classify and explain different types of beam and their support with neat sketch.

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

(a) Three bars made of copper; zinc and aluminum are of equal length and have cross section 500, 700, and 1000 mm2 respectively. They are rigidly connected at their ends. Of this compound member is subjected to a longitudinal pull of 250KN, estimate the proportional of the load carried on each rod and the induced stresses. Take the values of E for copper =1.3 x 105N/mm2 and for zinc=1.0x105N/mm2 and for aluminum=0.8 x 105N/mm2

(b) What do you mean by bending stress? Derive the expression for bending equation.

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

(a) Describe in brief the steady flow energy equation with the assumptions made.

(b) A fluid at a pressure of 3 bar and with specific volume of 0.18 m3 /kg contained in a cylinder behind a piston expands reversibly to a pressure of 0.6 bar according to a law , $p=c/v^2$ where c is a constant .Calculate the work done by the fluid on the piston.

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

(a) Classify and explain Internal combustion engine in details.

(b) What is pure substance? Draw the phase equilibrium diagram for a pure substance on T-S plot with relevant constant property lines.