Printed Pages: 02 **Sub Code: RME- 201**

Paper Id: 238510 **Roll No.** | | | | | | | | | | |

B.TECH
(SEM II) THEORY EXAMINATION 2022-23
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. 2x7=14

(a) Define the principle of transmissibility.
(b) Explain free body diagram with example.
(c) Define shear force and bending moment.
(d) State and explain Hooke's law.
(e) Define the terms 'system', 'surroundings', 'boundary' and 'universe' as related to thermodynamics.
(f) State Zeorth law of thermodynamics.
(g) Name different parts of IC engine.

SECTION B

2. Attempt any *three* of the following: 7x3=21

(a) Find the resultant of forces 2, $4\sqrt{3}$, 8, $2\sqrt{3}$ and 4 N that act at an angular point of a regular hexagon towards the other angular points taken in order.

(b) Define a beam. Classify different types of beams on the basis of **support conditions** and **loadings**.

(c) Draw a stress-strain curve for a mild steel specimen and explain the following:
(i) Proportional limit (ii) Elastic limit (iii) Yield strength (iv) Yield point (v) Ultimate strength (vi) Rupture strength.

(d) Write short notes on any two of the followings:
(i) state, path, process,
(ii) closed system, isolated system, open system,
(iii) Extensive and intensive properties.

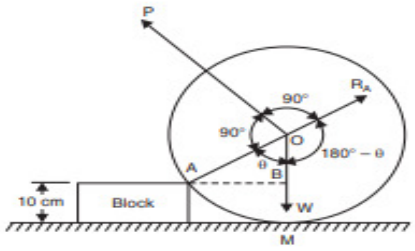
(e) State the Kelvin Planck and Clausius statements being used for second law of thermodynamics. Further, define; COP of a refrigerator and COP of a heat pump, and show that: $(COP)_{Heat\ pump}=1+(COP)_{Refrigerator}$.

SECTION C

3. Attempt any *one* part of the following: 7x1=7

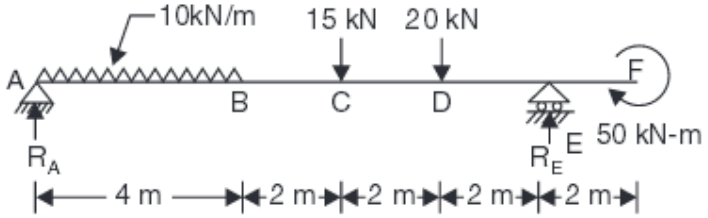
(a) How are the forces classified? Define a 'force system'. Name the different force systems.

(b) A uniform wheel 40 cm in diameter rests against a rigid rectangular block 10 cm thick as shown in Fig. 2.43. Find the least pull through the centre of the wheel to just turn it over the corner of the block. All surfaces are smooth. Find also the reaction of the block. The wheel weighs 800 N.

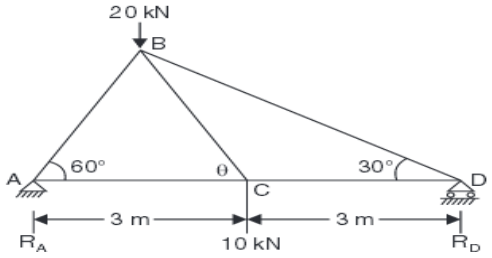


4. Attempt any *one* part of the following: 7x1=7

(a) Draw the SFD and BMD of the a beam loaded beam as shown in fig.



(b) Determine the forces in all the members of the truss shown in fig.

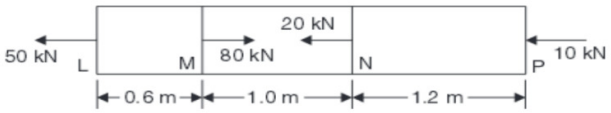


5. Attempt any *one* part of the following: 7x1=7

(a) Derive the bending equation:

$$\frac{M}{I} = \frac{E}{R} = \frac{\sigma}{y}$$

(b) A brass bar having cross-sectional area of 1000 mm^2 is subjected to axial forces shown in Fig. Find the total elongation of the bar. Modulus of elasticity of brass= 100 GN/m^2



6. Attempt any *one* part of the following: 7x1=7

(a) Define the first law of thermodynamics. Also give supporting mathematical expression for it. How the first law of thermodynamics is applied to a closed system undergoing a non-cyclic process?

(b) One mol of air at 0.5 MPa and 400 K, initially undergoes following processes, sequentially
(a) Heating at constant pressure till the volume gets doubled.
(b) Expansion at constant temperature till the volume is six times of initial volume.
Determine the work done by air.

7. Attempt any *one* part of the following: 7x1=7

(a) Find the internal energy, and enthalpy of unit mass of steam of a pressure of 7 bar when:
(i) Its quality is 0.8
(ii) It is dry saturated
(iii) Superheated the degree of superheat being 65^0C.

(b) Explain the working of a 4 stroke C.I Engine with the help of neat sketch, P-v and T-s diagram.