1st SEMESTER – B.TECH.(All Branches)
Mid Semester Examination, January 2023

Course: FCME006   Basics of Mechanical Engineering

Time: 1:30 Hours   Max. Marks: 25

Note: - Attempt all questions. Missing data/ information (if any) may be suitably assumed & mentioned in the answer.

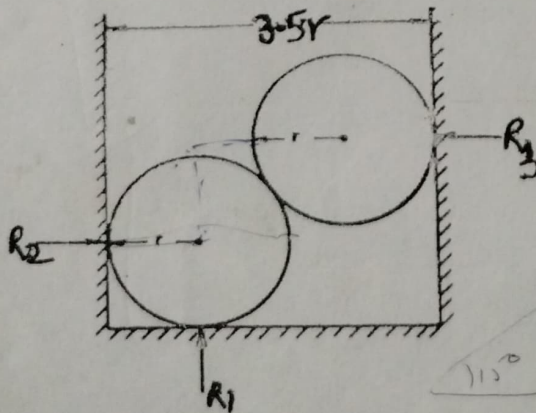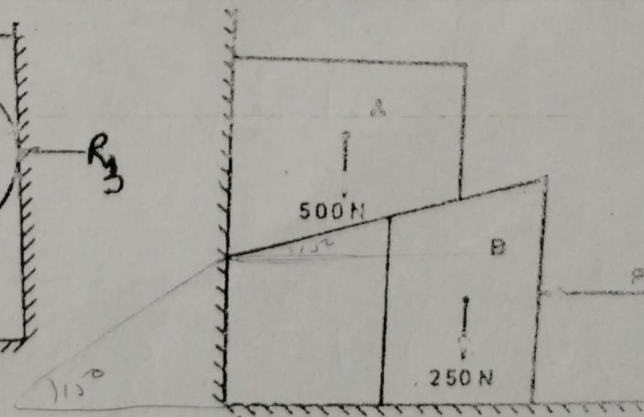| Q. No.	Question	Marks	CO
1a	State and prove Lami's Theorem.	2	CO1
1b	Two steel cylinders of equal diameters are supported in a rectangular vessel (Fig.1). Determine the support reactions. Weight of each cylinder may be taken as 100 N.	3	CO1
2a	A block weighing 500 N is to be raised by means of a 15^0 wedge weighing 250 N as shown in Fig.2. Assuming coefficient of friction between all contact surfaces to be 0.2. Draw free body diagram for both the blocks.	2	CO1
2b	For above problem, Determine what minimum horizontal force P should be applied to raise the block?	3	CO1
3a	What do you understand by zero force members in a truss?	1	CO1
3b	Find out the forces and their nature in all the members of the truss as shown in Fig.3.	4	CO1
4a	Draw stress- stain curve for a ductile material and explain important points on the curve.	3	CO2
4b	Explain Factor of Safety and its physical significance.	2	CO2
5a	Calculate the reactions at A (roller support) and D (hinge support) for the beam as shown in Fig.4.	1	CO2
5b	Draw the shear force and bending moment diagrams (SFD & BMD) showing all important values for above problem.	4	CO2

Fig.1

Fig.2   (PTO)

Fig.3

Fig.4

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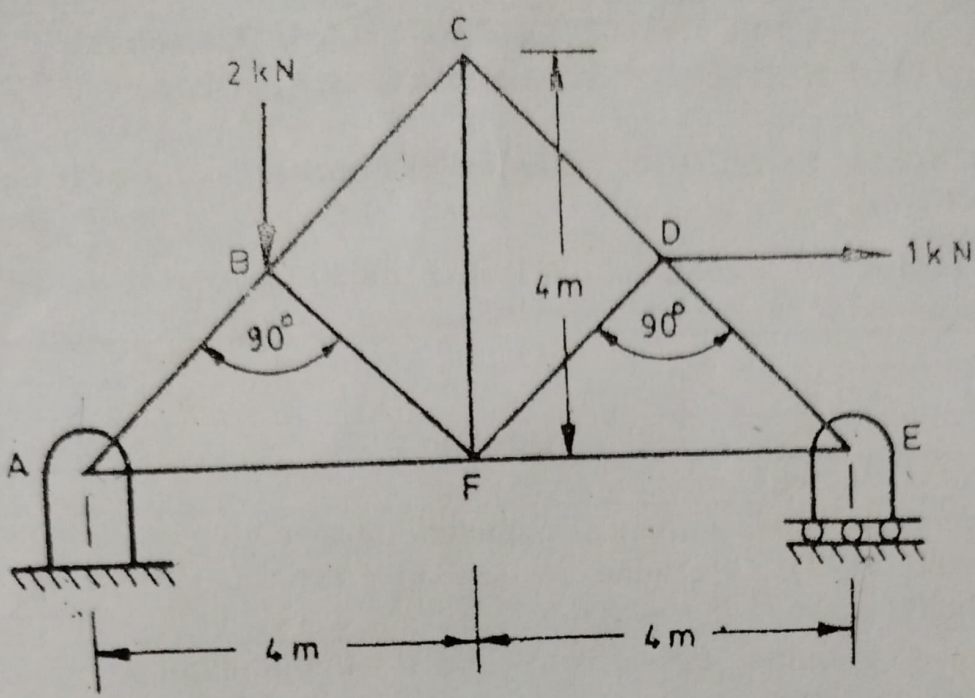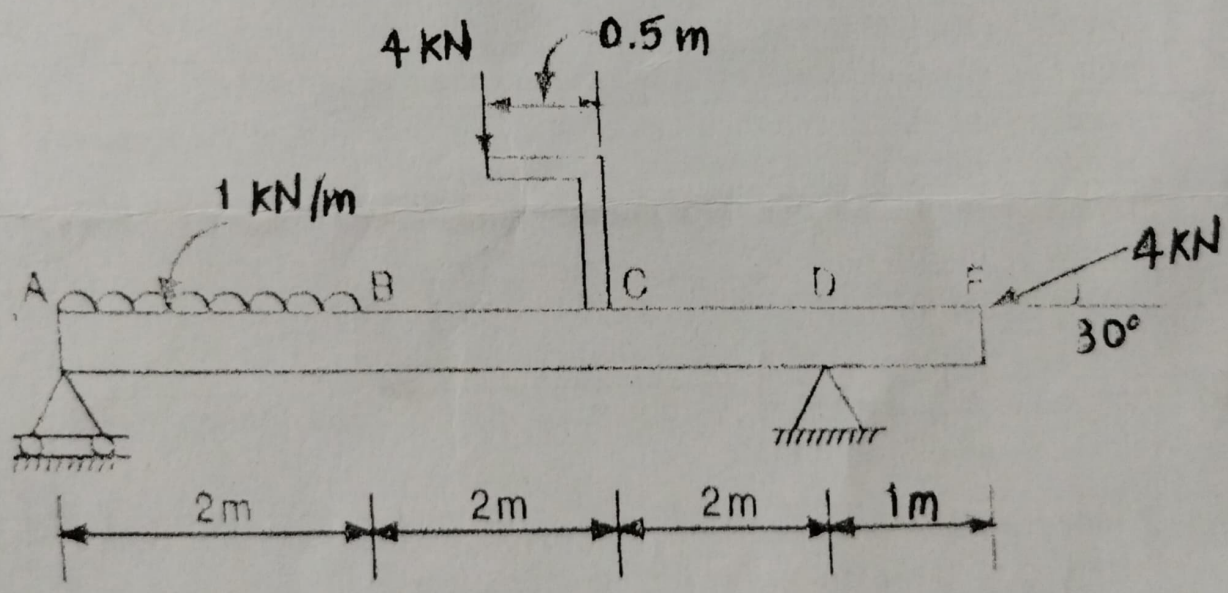
END-SEMESTER EXAMINATION, March, 2023
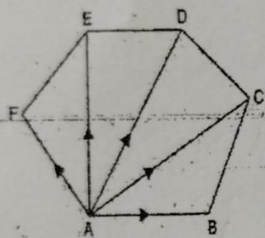
Course Code- FCME006   Course Title- Basics of Mechanical Engineering

Time- 3 Hours   Max. Marks- 50

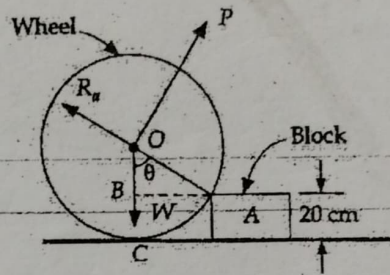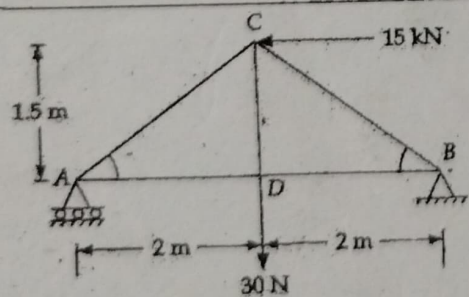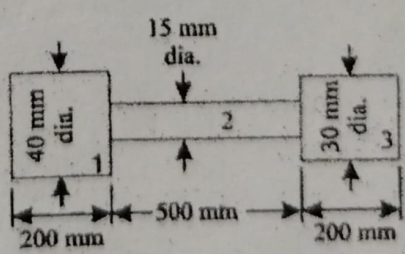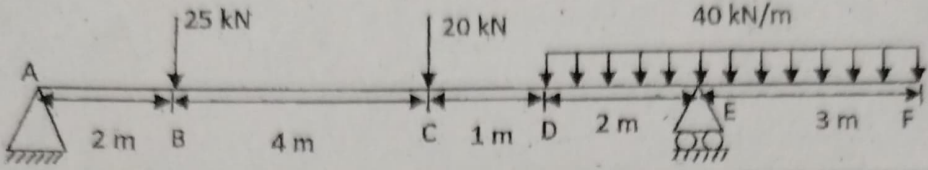**Note: - Attempt any two parts of each question. Missing data/ information if any, maybe suitably assumed & mentioned in the answer.**

Q. No.	Question	Marks	CO
1a	ABCDEF is a regular hexagon. Forces of magnitudes $2, 4\sqrt{3}, 8, 2\sqrt{3}$ and $4\,N$ act at A in the directions of AB, AC, AD, AE and AF respectively. Determine the resultant and its direction.	5	1
		Fig 1a And 1b Resp.	
1b	A uniform wheel of 50 cm diameter and 1 kN weight rests against a rigid rectangular block of thickness 20 cm (fig 1). Considering all surfaces smooth, determine (a) least pull to be applied through the centre of the wheel to just turn it over the corner of the block, (b) reaction of the block.	5	1
1c	Determine the magnitude and nature of forces in the various members of the triangular truss loaded and supported as shown in fig 2. Explain Method of joints and verify any one answer above by method of section	5	2
		Fig 1c And 2b Resp.	
2a	Define Young's Modulus of Elasticity and Modulus of Rigidity. Derive the relation $E = 3K(1-2\gamma)$. γ- Poisson's ratio	5	1

2b	A steel bar is 900 mm long; its two ends are 40 mm and 30 mm in diameter and the length of each rod is 200 mm. The middle portion of the bar is 15 mm in diameter and 500 mm long. If the bar is subjected to an axial tensile load of 15 kN, find its total extension and stresses in each part. E = 200 GPa.	5	2
2c	Find out reactions at the supports and Draw SFD for the following beam. 25 kN 20 kN 40 kN/m A 2 m B 4 m C 1 m D 2 m E 3 m F	5	2
3a	Explain the function of Sprue, runner and gate and riser. Differentiate split pattern, cope & drag pattern and match plate pattern.	5	6
3b	Discuss the working of submerged arc welding. Differentiate TIG And MIG.	5	6
3c	Enlist important parts of the lathe machine. Explain taper tuning, boring, knurling and thread cutting operations of lathe machine.	5	6
4a	Define work from thermodynamics point of view and explain the condition of reversible work? Air initially at 75 kPa,1000 K temperature and occupying a volume of 0.12 m³ is compressed isothermally until its volume is halved and subsequently it undergoes further compression at constant pressure till the volume is halved again. Sketch the process on p-v diagram and find the work transfer.	5	3
4b	Based on the Kelvin plank and Clausius statement of second law of thermodynamics explain the working of Heat engine and Heat Pump and prove that $COP_{HP} = COP_R + 1$	5	3
4c	Explain the working of Otto cycle and show the various processes on p-v and t-s diagram also drive the equation of efficiency of otto cycle.	5	4
5a	Define the various types of fluid exist in nature based on the Newton's law of viscosity with example. A flat plate of area 3 cm² is pulled with a speed of 0.6 m/sec relative to another plate located at a distance of 0.25 mm form first plate. Calculate the force and power required to maintain this speed if fluid has a viscosity of 1 poise.	5	3
5b	Define the following properties of fluid, weight density, specific gravity, kinematic viscosity. Explain the various types of flow of fluids.	5	3
5C	Water is flowing through a pipe with certain rate, having diameter at inlet and exit as 8 cm and 4.5 cm respectively. The pressure measured at inlet is 40 kPa while at exit it is 28 kPa. If the difference between the elevation of inlet and exit is 6 meters, Calculate the volume flow rate through the pipe.	5	3

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