BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : I**
BRANCH: CSE/AIML/ECE/EEE **SESSION : MO/2023**

SUBJECT: ME101 BASICS OF MECHANICAL ENGINEERING

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Find the internal forces developed in the member BD and CD of truss as shown in Figure 1, if a 36 kN load is acting along the line of AB.	[5]	1	M

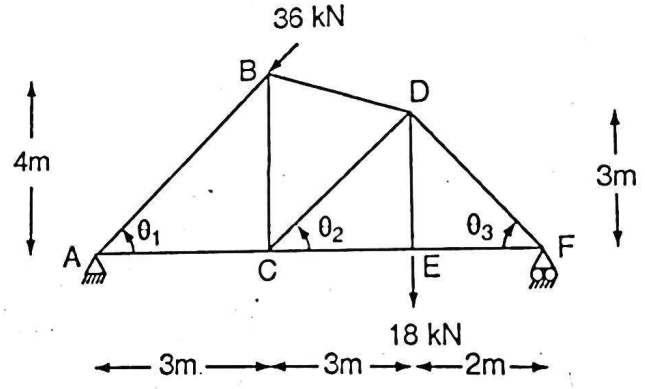

Figure 1

Q.1(b)	A steel bar 35 mm x 35 mm in section and 100 mm in length is acted upon by a tensile load of 180 kN along its longitudinal axis and 400 kN and 300 kN along the axis of the lateral surfaces. Determine : (i) change in the dimensions of the bar, (ii) change in volume, (iii) longitudinal axial load acting alone to produce the same longitudinal strain as in (i). Take E = 205 GPa; v = 0.3.	[5]	1	M

Q.2(a)	A steam engine has a crank of radius 15 cm and connecting rod of length 75 cm as shown in Figure 2. The crank CQ rotates in a clockwise direction with a constant speed of 300 r.p.m. Calculate the velocity of the piston P at the instant when the angle θ = 30°. Also calculate the angular velocity of connecting rod.	[5]	2	M

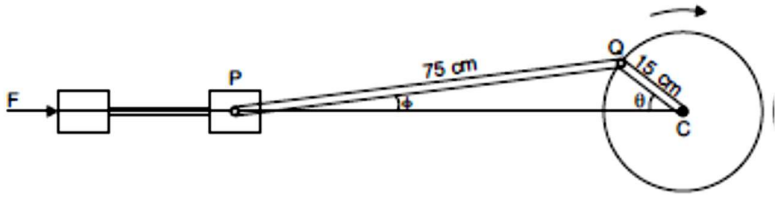

Figure 2

Q.2(b)	A bar of length 2 m has its end A and B constrained to move horizontally and vertically. The end A of bar is inclined 30^0 with the horizontal and moves with a constant velocity of 6 m/s horizontally. Make calculations for: (i) the angular velocity of the bar AB, (ii) the velocity of the end B, and (iii) the velocity of the midpoint of the bar at the instant when the bar makes an angle of 30^0 with the horizontal.	[5]	2	M

PTO

Q.3(a)	For a simple screw jack, derive the expressions for effort applied at the circumference of spindle and force applied at the end of the lever, when the load is hoisted upwards.	[5]	3	L
Q.3(b)	Explain angle of repose and angle of friction with neat sketches.	[5]	3	L
Q.4(a)	Distinguish between 4-stroke and 2-stroke engine.	[5]	4	L
Q.4(b)	A furnace wall comprises three layers: 13.5 cm thick inside layer of fire brick, 7.5 cm thick middle layer of insulating brick and 11.5 cm thick outside layer of red brick. The furnace operates at 870^0C and it is anticipated that the outside of this composite wall can be maintained at 40^0C by the circulation of air. Assuming close bonding of layers at their interfaces, find the rate of heat loss from the furnace and the wall interface temperature. The wall measures 5m x 2m and the data on thermal conductivities is : Fire brick k_1 = 1.2 W/m-deg, Insulating brick k_2 = 0.14 W/m-deg, and red brick k_3 = 0.85 W/m-deg.	[5]	4	L
Q.5(a)	Explain the advantages and disadvantages of renewable and non-renewable energy resources.	[5]	5	L
Q.5(b)	Explain the harnessing of ocean thermal energy resources with neat sketches.	[5]	5	L

:::::14/12/2023 M:::::