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

CLASS: BTECH **SEMESTER : I**
BRANCH: CS/ECE/AI/EEE **SESSION : MO/2022**

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 out the internal forces in the members FH, GH and GI of Figure 1	[5]	CO1	4

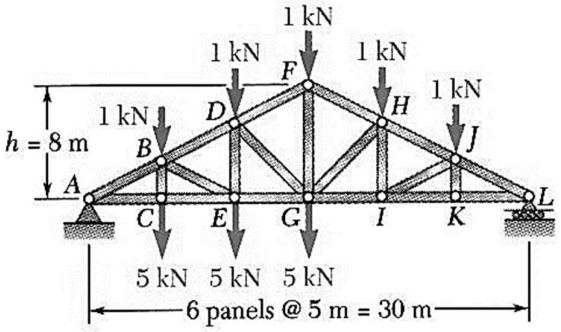

Figure 1

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]	CO1	4
Q.2(a)	The crank AB in the mechanism shown in Figure 2, rotates at 5 rev/s is 300 mm long. The link CB is 600 mm long, and the piston C moves in horizontal guides. Find for the position shown (i) velocity of piston C, (ii) angular velocity of the connecting rod BC and (iii) velocity of a point D at the center AB.	[5]	CO2	4

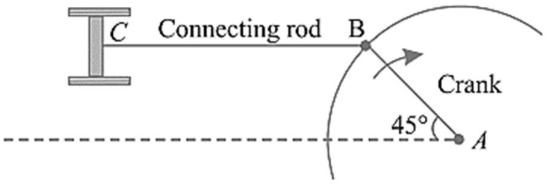

Figure 2

Q.2(b)	The ladder AB of length l makes an angle θ with the vertical wall. The foot of the ladder moves to the right with constant speed v_A. Determine velocity and acceleration of point B of ladder in terms of v_A , l and θ.	[5]	CO2	3
Q.3(a)	Two blocks A and B of weights 1 kN and 2 kN, respectively are in equilibrium as shown in Figure 3. If the co-efficient of friction between two blocks as well as the block B and the floor is 0.3, find the force (P) required to move the block B.	[5]	CO3	3

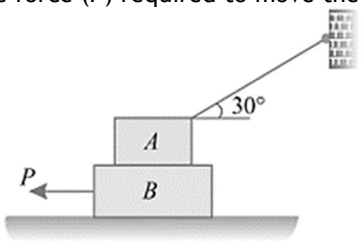

Figure 3

PTO

Q.3(b)	The mean radius of the screw of a square threaded screw jack is 25 mm. The pitch of thread is 7.5 mm. If the coefficient of friction is 0.12, what effort applied at the end of lever 60 cm length is needed to raise a weight of 2 kN.	[5]	CO3	3
Q.4(a)	Differentiate two stroke and four stroke engine with neat sketches.	[5]	CO4	2
Q.4(b)	A furnace wall consists of 120 mm thick refractory brick and 120 mm thick insulating firebrick separated by an air gap. The outside wall is covered with a 10 mm thickness of plaster. The inner surface of the wall is at 1000^0 C and the room temperature is 20^0 C. Calculate the rate at which heat is lost per m^2 of the wall surface. The heat transfer coefficient from the outside wall surface to the air in the room is 20 W/m^2 K, and the resistance to heat flow of the air gap is 0.15 K/W. The thermal conductivity of refractory brick, insulating firebrick, and plaster are 1.6, 0.3, and 0.14 W/mK, respectively. Also, calculate each interface temperature of the outside of the wall.	[5]	CO4	3
Q.5(a)	State the advantages and disadvantages of renewable energy and non-renewable energy resources.	[5]	CO5	2
Q.5(b)	Explain the harnessing of tidal energy resources with neat sketches.	[5]	CO5	2

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