CLASS: BTECH   SEMESTER : II
BRANCH: MECH/CIVIL/PROD/CHEMICAL/BIOTECH   SESSION : SP/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) Determine the forces in BD and BE members with proper free body diagram of the   [5]   1   M
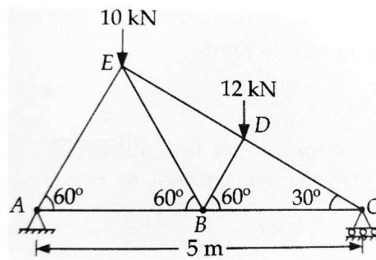whole truss as shown in Figure 1

Figure 1

Q.1(b) A steel rod 5 m long and 30 mm in diameter is subjected to an axial tensile load of   [5]   1   H
50 KN. Determine the change in length, diameter and volume of the rod. Take E = 2
x10^5 N/mm^2 and Poisson's ratio = 0.25

Q.2(a) A bar of length 2 m has its end A and B constrained to move horizontally and vertically.   [5]   2   M
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.

Q.2(b) In a crank and connecting rod mechanism, the crank is 300 mm long and the   [5]   2   H
connecting rod 1500 mm long. If the crank rotates uniformly at 300 rpm, find the
velocity of the cross-head when the crank is inclined at 30^0 with the inner dead
Centre.

Q.3(a) For a simple screw jack, derive the expressions for effort applied at the   [5]   3   L
circumference of spindle and force applied at the end of the lever, when the load is
hoisted upwards.

Q.3(b) Two blocks of weight 200 N and 300 N and connected by a string passing over a   [5]   3   M
frictionless pulley rest on rough surfaces; block of weight 200 N on horizontal surface
and the other on an inclined surface as shown in Figure 2. For both the surfaces the
coefficients of friction μ = 0.25. Find out the minimum value of force, both in
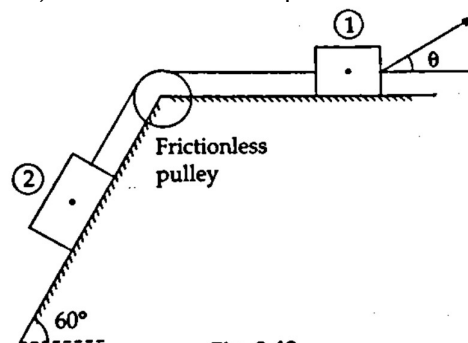magnitude and direction, for the motion to impend.

Figure 2

Q.4(a)	Differentiate between two stroke and four 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	M
Q.5(a)	Explain advantages and disadvantages of renewable and nonrenewable energy resources.	[5]	5	L
Q.5(b)	Explain when and where tides occur? How tidal energy is harnessed for useful power utilization. Explain your answer with suitable diagrams.	[5]	5	L

:::::21/07/2023:::::