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

**CLASS: B.TECH** **SEMESTER : II**
**BRANCH: MECH/PROD/CIVIL/CHEMICAL/POLYMER/BIOTECH** **SESSION : SP/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*. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

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Q.1(a) Analyze the forces in members AC and BC of the Truss shown in Figure 1. [CO-1, PO-1, BT-2] [5]

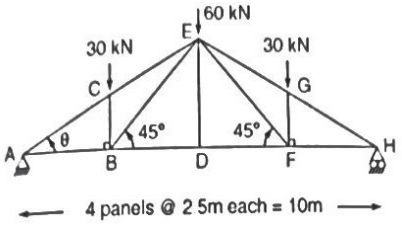


FIGURE 1.

Q.1(b) A circular rod of 100 mm diameter and 500 mm long is subjected to a tensile force of 100 KN. Determine modulus of rigidity, bulk modulus, and change in volume if Poisson's ratio = 0.3 and Young's modulus E = $2 \times 10^5$ N/mm$^2$. [CO-1, PO-1, BT-2] [5]

Q.2(a) The rod as shown in Figure 2 has a velocity 6 m/s vertically at point Q. Determine the angular speed of PQ, velocity of end P, and velocity of middle point R of PQ. The length of the rod is 2.1 m. Use the method of instantaneous center. [CO-2, PO-2, BT-3] [5]

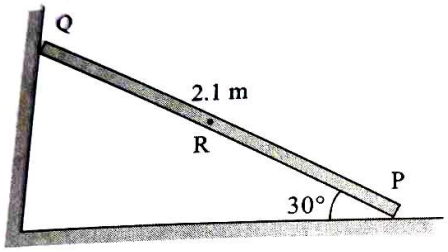


FIGURE 2.

Q.2(b) 2 masses are interconnected with an inextensible cord as shown in Figure 3. Considering coefficient of friction in the contiguous surfaces μ = 1/3, determine the acceleration and the tension of the string. Take $m_1$ = 12 Kg and $m_2$ = 6 Kg. [CO-2, PO-2, BT-3] [5]

Q.3(a) Two blocks of weights $W_1$and $W_2$ connected with a string rest on a rough incline as shown in Figure 3. If the coefficients of friction are 0.2 and 0.3 for the blocks respectively, and $W_1$ = $W_2$=50 N, find the value of angle α (alpha) for which sliding will impend. [CO-3, PO-1, BT-1] [5]

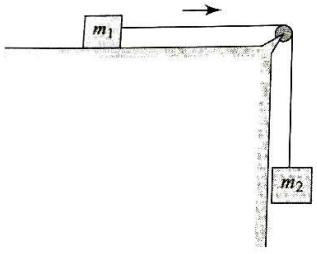


FIGURE 3.

**PTO**

Q.3(b) The period $\tau_d$ of damped linear oscillation for a certain 1-kg mass is 0.2 s. If the stiffness of the supporting linear spring is 800 N/m, calculate the damping coefficient c. [CO-3, PO-2, BT-3] [5]

Q.4(a) Distinguish between 4-stroke and 2-stroke engine. [CO-4, PO-1, BT-1] [5]

Q.4(b) The walls of house in cold region comprise of 3 layers [5]

15 cm outer brick work (k = 0.75 W/m-degree)
1.25 cm inner wooden paneling (k = 0.20 W/m-degree)
7.5 cm intermediate layer of insulating materials

The insulation layer is stated to offer resistance twice the thermal resistance of brick work. If the inside and outside temperatures of the composite wall are $20^0$ C and $-15^0$ C respectively, determine the rate of heat loss per unit area of the wall and the thermal conductivity of the insulating material. [CO-4, PO-2, BT-1]

Q.5(a) Explain the advantages and disadvantages of renewable and non-renewable energy resources. [CO-5, PO-1, BT-1] [5]

Q.5(b) Define the ocean thermal energy sources and its conversion. [CO-5, PO-1, BT-1] [5]

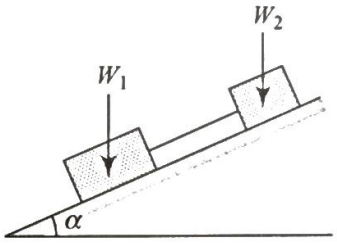


**FIGURE. 4**

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