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

CLASS: BTECH
BRANCH: CS/IT/ECE/EEE

SEMESTER : I
SESSION : MO/19

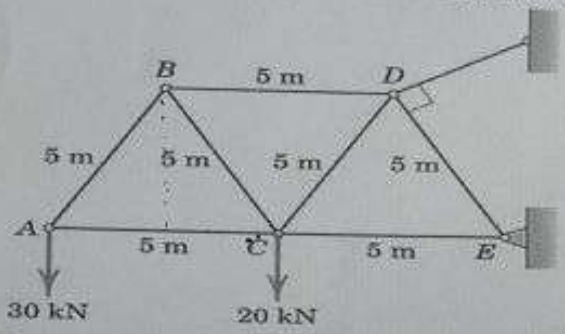
SUBJECT: ME101 BASICS OF MECHANICAL ENGINEERING

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.

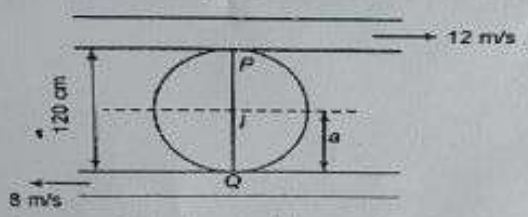
Q.1(a) Determine the forces in members AC, BC and BD of the loaded truss as shown below. [6]



Q.1(b) Explain how thermal stress is generated in a member. Derive the expression for it. [4]

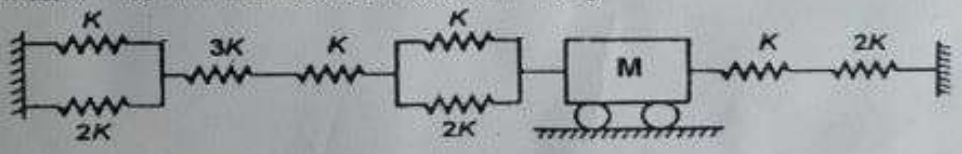
Q.2(a) Explain the concept of dynamic equilibrium with a suitable example. [5]

Q.2(b) A roller of radius 60 mm rides between two horizontal bars moving in opposite direction shown below. Determine the distance 'a' defining the position of the path of instantaneous centre of rotation of the roller. Assume no slip at points contact P and Q. [5]



Q.3(a) A square threaded screw jack is used to raise and lower 100 kg block. Determine (a) the torque required to begin moving the block up, and (b) the torque required to begin moving block down. Also determine if the block will remain stationary when the effort is removed. The screw has a pitch = 10 mm, mean radius of the screw = 8 mm. The coefficient of static friction between the screw and the base material is = 0.25. [5]

Q.3(b) Determine the natural frequency of the series-parallel spring - mass system as shown below. Take Spring stiffness K = 100 N/m and mass of the block m = 10 Kg. [5]



Q.4(a) A steel pipe (thermal conductivity, k = 45.0 W/m.K) having a 0.05 m O.D is covered with a 0.042 m thick layer of magnesia (thermal conductivity ,k = 0.07 W/m.K) which in turn covered with a 0.024 m layer of fiberglass insulation (thermal conductivity ,k = 0.048 W/m.K). The pipe wall outside temperature is 370 K and the outer surface temperature of the fiberglass is 305 K. What is the interfacial temperature between the magnesia and fiberglass? Also determine the steady state heat transfer. [5]

Q.4(b) Explain the function of the following boiler accessories: (i) Fusible plug, (ii) Air pre heater, (iii) Super heater, (iv) Economizer and (v) Boiler feed pump. [5]

Q.5(a) Explain the various sources of renewable energy. [5]

Q.5(b) With a neat sketch explain the working of hydro- energy power generation system. [5]

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