

Total No. of Printed Pages:4

**F.E. Semester-I (Revised Course 2019-20)**  
**EXAMINATION MARCH 2022**  
**Basics Of Mechanical Engineering**

[Duration : Three Hours]

[Total Marks : 100]

**Instructions:**

- 1) Answer any five full questions with at least two questions each from PART A & PART B, and one question from PART C.
- 2) Assume suitably any missing data.
- 3) Draw neat free body diagrams wherever applicable.
- 4) Draw neat sketches wherever necessary,

**PART-A**

- Q.1 a) A bracket is subjected to the system of forces and couples as shown in Fig. 1. Find the resultant of the system and the point of intersection of its line of action with (a) line AB, (b) line BC and line CD.

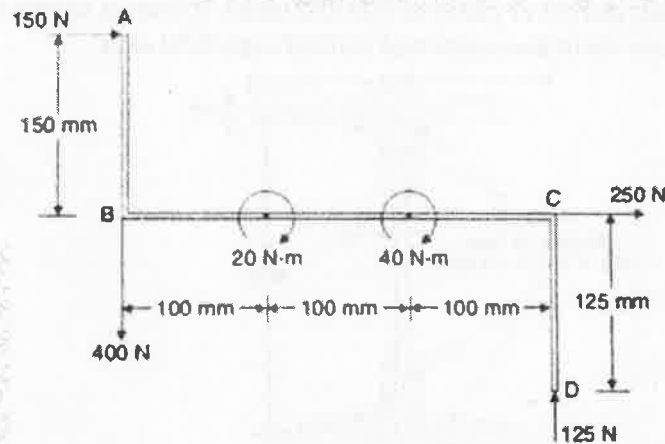


Fig.1

- b) Three spheres A, B and C having their diameters 500 mm, 500 mm and 800 mm, respectively are placed in a trench with smooth side walls and floor as shown in Fig.2. The centre-to-centre distance of spheres A and B is 600 mm. The cylinders A, B and C weigh 4 kN, 4 kN and 8 kN respectively. Determine the reactions developed at contact points P, Q, R and S.

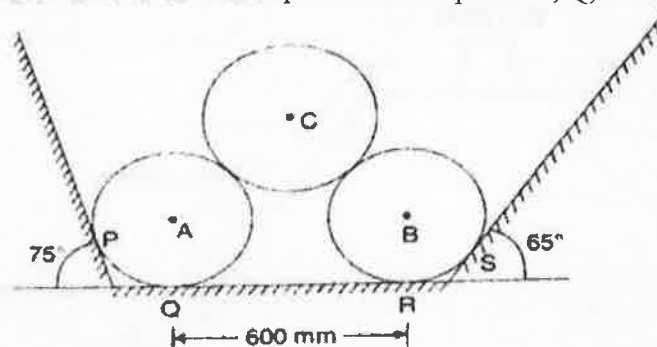


Fig.2

- Q.2 a) What is the value of  $P$  in the system shown in Fig. 3 to cause the motion of 500N block to the right side? Assume the pulley is smooth and the coefficient of friction between other contact surfaces is 0.20.

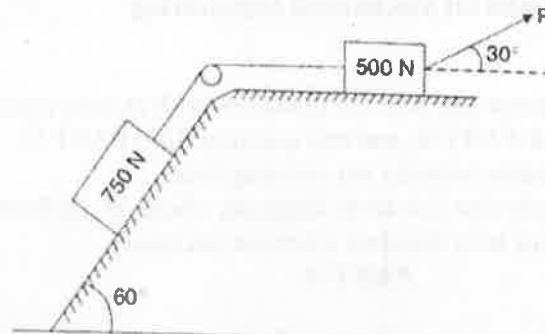


Fig.3

- b) A plate girder is made up of a web plate of size 400 mm x 10 mm, four angles of size 100 mm x 100 mm x 10 mm and cover plates of size 300 mm x 10 mm as shown in Fig. 4. Determine the moment of inertia about horizontal and vertical centroidal axes.

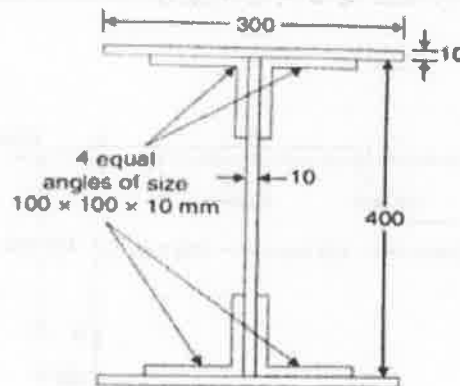


Fig.4

- Q.3 a) Determine the constant force  $P$  that will give the system of bodies shown in Fig. 5 a velocity of 3 m/sec after moving a distance of 4.5 m from the position of rest. Coefficient of friction at all contact points is 0.3. Assume pulleys as frictionless.

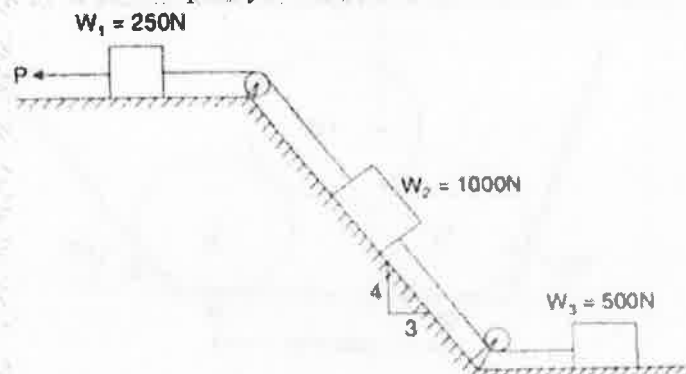


Fig.5

- b) A 500 N body moves along the two inclines for which the coefficient of friction is 0.2 (Fig. 6). If 10 the body starts from rest at A and slides 60 m down the  $30^\circ$  incline, how far will it then move along the other incline? What will be its velocity when it returns to B?

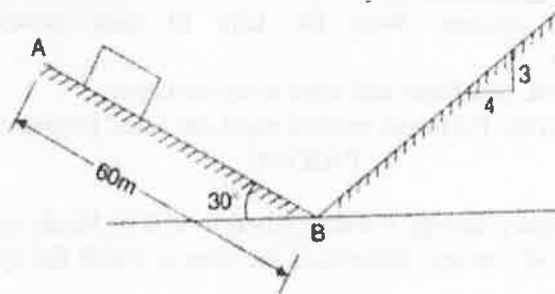


Fig.6

**PART-B**

**PART-B**

- Q.4
- Describe the basic steps involved in sand casting. 5
  - Explain and draw the following processes on a P-V Diagram 5
    - Isobaric process
    - Isochoric process
  - Explain in brief the following Metal Joining Processes 5
    - Welding
    - Soldering
  - Explain the concept of latent heat and specific heat 5
- Q.5
- Explain the various operations that can be performed on Sheet metals. 5
  - Explain the following terms with suitable examples 5
    - Path function and point function
    - Intensive and extensive properties.
  - When a system is taken from state a to b as shown in the fig.7. below, along path acb, 84kJ of 5 heat flows into the system and the system does 32kJ of work.

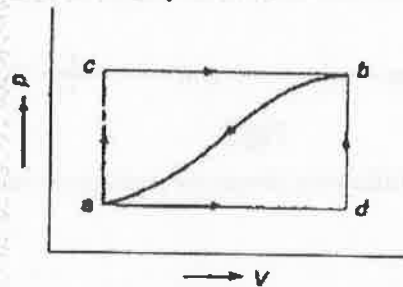


Fig.7

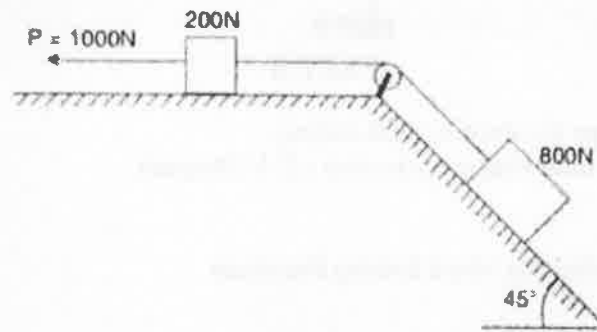
- How much will be the heat that flows into the system along path adb, if the work done is 10.5kJ.
- When the system is returned from b to a along the curved path, the work done on the system is 21kJ. Does the system absorb or liberate heat, and how much of the heat is liberated or absorbed?

d) Describe with neat sketch the working principle of gear drive system. 5

- Q.6
- Write a short note on forging operation. 5
  - Define thermodynamic system. With the help of neat sketches explain the various thermodynamic systems. 5
  - Write a short note on CNC machines and state its advantages 5
  - With an example explain the Perpetual motion machine 1 and Perpetual motion machine 2. 5

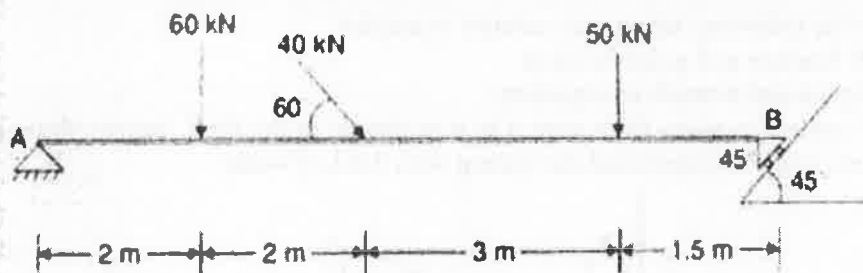
**PART-C**

- Q.7
- Force  $P = 1000 \text{ N}$  as shown in Fig. 8 was applied to  $200 \text{ N}$  block when the block was moving  $10$  with rightward velocity of  $5 \text{ m/sec}$ . Determine the time at which the system has;
    - no velocity,
    - a velocity of  $3 \text{ m/sec}$  towards left. Coefficient of friction between blocks and surface  $= 0.25$ . Assume pulley to be ideal.



**Fig.8**

- Beam AB,  $8.5 \text{ m}$  long, is hinged at A and has a roller support at B. The roller support is inclined at  $45^\circ$  to the horizontal. Find the reactions at A and B, if the loads acting are as shown in Fig. 9



**Fig.9**

- Q.8
- With neat sketches explain the following processes performed on the lathe machine. 10
    - Plain Turning
    - Step Turning
    - Taper turning
    - Knurling
  - State all the laws of thermodynamics with suitable illustrations. 10