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F.E. Semester-I (Revised Course 2019-20)
EXAMINATION AUGUST 2021
Basics of Mechanical Engineering

[Duration: Two Hours]   **[Total Marks:60]**

Instructions: i)   Answer THREE FULL QUESTIONS with ONE QUESTION FROM EACH PART.
                           ii)   Sketches are very important. Draw neat sketches wherever required.
                           iii)   Assume suitable data if required.

Part A

Q.1   a)   A light string ABCDE whose extremity A is fixed, has weights W1 and W2 attached to it   (07)
at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free
end E as shown in figure 1. If in the equilibrium position, BC is horizontal and AB and
CD make 150^0 and 120^0 with BC, find (i) Tensions in the portion AB, BC and CD of the
string and (ii) Magnitudes of W1 and W2
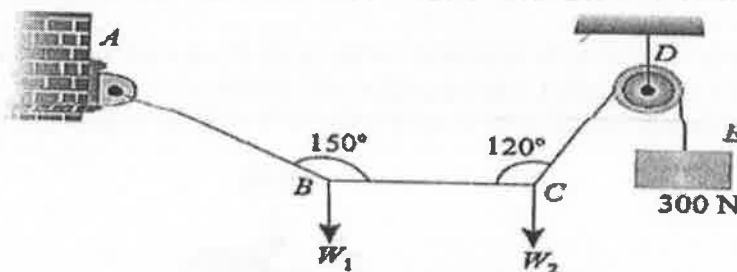
Figure 1

    b)   A uniform wheel of 600mm diameter, weighing 5kN rests against a rigid rectangular   (07)
block of 150mm height as shown in figure 2. Find the least pull, through the Centre of the
wheel, required just to turn the wheel over the corner A of the block. Also find the
reaction on the block. Take all the surfaces to be smooth
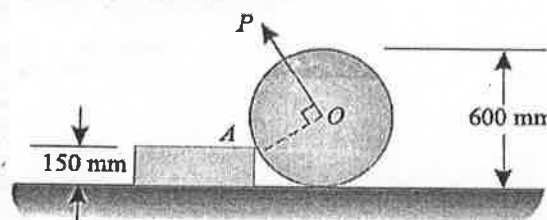
Figure 2

    c)   State and prove Varignon's theorem   (06)

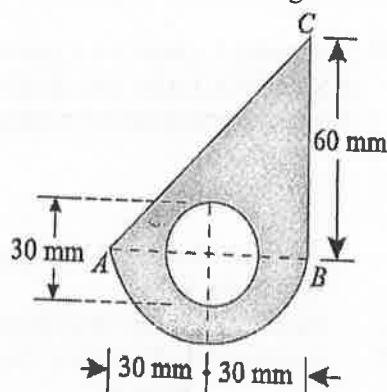Q.2   a) Find the moment of inertia of the lamina shown in figure 3 about the Axis AB   (08)

Figure 3

b) A uniform ladder 3m long weighs 200N. It is placed against a wall making an angle of 60^0 (12)
with the floor as shown in Figure 4 below.
The coefficient of friction between the wall and the ladder is 0.25 and that between the
floor and ladder is 0.35. The ladder, in addition to its own weight, has to support a man of
1000N at its top B. calculate:
i)   The horizontal force P to be applied to ladder at the floor level to prevent slipping.
ii)   If the force P is not applied, what should be the minimum inclination of the ladder
        with the horizontal, so that there is no slipping of it with the man at its top
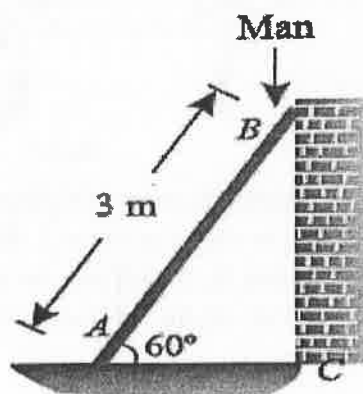

Figure 4

Q.3   a) A simply supported beam AB of 6m span is subjected to loading as shown in figure 5.   (10)
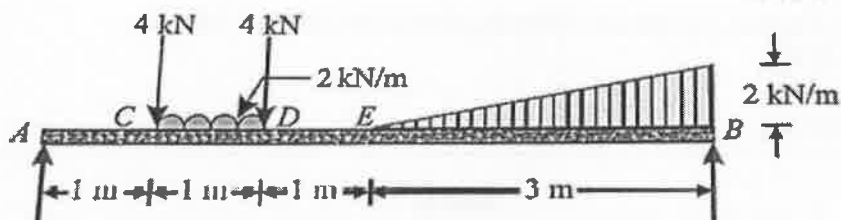Find the support reactions at A and B

Figure 5

b) A body weighing 1200N rests on a rough plane inclined at 12^0 to the horizontal. It is pulled up the plane by means of a light flexible rope running parallel to the plane and passing over a light frictionless pulley at the top of the plane as shown in figure 6. The portion of the rope beyond the pulley hangs vertically down and carries a weight of 800N. If the coefficient to friction for the plane and the body is 0.2, find   (10)
   i)   Tension in the rope
   ii)   Acceleration with which the body moves up the plane
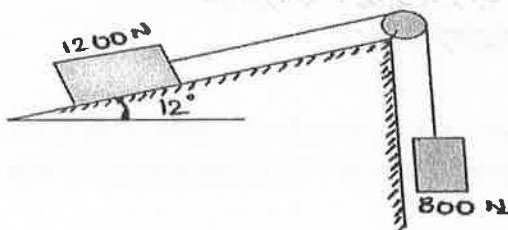   iii) The distance moved by the body in 3 seconds after starting from rest

Figure 6

Part B

Q.4   a) Explain and draw the following process on a P-V diagram   (08)
   (i)   Isochoric process
   (ii)   Isobaric process
   (iii) Adiabatic process
   (iv)   Isothermal process

   b) What is a thermodynamic cycle? Distinguish between the terms 'change of state', 'path' and 'process' and how do they relate to the thermodynamic cycle?   (08)

   c) Explain specific heat and latent heat   (04)

Q.5   a) State all the laws of thermodynamic with relevant illustrations   (10)
   b) Write a short note on Casting   (05)
   c) Write a short note on Forging   (05)

Q6   a) What is a thermodynamic system? What is the difference between open loop and closed loop system   (10)

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b) With neat diagram explain the following operations done on lathe (10)
   i)   Turning
   ii)   Knurling
   iii) Grooving

Part C

Q.7   a) Two identical rollers each of mass 50kg and radius 'R' are supported by inclined plane (10)
and a vertical wall as shown in Figure 7. Assuming smooth surfaces, find the reactions
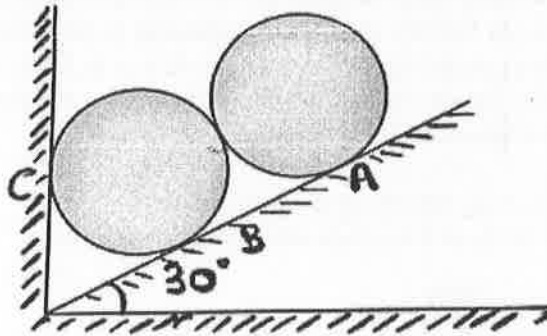induced at the point of support A, B and C.

Figure 7

b) A uniform lamina shown in Figure 8. Consists of a rectangle, a circle and triangle. (10)
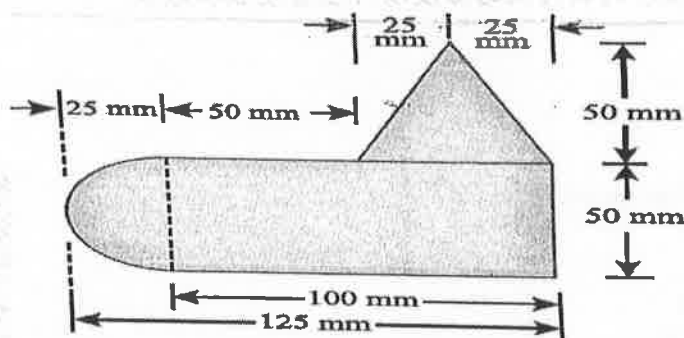Determine the Centre of gravity of the lamina. All dimensions are in mm

Figure 8

Q.8   a) Write short note on the following (06)
   i)   Intensive and extensive properties
   ii)   Path function and point function
b) Give the various types of lathes (06)
c) Briefly explain the Metal forming processes (08)

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