FE1901

Total No. of Printed Pages:05

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

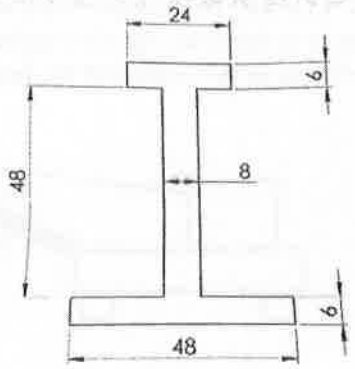
[Duration : Two Hours] **[Total Marks :60]**

Instructions:

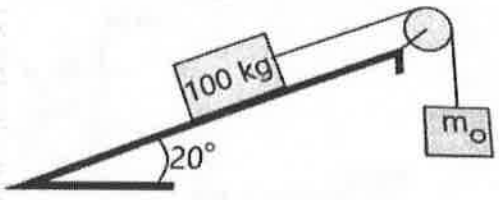
1. Answer THREE FULL QUESTIONS with ONE QUESTION FROM EACH PART
2. Read the question paper carefully.
3. Sketches are very important. Draw neat sketches wherever required.
4. Assume suitable data if required.

PART A

Q.1 a) State and explain the theorem of parallel axes for moment of inertia. And calculate the moment of inertia for the following object about the longest edge at the bottom of the figure. Dimensions are in mm. **(7)**



b) Determine the value for m_0 so that the setup as shown below remains in static equilibrium. The coefficient of friction is 0.3. Assume that the string connecting the two masses is inextensible and the pulley is massless and frictionless. **(6)**



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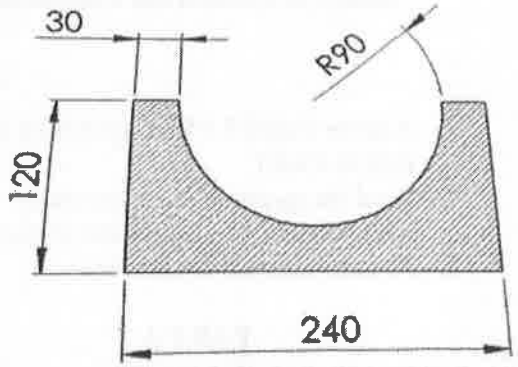
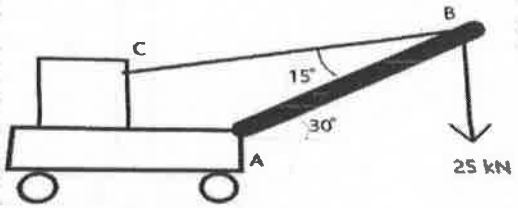
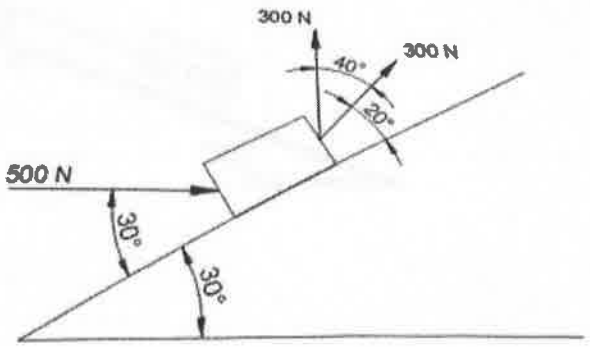
c) Determine the moment of inertia of the shaded area about the centroidal axes of the composite area. Dimensions are in mm. (7)



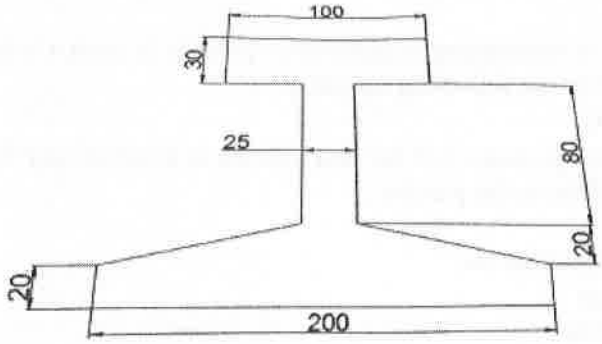
Q.2 a) A boom 'AB' is 12 m long and weighing 10kN, supports a weight of 25kN using a cable which extends from C to B and then supports the weight as shown in the figure. The center of gravity of the boom is at 6m from the pivot point A (as measured along the length of the boom). Solve for the forces in the cable and the boom. (7)



b) A block is placed on a ramp as shown in the figure. What is the weight of the block that is required to prevent impending motion down the ramp? The coefficient of friction between the block and the ramp is 0.3. (7)

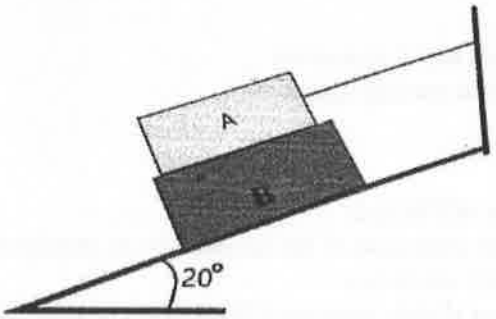


c) Referring to the figure, determine the moment of inertia of the composite area about the horizontal base. Dimensions are in mm. **(6)**

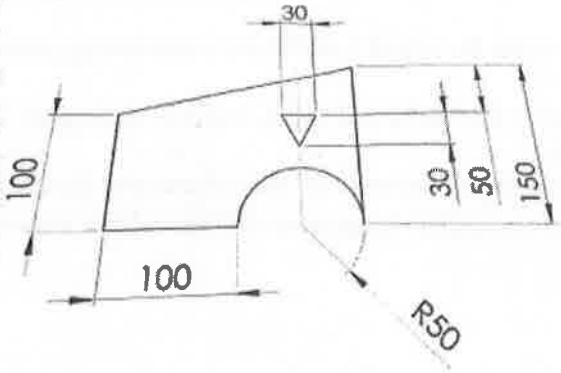


Q.3 a) Two blocks are on an inclined plane as in the figure. Masses of A & B are 10 kg & 25 kg respectively. The angle of the incline is 20^0. **(10)**

1. What is the minimum coefficient of friction to prevent the blocks from slipping?
2. What will be the value if the coefficient of friction between the blocks is 4 times that between the block and the ramp?



b) Determine the moment of inertia about the centroidal axes of the composite area shown in the figure. Dimensions are in mm. **(10)**



PART B

Q.4 a) What are the different types of thermodynamic systems? Give suitable examples of each. **(5)**

b) A system is undergoing a quasi-static process in such a way that the pressure and volume are linked by the following equation: **(5)**

$PV^{1.75} = C$

If the initial pressure is 2 bar and volume is $0.005m^3$ and final volume is $0.1m^3$. Calculate the work done in the process.

c) Write a short note on: **(5)**
1. Turning
2. Knurling

d) Write a note on lathe machine. **(5)**

Q.5 a) Explain the concept of internal energy. Justify whether it is a path or point function. **(5)**

b) Derive the expressions for work done in the following processes: **(5)**
1. Adiabatic process
2. Isothermal process

c) Write a note on sheet metal processes **(5)**

d) Write a note on thread cutting operation. **(5)**

Q.6 a) Explain the concept of PMM-2. **(5)**

b) Discuss the Clausius statement of the second law of thermodynamics. **(5)**

c) Write a note on CNC machines. **(5)**

d) With the help of neat sketch, explain differences between flat, v and round belt transmissions. **(5)**

PART C

Q.7 a) What do you mean by a rigid body? State work-energy principle for a rigid body. **(5)**

b) One mol of air at 0.45 MPa and 450 K, initially undergoes following processes (sequentially) **(5)**
1. Heating at constant pressure till the volume gets doubled and
2. Expansion at constant temperature till the volume is five times of initial volume.

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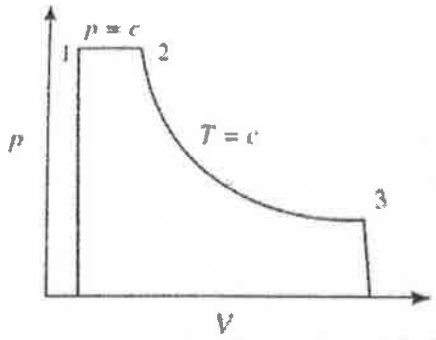
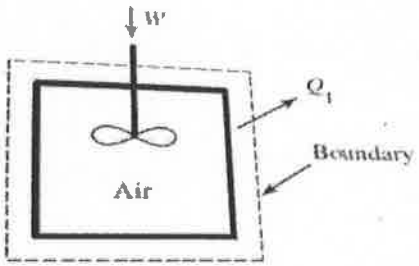


Determine the work in joules done by air.

c) Discuss the Kelvin Plank statement of the second law of thermodynamics. **(5)**

d) Write a note on metal joining processes. **(5)**

Q.8 a) A paddle wheel is used to stir a tank containing air as shown in the figure. The work input to the paddle wheel is 10 MJ and the heat transferred to the surroundings from the tank is 3 MJ. Determine the change in internal energy of the system. **(5)**



b) State and explain the perpendicular axes for moment of inertia. **(5)**

c) Explain the concept of adiabatic & isolated systems. Discuss them from the perspective of the first law of thermodynamics. **(5)**

d) Explain the working of the following processes: **(5)**

1. Open & closed die forging
2. Sheet metal bending