Total No. of Printed Pages:05

F.E. Semester-I (Revised Course 2016-17)
EXAMINATION OCTOBER 2020
Engineering Mechanics

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

Instruction:
1) Answer THREE FULL QUESTIONS with ONE QUESTION FROM EACH PART.
2) Assume any data if required and state them clearly

Part- A

Q.1 a) Two identical rods PQ and RS are welded perpendicular to each other to form a Tee as shown calculate the angle "θ" for the equilibrium of the given force system. **10**

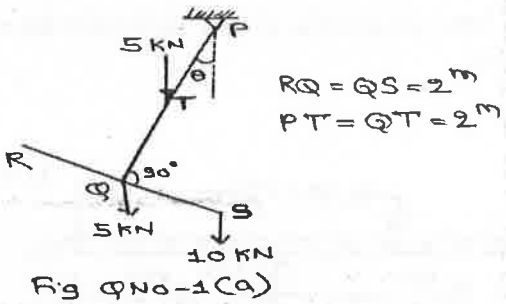


Fig QNo-1(a)

b) Determine the position of centroid of the shaded area for the plane figure with respect to axes shown. All the dimensions are in mms. **10**

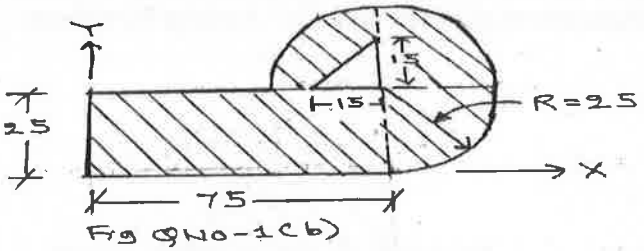


Fig QNo-1(b)

Q.2 a) A triangular lamina ABC is subjected to a system of co-planar forces as shown. Determine the resultant and locate its position with respect to point A. **14**

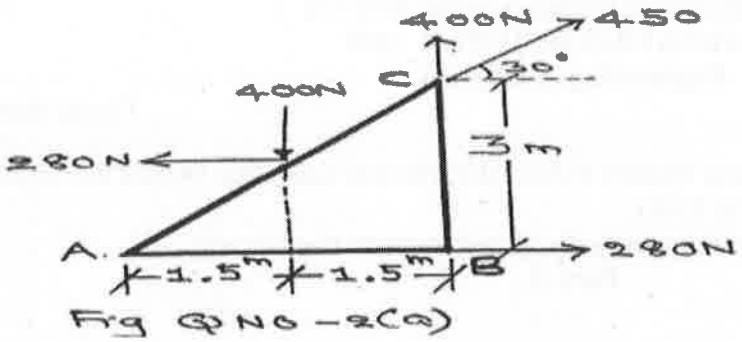


Fig Q No -2(a)

b) Derive an expression for the mass moment of inertia of a solid sphere of radius "R" about its centroidal axis **06**

Q.3 a) An overhanging beam ABC is loaded as shown. Determine the reactions using the Principle of virtual work. **06**

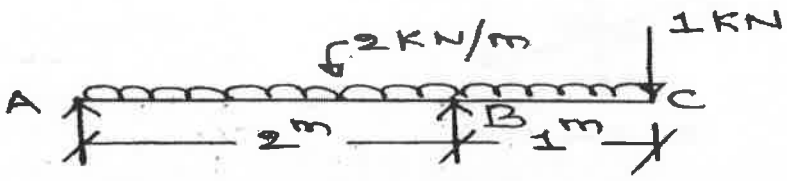


Fig Q No -3(a)

b) Determine the moment of inertia of the shaded area with reference to axes shown. also determine polar moment of inertia about "a" Assume PQ=50mm. **14**

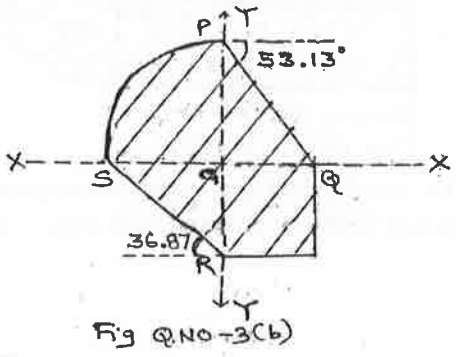


Fig Q.No -3(b)

Part- B

Q.4 Determine forces in all the members of the plane frame shown and tabulate the results **20**

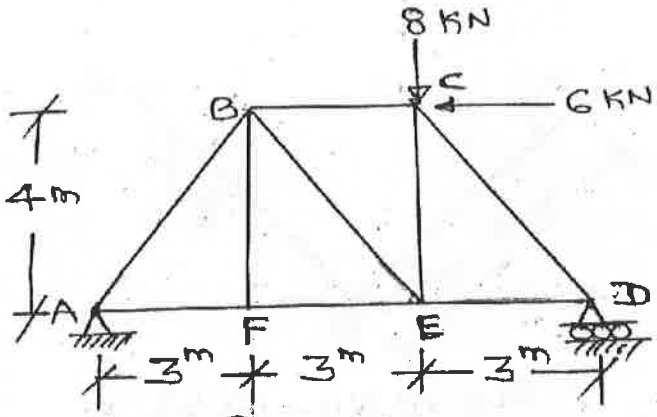


Fig QNo-4

Q.5 a) A ladder of length "L" and weighing "w" is resting against a vertical wall making an angle of "$\propto$ " with the horitzontal. If μ_1 =coeff of friction at floor level μ_2 = coeff of friction between the wall & ladder , show that at wall & ladder, show that at the point of slipping **10**

$$tan \propto = \frac{1-\mu_1\mu_2}{2\mu_1}$$

b) For the system shown, determine the time required to attain a velocity of 10m/sec starting from the rest. What is the magnitude of tension in the string. Assume the coeff of friction = 0.20 for plane AC and 0.30 for plane BC. Use "Impulse Momentum" Equation. **10**

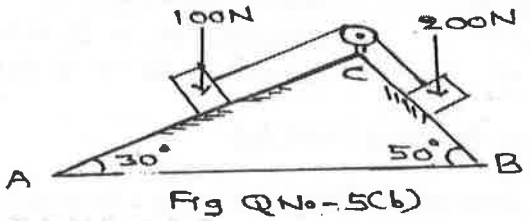


Fig QNo-5(b)

Q.6 a) In a differential wheel and axle, the wheel has a diameter of 360mm AND the diameters of axles are 180mm and 140mm resp. An effort of 76N is required to raise a load of 840N. calculate **10**

i) Mechanical Advantage, Velocity ratio and efficiency
ii) The effort lost in friction at a load of 1200N if the efficiency at this load is 60%
iii) Maximum efficiency

b) A body weighing 800N moves along two inclined planes as shown. It starts from rest at A and slides down 70m along plane AB. Find how far will the block move along the other plane BC. Determine the velocity of the block when it returns to B. Assume the **10**

coeff of friction = $\mu = 0.20$ for both the planes. Use "work Energy" principle

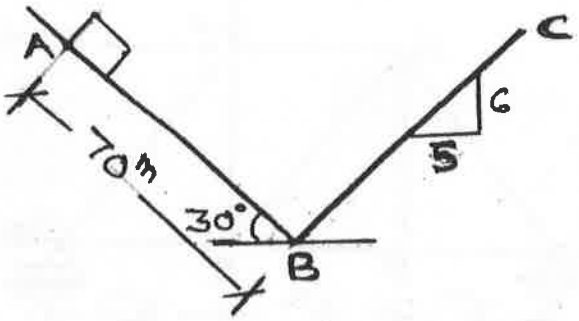


Fig Q No-6(b)

Part- C

Q.7 a) In a simple lifting machine, the Law of machine is given by the relation $P = 0.04W + 7.5$ .what is the Mechanical Advantage and efficiency when the l;oad is 2KN and velocity ration is 40 Find the maximum efficiency of the machine, and the effort lost in friction for the same load. **08**

b) Find the value of slope of the inclined plane [$\propto$] if the motion of the system shown is impending Assume coeff of friction =$\mu = 0.25$ **12**

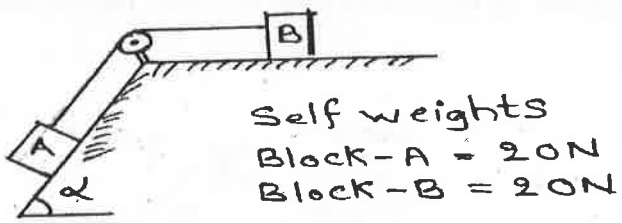
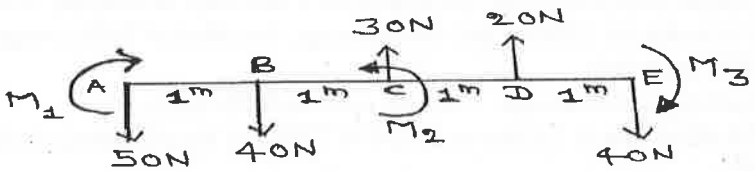


Fig Q No-7(b)

Q.8 a) Replace the given force system acting on a bar by a force and a couple acting at B. **08**



$M_1 = 85$ Nm, $M_2 = 65$ Nm

$M_3 = 90$ Nm.

Fig Q No-8(a)

b) For the system shown, find the acceleration of the system and also tension in the connecting string Assume coeff of friction $=\mu = 0.20$ use D' Alembert's Principle. **08**

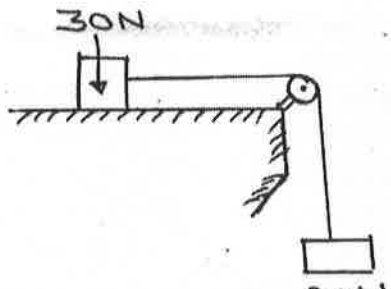


Fig QNo-8(b)

c) The polar moment of inertia of the lamina about point "A" is $45 \times 10^6\ mm^4$ the area of the lamina is $1000mm^2$. Determine moment of inertia about both the centrioidal axes of $I_{YY} = 2I_{XX}$ **04**

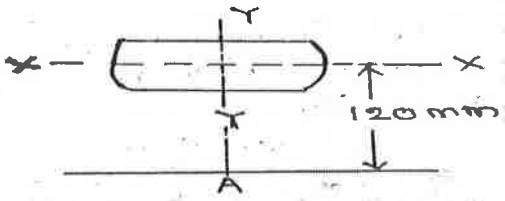


Fig QNo-8(c)