SEM 1 – 4 (RC 16-17)

F.E. (Semester – I) (Revised in 2016-2017) Examination, May/June 2017
ENGINEERING MECHANICS

Duration : 3 Hours | Total Marks : 100

Instructions : *1) Attempting **one** question from Part – **C** is **compulsory**.*
*2) Assume **any** data **if** required and state them **clearly**.*

PART – A

Answer **any two** questions of the following :

1. a) A lever ABC of a machine is hinged at B and is subjected to a system of co-planar forces as shown. Find the magnitude of the force (p) to keep the lever in equilibrium. Also determine reaction at hinge "B". **10**

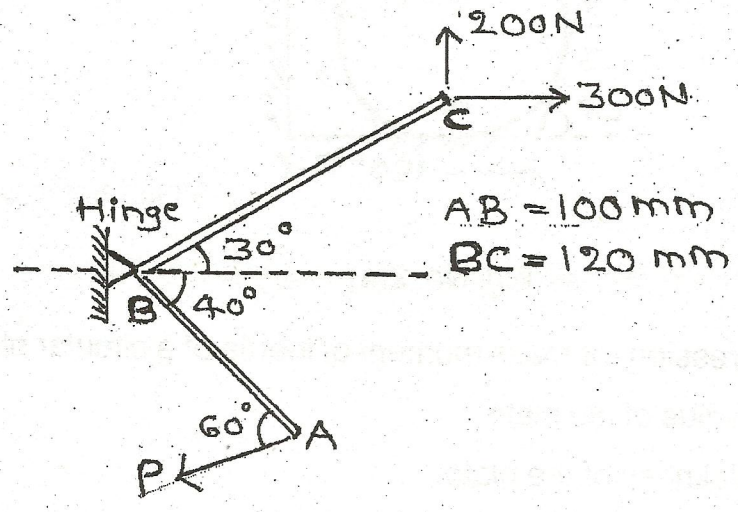

Fig. No. 1(a)

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

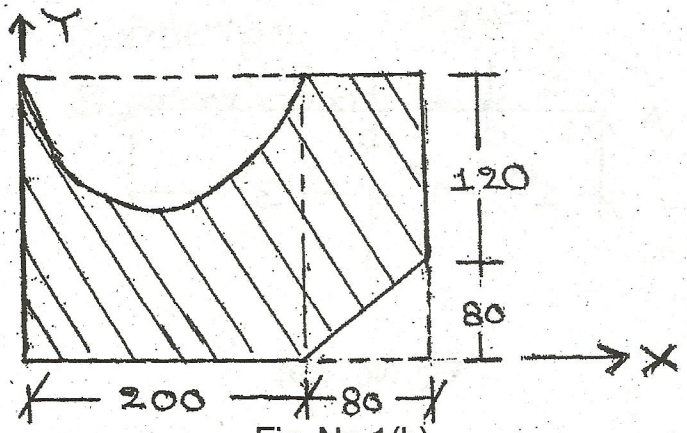

Fig. No.1(b)

P.T.O.

2. a) Two spheres rest in a channel section as shown. The smaller sphere has a diameter of 100 mm and weighs 200 N. The bigger sphere has a diameter of 180 mm and weighs 500 N. Determine the reactions at all the four points of contact 1, 2, 3 and 4. The width of the channel at the base is 180 mm. **14**

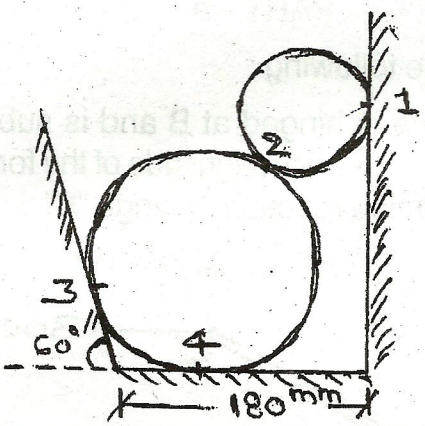

Fig. No. 2(a)

b) Derive an expression for mass moment of inertia of a circular plate.
Assume R = radius of the plate
t = thickness of the plate. **6**

3. a) Determine the reactions using the principle of virtual work for the beam shown. **6**

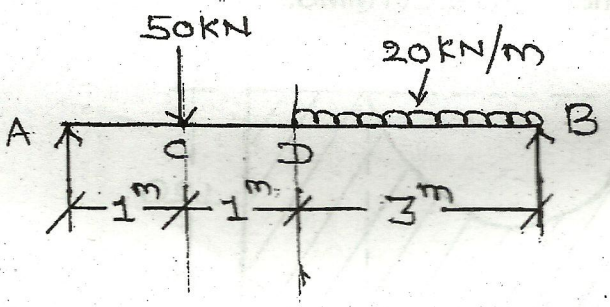

Fig. No. 3(a)

b) Determine the moment of inertia of the plane figure shown about both the centroidal axes. All the dimensions are in MMS. **14**

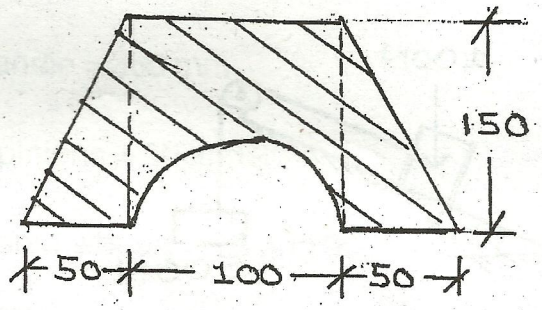

Fig. No. 3(b)

PART – B

Answer **any two** of the following :

4. a) Determine the forces in all the members of the plane frame shown and tabulate the results. **12**

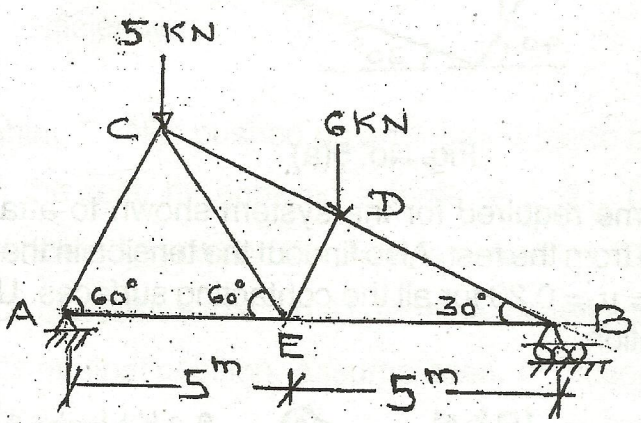

Fig. No. 4(a)

b) For the system shown, find the acceleration of the system, tension in the string and also the distance moved in 30 seconds starting from the rest. Assume coeff. of friction = μ = 0.20. Use D' Alembert's principle. **8**

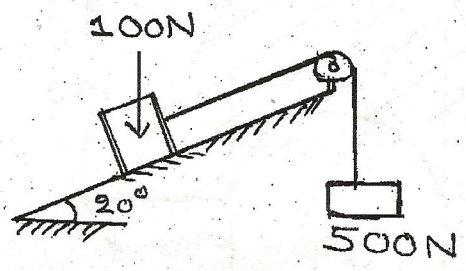

Fig. No. 4(b)

5. a) Determine the minimum and maximum values of the load "W_2" for which the system is in equilibrium. Assume the angle of friction for both the planes as 20°. **12**

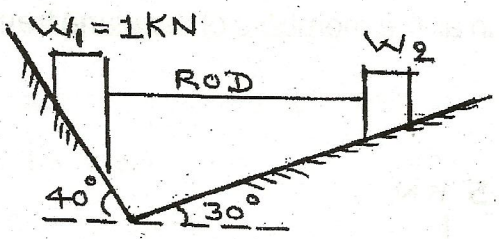

Fig. No. 5(a)

b) Determine the time required for the system shown to attain a velocity of 20 m/sec starting from the rest. Also findout the tension in the string. Assume coeff. of friction = μ = 0.20 for all the contacting surfaces. Use Impulse Momentum Equation. **8**

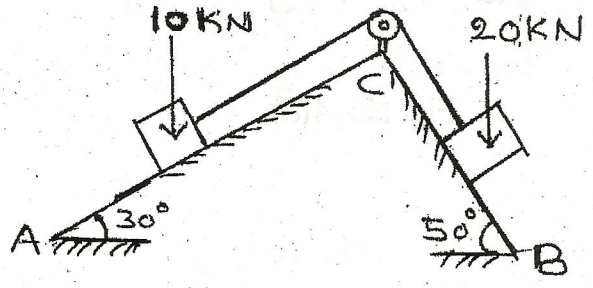

Fig. No. 5(b)

6. a) A double purchase winch crab has the following details.

Diameter of the load drum = 160 mm

Length of the handle = 360 mm

No. of teeth on pinions = 20 and 30

No. of teeth on spur wheels = 75 and 90

It was found that an effort of 90 N lifted a load of 1.8 kN and an effort of 135 N lifted a load of 3.15 kN. Determine : **10**

i) Law of machine

ii) Effort required to lift a load of 4.5 kN

iii) Efficiency of the machine in the above case

iv) Maximum efficiency.

b) A block weighing 2 kN is pushed up an inclined plane by a distance of 8 m starting from the rest, by applying a force of 2 kN. The force is applied parallel to the inclined plane and the plane is inclined at 40° with the horizontal. Then the force of 2 kN is removed. Determine the velocity of the block when it returns to its original position. Assume coeff. of friction = μ = 0.30. Use "work energy" principle. **10**

PART – C

Attempt **any one** of the following :

7. a) The table shows the efforts required for lifting various loads in a simple lifting machine of velocity ratio = 20. Determine law of machine, maximum efficiency and an effort required to lift a load of 300 N. **8**

Load in N	50	70	80	90	100
Effort in N	11.4	15.5	17.6	19.5	21.4

b) Determine the value of "P" just to start the motion of the concrete block. Assume coeff. of friction = μ = 0.25 for all contacting surfaces. **12**

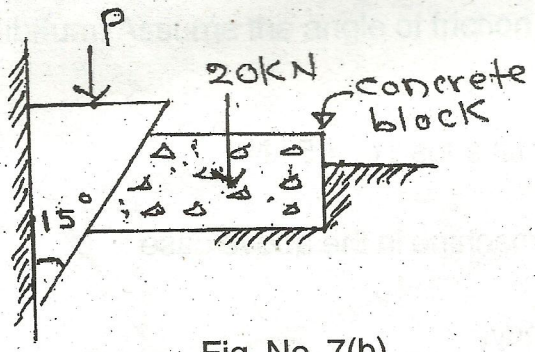

Fig. No. 7(b)

8. a) Determine reactions for the beam shown. **8**

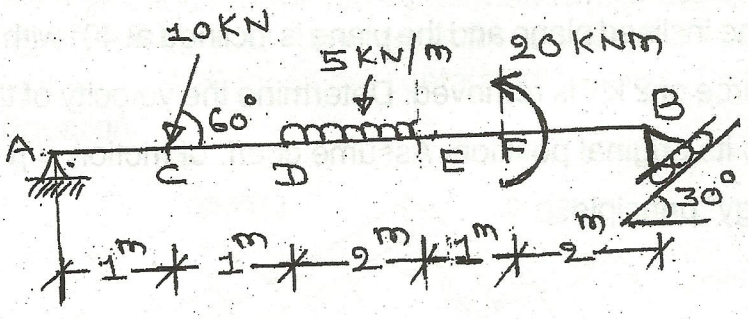

Fig. No. 8(a)

b) Determine forces in all the members of the plane frame show using method of sections. 6

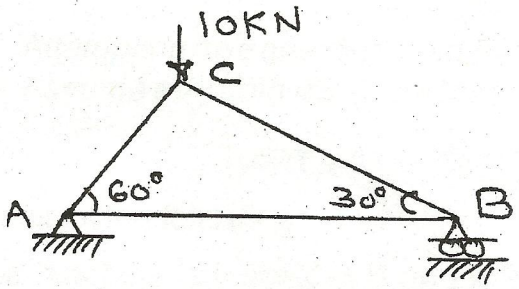

Fig. No. 8(b)

c) Determine moment of inertia about the axis AB for the plane Lamina shown. 6

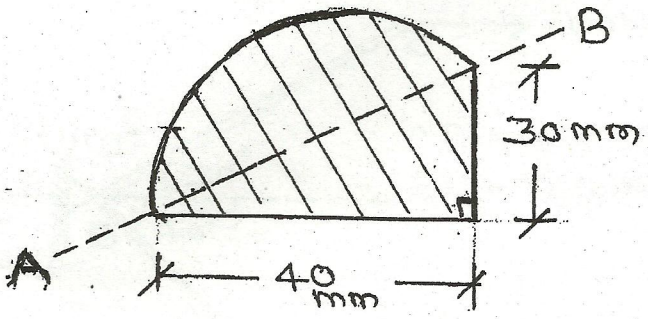

Fig. No. 8(c)