SEM 1– 4 (RC 16 -17)

F.E. (Semester – I) (Revised Course 2016-17) Examination, May/June 2018
ENGINEERING MECHANICS

Duration : 3 Hours | Total Marks : 100

Instructions *: 1) Attempt **two** questions from Part **A**, **two** questions from Part **B** and **one** question from Part **C**.*
*2) Figures to the **right** indicate **full** marks.*
*3) Make suitable assumptions **wherever** necessary.*

PART – A

1. a) Two identical prismatic bars PQ and RS weighing 75 N are welded together to form a 'TEE' and are suspended in a vertical plane as shown in figure below. Calculate the value of 'θ' that the bar PQ will make the vertical when a load of 100 N is applied at S. **10**

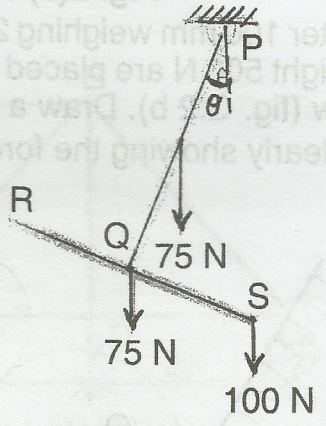

Fig. 1(a)

b) Determine the position of the centroid of the shaded area with respect to the X and Y axis marked on the figure (fig. Q.1 b) (All dimensions are in cms). **10**

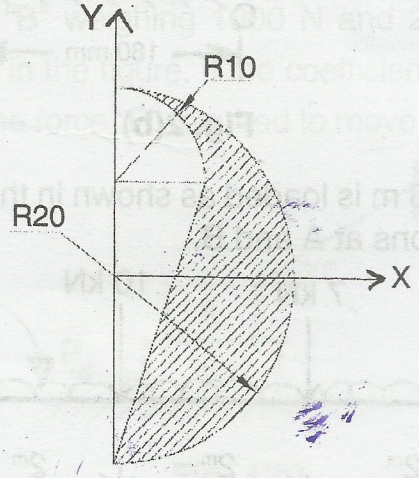

Fig. 1(b)

P.T.O.

2. a) Calculate the moment of inertia and radius of gyration of the shaded area about the centroidal X-X axis and axis BC marked on the figure (fig Q.2 a). **14**

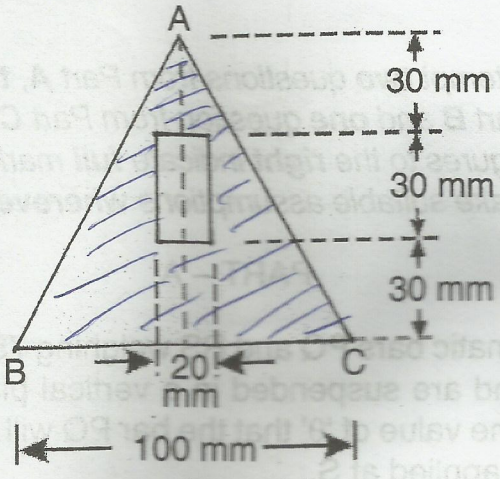

Fig. 2(a)

b) A cylinder P of diameter 100 mm weighing 200 N each and cylinder Q of 180 mm diameter and weight 500 N are placed in a channel of 180 mm width as shown in figure below (fig. Q.2 b). Draw a neat labelled free body diagram for all the cylinders clearly showing the forces and reactions. **6**

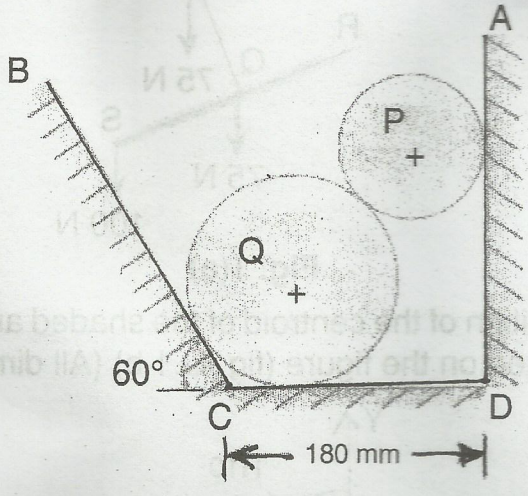

Fig. 2(b)

3. a) A beam A-B of span 6 m is loaded as shown in the figure below (fig. Q.3 a). Determine the reactions at A and B. **10**

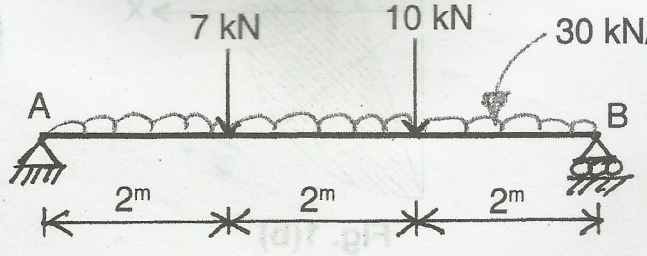

Fig. 3(a)

b) Two beams AD and DF of spans 5 m and 4 m respectively are hinged at C and supported at A, D and F. The beams are loaded as shown in the figure below (fig. Q.3 b); using the principle of virtual work, find the reaction at D. **10**

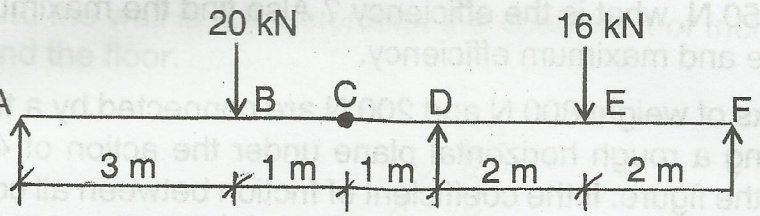

Fig. 3(b)

PART – B

4. a) Find the forces in all the members of the plane frame shown (fig. Q.4 a). Tabulate the results. **12**

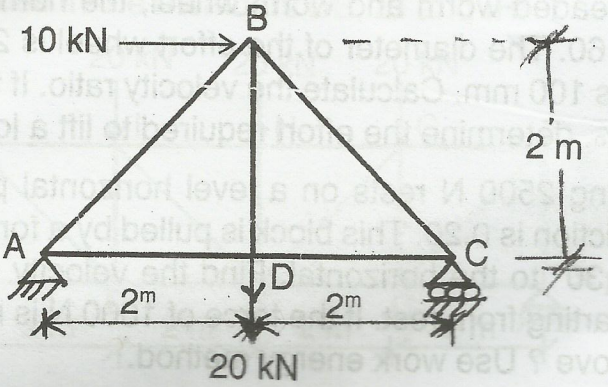

Fig. 4(a)

b) Two blocks "A" and "B" weighing 1000 N and 2000 N respectively are in equilibrium as shown in the figure. If the coefficient of friction at all contacting surfaces is 0.3, find the force "P" required to move the block "B". **8**

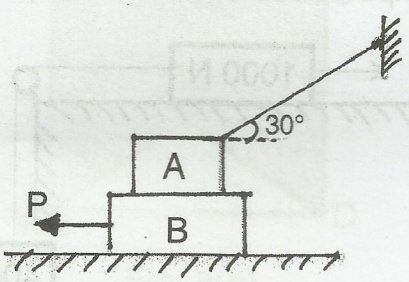

Fig. 4(b)

5. a) In a weight lifting machine an effort of 150 N raised a load of 7700 N. What is the mechanical advantage ? Find the velocity ratio if the efficiency at this load is 60%. If by the same machine, a load of 13,200 N is raised by an effort of 250 N, what is the efficiency ? Also find the maximum mechanical advantage and maximum efficiency. **10**

b) Two blocks of weight 800 N and 200 N are connected by a thread and they move along a rough horizontal plane under the action of 400 N force as shown in the figure. If the coefficient of friction between all contact surfaces is 0.3 determine the acceleration of the weight and tension in the thread. Use D' Alembert's principle. **10**

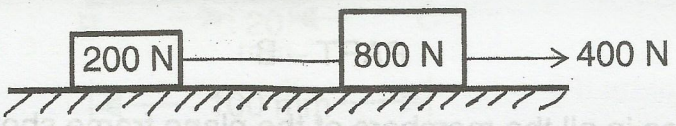

Fig. 5(b)

6. a) In a double threaded worm and worm wheel, the number of teeth on the worm wheel is 60. The diameter of the effort wheel is 250 mm and that of the load drum is 100 mm. Calculate the velocity ratio. If the efficiency of the machine is 50%, determine the effort required to lift a load of 300 N. **10**

b) A block weighing 2500 N rests on a level horizontal plane for which the coefficient of friction is 0.20. This block is pulled by a force of 1000 N acting at an angle of 30° to the horizontal. Find the velocity of the block after it moves 30 m starting from rest. If the force of 1000 N is removed how much further will it move ? Use work energy method. **10**

PART – C

7. a) The system shown in the figure has a rightward velocity of 4 m/sec, just before a force "P" is applied. Determine the value of "P" that will give a leftward velocity of 6m/sec in a time interval of 20 sec. Take coefficient of friction is 0.20. Use Impulse Momentum Principle. **12**

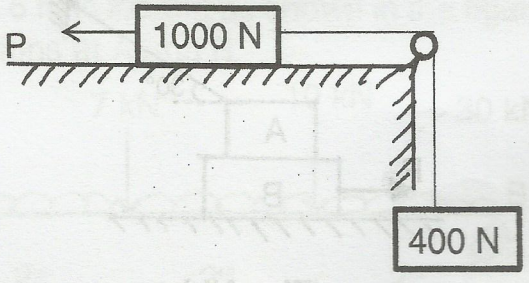

Fig. 7 (a)

b) A 4m long ladder weighing 200 N is placed against a vertical wall and a horizontal floor. As a man weighing 800 N reaches a point 2.7 m from A, the ladder is about to slip. Assuming that the coefficient of friction between the ladder and the wall is 0.2, determine the coefficient of friction between the ladder and the floor. **8**

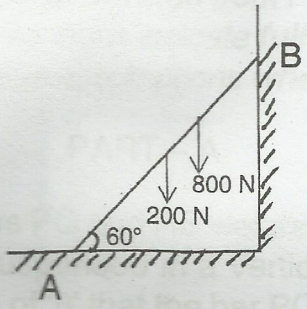

Fig. 7(b)

8. a) For a pin jointed truss shown in the figure (fig Q. 8a), determine the magnitude and nature of forces in the members DE, EI and IH. **10**

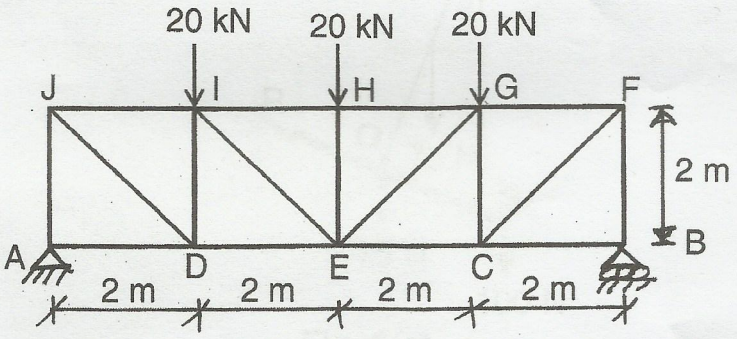

Fig. 8(a)

b) An isosceles triangle is to be cut from one edge of a square plate of side 1 m such that the remaining part of the plate remains in equilibrium in any position when suspended from the apex for the triangle. Find the area of the triangle to be removed. **10**

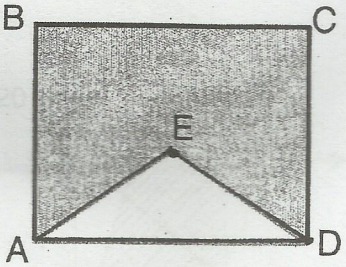

Fig. 8(b)