Total No. of Printed Pages:05

F.E Semester-I (Revised Course 2016-17)
EXAMINATION JANUARY 2021
Engineering Mechanics

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

Instruction: 1. Answer THREE FULL QUESTIONS with ONE QUESTION FROM EACH PART.
2. Figures to the right indicate full marks
3. Make suitable assumptions wherever necessary.

Part- A

Q.1   a) Two identical prismatic bars PQ and RS weighing 75N are welded together to form a   **10**
TEE' and are suspended in a vertical plane as shown in figure below. Calculate the
value of $'\theta'$ that the bar PQ will make the vertical when a load of 100N is applied at S
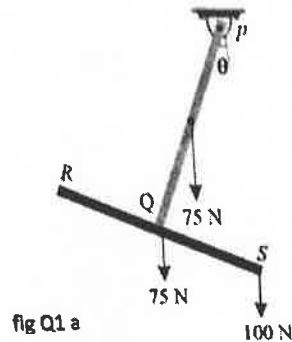
fig Q1 a
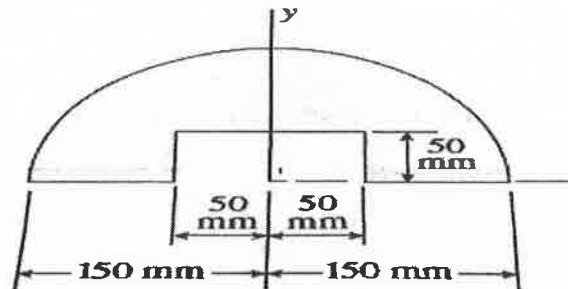
b) Determine the position of the centroid of the shaded area with respect to the X and Y
axis marked on the figure (fig Q.1 b)   **10**

fig Q1 b

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4C3902C9DA74561D19861342C0DDF1D9
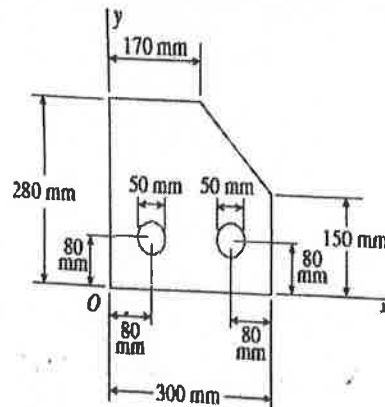
Q.2 a) Calculate the moment of inertia and radius of gyration of the shaded area about the centroidal X-X axis and Y-Y axis AB (figQ.2 a)   **14**

fig Q2 a

b) A cylinder P of diameter 100mm weighing 200N each and cylinder Q of 180 mm diameter and weight 500N 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   **06**
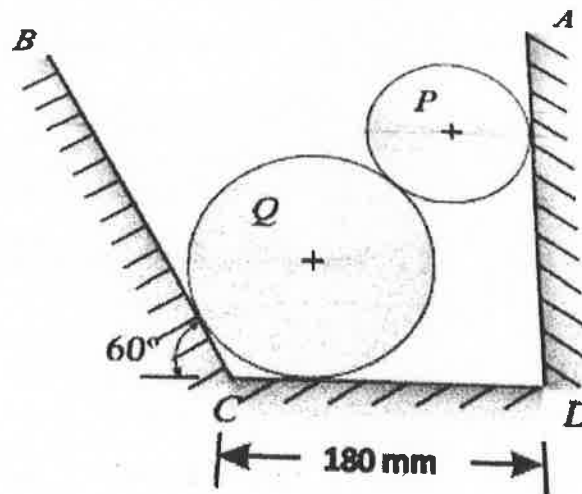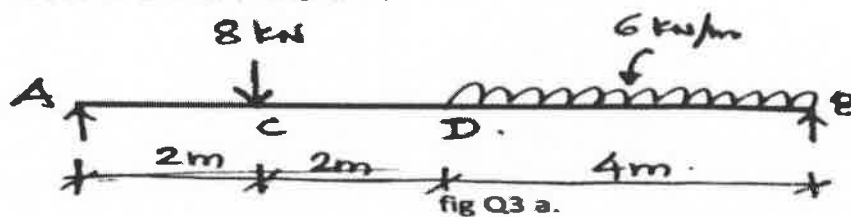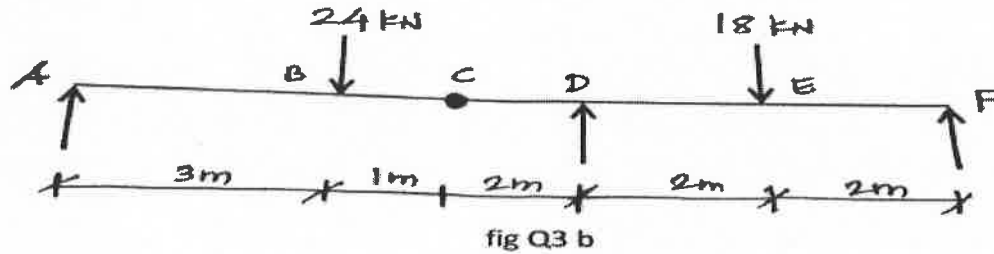
fig Q2 b

Q.3 a) A beam A-B of span 8 m is loaded as shown in the figure below.(Fig Q.3 a)Determine **10** the reactions at A and B graphically.

fig Q3 a.

b) Two beams AD and DF of spans 6m and 4m respectively are hinged at C and   **10**
supported at A,D and F. the beams are loaded as shown in the figure below (figQ.3b)
using the principle of virtual work, find the reaction at D

fig Q3 b

Part- B

Q.4   a) Find the forces in all the members of the plane frame shown (figQ4 a). tabulate the   **12**
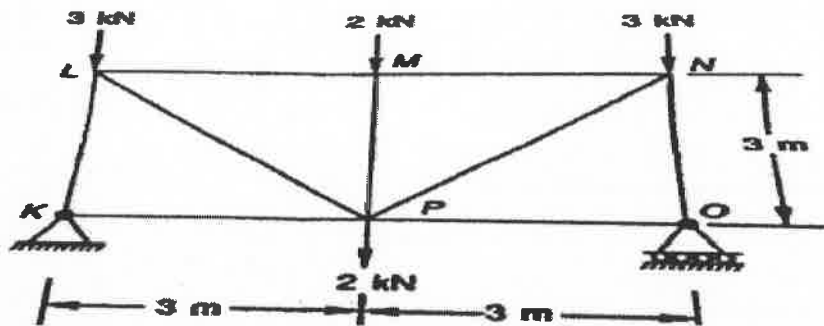results

Fig Q.4.a

b) Block A of weight 300N rests n block B of weight 400N. Block A is restrained from   **8**
moving by a horizontal string tied at point C. what force 'P' applied parallel to the
plane inclined at $30°$ with horizontal is necessary to start block B down the plane. Take
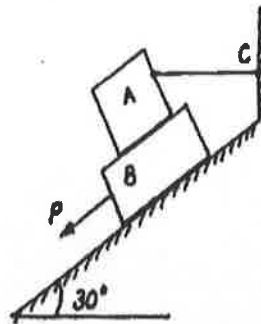$\mu = 0.35 \ for \ all \ surfaces$

Fig Q.4.b

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Q.5   a) In a weight lifting machine an effort of 150N raised a load of 5000N. what is the   **10**
mechanical advantage? Find the velocity ratio if the efficiency at this load is 75%. If
by the same machine a load of 10,000N is raised by an effort of 280N, what is the
efficiency? Also find the maximum mechanical advantage and maximum efficiency

                                                                                           10

    b) A body of mass 150kg rests on a rough plane inclined at $10°$ to the horizontal . it is
pulled up the plane from rest by means of a light flexible rope running parallel to the
plane. The portion of the rope beyond the pulley hangs vertically downwards carries a
mass of 80kg at the end .$\mu = 0.2$ for the plane and the body. using D' Alembert's
principle find the tension in the rope, the acceleration with which the body moves up
the plane and the distance moved by the body in 4 seconds starting from rest.

Q.6   a) In a worm and worm wheel the number of teeth in the worm wheel is 25. The effort   **10**
handle is 25 cms long and load drum is of 15cm diameter. Find the efficiency of the
machine if an effort of 30N can lift a load of 325N. Worm is single threaded.

    b) A block weighing 2500N rests on a level horizontal plane for which the coefficient of   **10**
friction is 0.25. this block is pulled by a force of 1000N acting at an angle of $30°$ to the
horizontal. find the velocity of the block after it moves 30m starting from rest. if the
force of 1000N is removed how much further will it move? Use work Energy method

Part- C

Q.7   a) The system shown in the figure has a rightward velocity of 4m/sec just before a force   **12**
"P" is applied. Determine the value of "P" that will give a leftward velocity of
7.5m/sec in a time interval of 25sec. take coefficient of friction is 0.25 use impulse
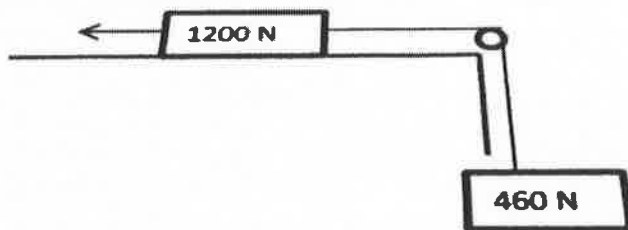Momentum Principle.

Fig Q.7.a

    b) A uniform ladder of 4m length rests against a vertical wall with which it makes an   **08**
angle of $45°$. the coefficient of friction between the ladder and the wall is 0.4 and that
between ladder and the floor is 0.5. if a man, whose weight is one –half of that of the
ladder, ascends it, how high will he be when the ladder slips?

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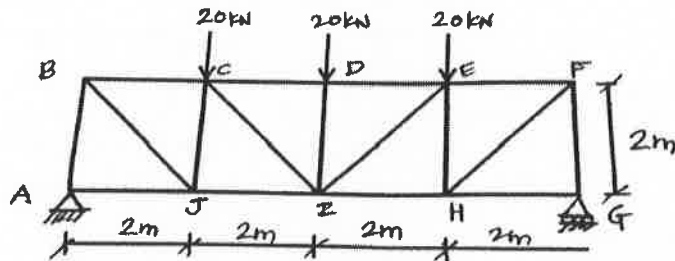nature of forces in the members DE, EI and IH

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fig Q8 a

b) A thin homogenous composite plate is formed by a semi- circular and a triangular shape as shown in fig Q.8b is freely suspended from point A. if the side BC remains horizontal in equilibrium condition then find the length of the side BC
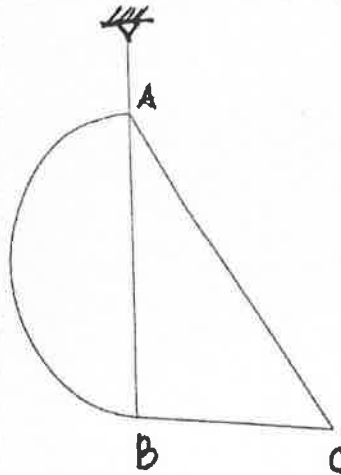
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Fig Q.8 b