Total No. of Printed Pages:5

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

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

Instructions:
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) Determine the values of α and θ so that the forces shown in figure Q1a will be in equilibrium **(10)**

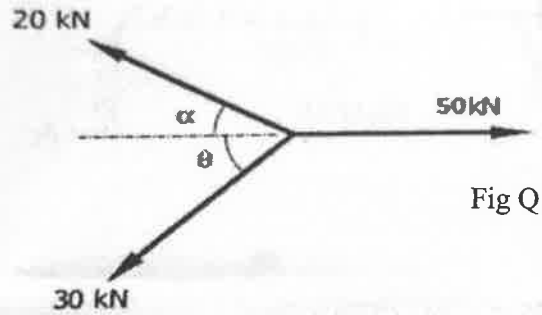


Fig Q1 a

b) Determine the position of the centroid of the shaded area with respect to the X and Y axis marked on the figure (fig Q1 b.) (all dimensions are in mm). **(10)**

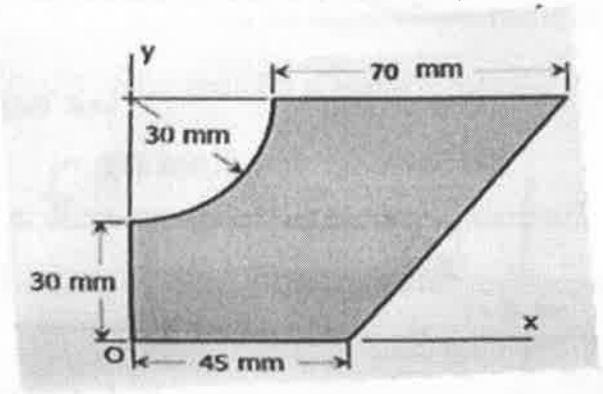


Fig Q1 b

Q.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 Q2 a.). **(14)**

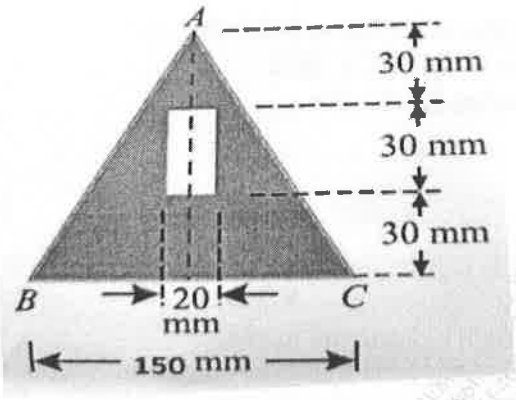


Fig Q2 a

b) An electric bulb weighing 200N is suspended between wall and the roof by two wires as shown in fig. Q2 (b). Determine the tension in the wires using Lami's theorem. **(06)**

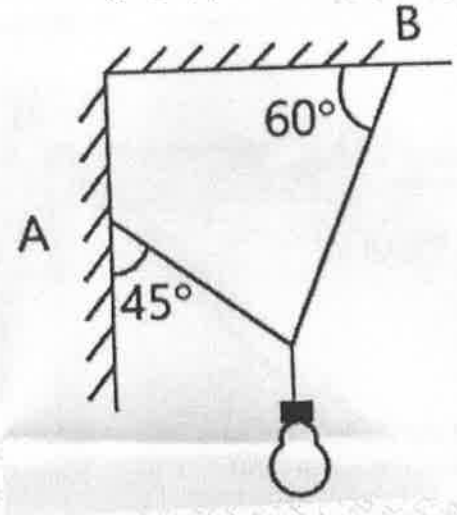


Fig Q 2 b

Q.3 a) A beam A- B is loaded as shown in the figure below. (Fig Q3a.) Determine the support reactions. **(10)**

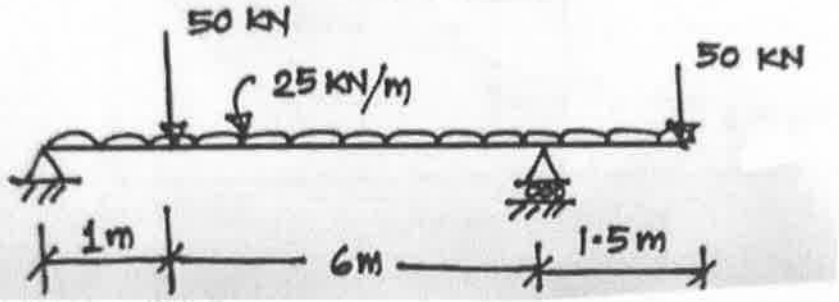


Fig Q 3 a

b) A two span beam is loaded as shown in the figure below (fig Q3 b); using the principle of virtual work, determine the reaction at C. **(10)**

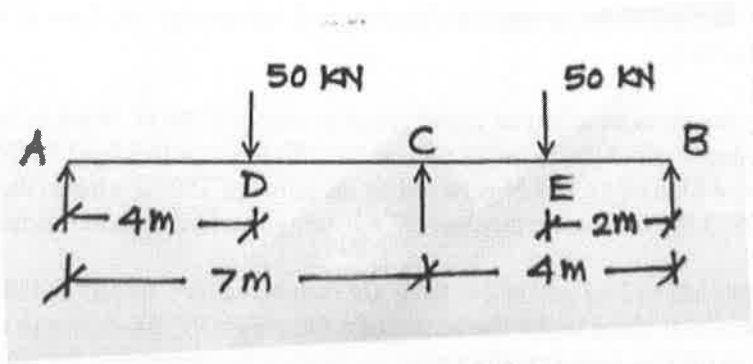


Fig Q3 b

PART B

Q.4 a) Determine the forces in all members of the plane frame shown (fig Q4 a). Tabulate the results. **(08)**

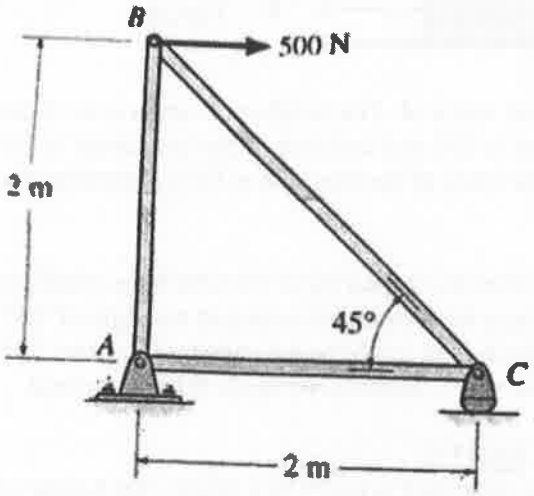
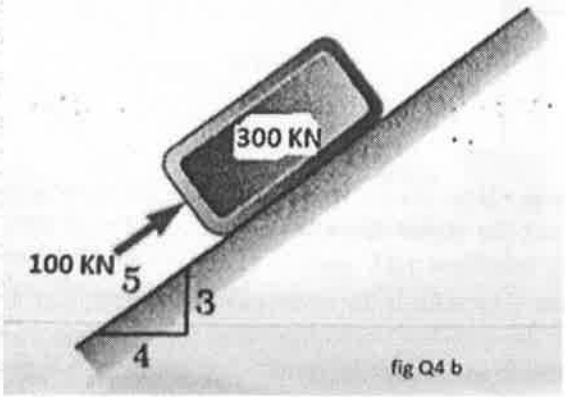


Fig Q4 a

b) A 100 KN fore acts on a body weighing 300 KN block placed on an inclined plane. The coefficients of friction between the block and the plane are $\mu_s = 0.28$ and $\mu_k = 0.22$. determine whether the block is in equilibrium and find the value of friction force. **(08)**



c) Define the following; (i) Velocity ratio (ii) Mechanical Advantage (iii) Law of the machine (iv) efficiency. **(04)**

Q.5 a) In a simple lifting machine an effort of 200N raised a load of 5700 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 11,200 N is raised by an effort of 350 N, what is the efficiency? Also find the maximum mechanical advantage and maximum efficiency. **(10)**

b) Two blocks of mass M1=12 kg and M2 = 18kg are connected by a thread and they move along a rough horizontal plane under the action of a force F=90N. As shown in the figure. If the coefficient of friction between all contact surfaces is 0.2 determine the acceleration of the weight and tension in the thread. Use D' Alembert's principle. [Fig Q5 b] **(10)**

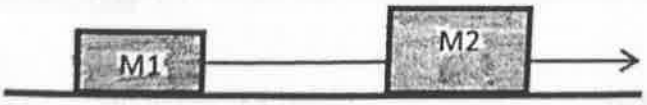


Fig Q5b

Q.6 a) A worm and worm wheel is **n** threaded and n=4. 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 of lift a load of 30N. **(10)**

b) A block weighing 2000 N rests on a level horizontal plane for which the coefficient of friction is 0.20. This block is pulled by a force of 800 N acting at an angle of 20^o to the horizontal. Find the velocity of the block after it moves 8m starting from rest. If the force of 800N is removed how much further will it move? Use Work Energy method. **(10)**

PART C

Q.7 a) The system shown in the figure has a rightward velocity of 4 m/sec, just before a force P=1600 n is applied. Determine the time at which (i) system will have no velocity and (ii) System will have a leftward velocity of 6 m/sec. take coefficient of friction is 0.20. Use Impulse Momentum Principle. [fig Q7 a] **(12)**

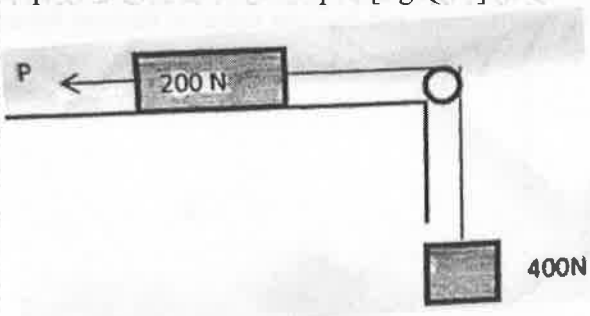


Fig Q7 a

b) A ladder having a mass of 20 kg has C.G at G. If the coefficients of Friction at A and B are 0.3 0.2, respectively, determine the smallest horizontal force that the man must exert of the ladder at point C in order to push the ladder forward. **(08)**

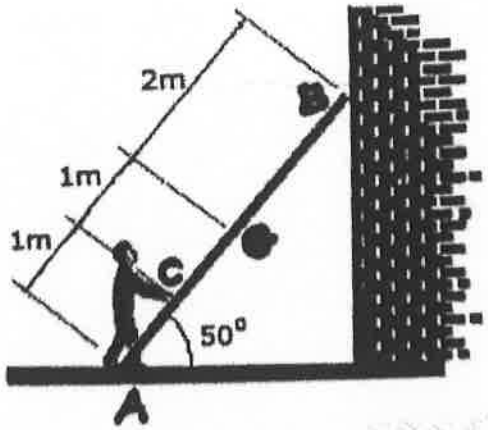


Fig Q7b

Q.8 a) For a pin jointed truss shown in the figure (Fig Q 8a) , determine the magnitude and nature of forces in the members EF, EC and BC. **(10)**

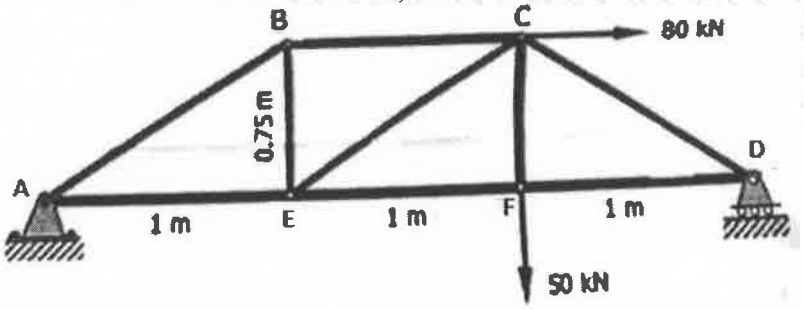


Fig Q 8a

b) Calculate the reaction at the contact surface for two identical cylinders weighing 1000N each as shown in fig. Q8 (b). **(10)**

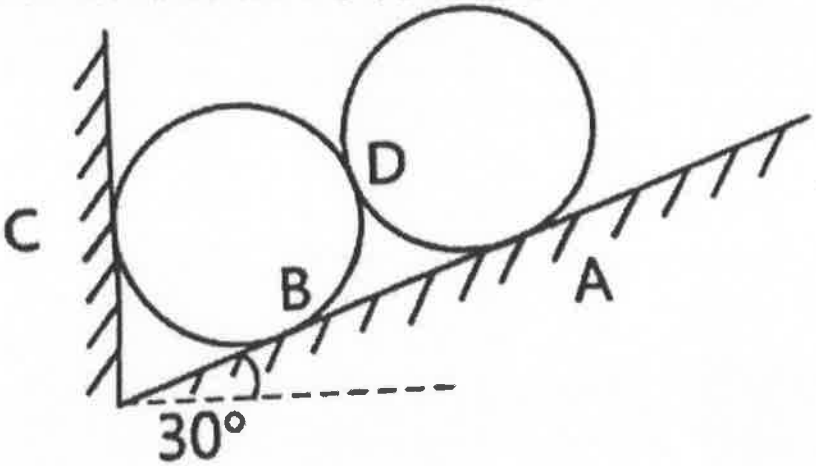


Fig Q 8b