B.E. Second Semester (C.B.S.) / B.E. Second Semester (Fire Engineering)

Engineering Mechanics Paper – IV

P. Pages : 4 **KNT/KW/16/7205**

Time : Two Hours * 0 0 8 7 * Max. Marks : 40

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Due credit will be given to neatness and adequate dimensions.
7. Assume suitable data whenever necessary.
8. Illustrate your answers whenever necessary with the help of neat sketches.
9. Use of non programmable calculator is permitted.

1. a) State and explain Varignon's principle of moment. **3**

b) A system consists of force $\bar{F} = 25\bar{i} + 40\bar{j} - 30\bar{k}$ (N) passing through point 'A' with a couple moment of 90 Nm in the direction of force $\bar{F}$. The position vector of point 'A' is given by $\bar{r} = 2\bar{i} + \bar{j} + \bar{k}$. Calculate the moment of the given system about the origin. **7**

OR

2. a) Find the resultant force of the system as shown in the figure (2a) and locate the position of its line of action along OD. **5**

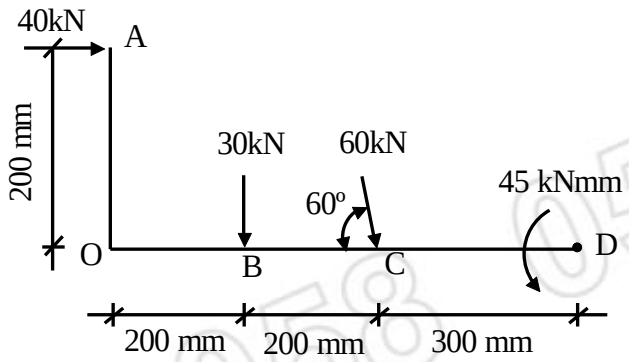


Fig. 2(a)

b) A force 'F' of 2500N is acting from A (2, -1, 3) to B (5, 6, 2) **5**
Determine :

i) Moment of the force 'F' about point C(-3, 3, 3)

ii) Moment of the force 'F' about a line $\bar{L} = (-i + j - 2k)$ passing through the point 'C'.

3. a) Define Free Body Diagram and explain with neat sketches. **3**

b) Three bars mechanism is pinned at B and C and supported at hinges A and D as shown in the fig. (3b). Determine the value of 'P' that will prevent motion of the mechanism. **7**

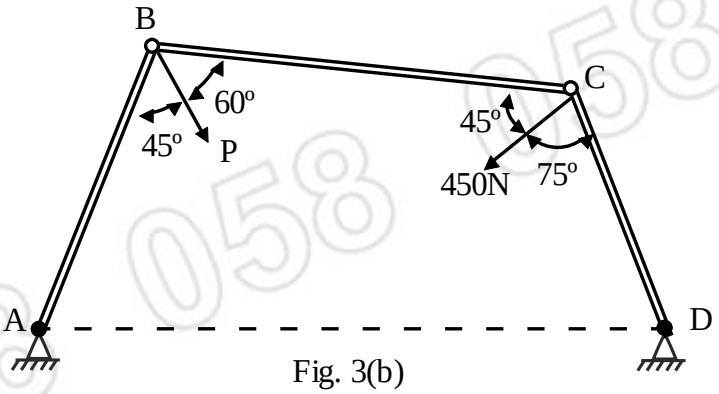


Fig. 3(b)

OR

4. a) Determine the reactions at the supports for the given type of loads as shown in the fig. (4a). **5**

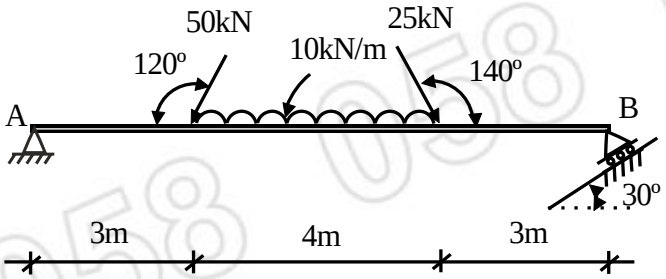
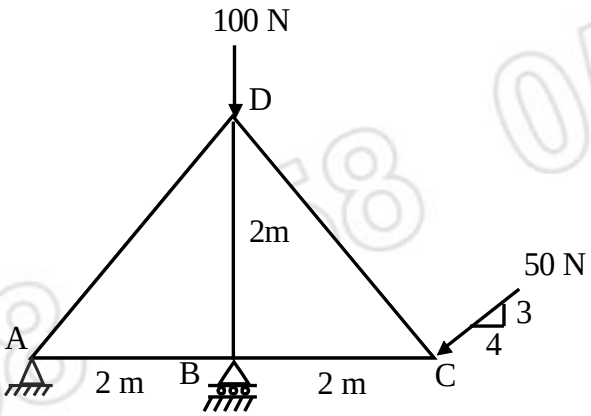


Fig. 4 (a)

b) Find the forces in all the members of given Truss, as shown in fig., 4(b). **5**



5. a) State parallel axis theorem of moment of inertia. **2**

b) Determine the moment of inertia of the shaded region as shown in fig. (5b) about the given x and y references axes. **8**

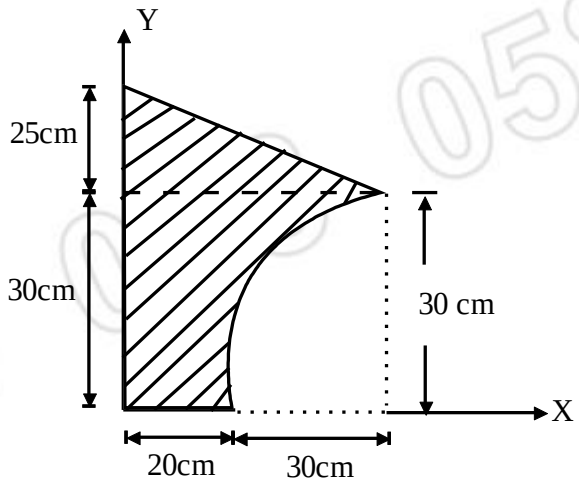


Fig. 5 (b)

OR

6. a) State and explain the principle of virtual work. **3**

b) Using the method of virtual work, determine the values of angles θ_1, θ_2 and θ_3 at the equilibrium position of three homogeneous links each weighing 200N and 3m long. The mechanism is held in equilibrium by 300N horizontal force as shown in fig. (6b). **7**

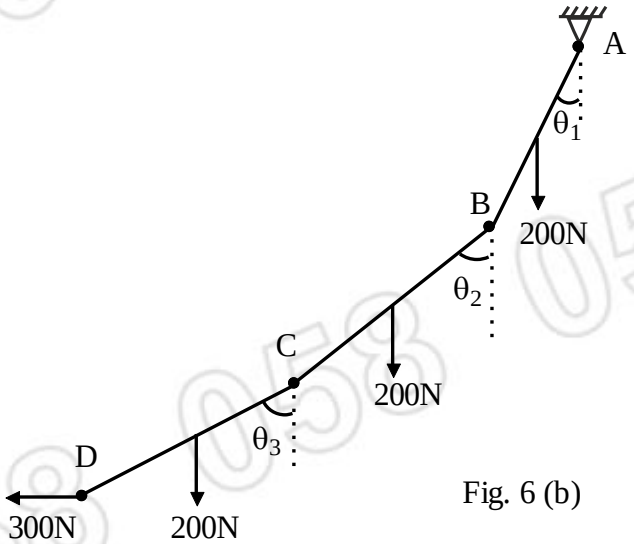


Fig. 6 (b)

7. a) State and explain D'Alembert's principle. **3**

b) A two blocks system as shown in fig. (7b) has block A of 250N and block B of 200N weight. The coefficient of kinetic friction is 0.20 at all contact surfaces. Determine the time taken by block B to travel 10m, if released from rest. **7**

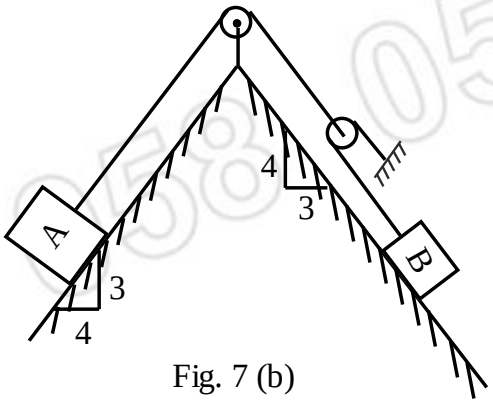


Fig. 7 (b)

OR

8. a) Define and explain coefficient of restitution. **3**

b) Bullet 'A' of mass 0.01 kg moving with a velocity of 150 m/s hits a bob 'B' of a simple pendulum horizontally. Consider the mass of the bob as 1 kg and length of pendulum 1.50 m as shown in fig. (8b). Determine the maximum angle through which the pendulum swings when **7**

a) the bullet gets embedded into the bob.
b) the bullet rebounds from the surface of the bob with a velocity of 30 m/s.
c) the bullet escapes from the other end of the bob with a velocity of 30 m/s.

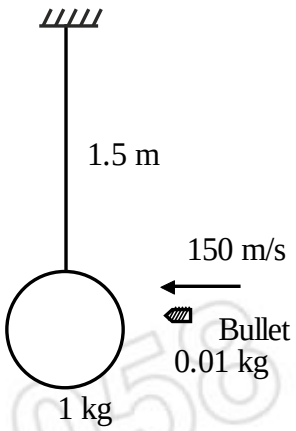


Fig. 8 (b)

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