

1.1 System of Coplanar Forces- Resultant

1.1.1 SCF-RESULTANT- Class Work Questions

1. A concurrent system of forces is shown in the Figure 1.1-1. Find the resultant passing through the origin.

$$[R = 189.5\text{N}, \theta = 38.8^\circ]$$

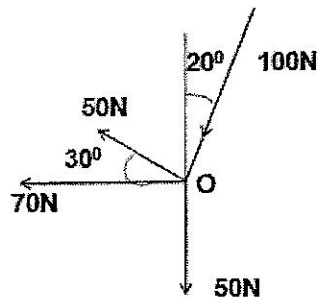


Figure 1.1-1

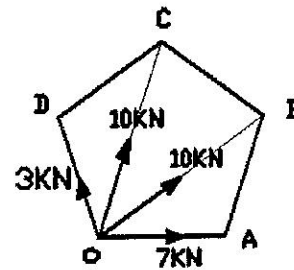


Figure 1.1-2

2. Forces 7kN, 10kN, 10kN and 3kN respectively act at one of the angular points of regular pentagon toward the other four points taken in order. Find their resultant completely. Refer Figure 1.1-2.

$$[R = 25.10\text{ KN}, \theta = 46.59^\circ]$$

3. Three forces shown in the Figure 1.1-3 plus two additional forces one in "U" direction and one in "V" direction, combine produce a zero resultant. Determine the magnitude of the forces

$$[\text{Ans : } U = 14.14\text{N}, \theta = 45^\circ, V = 14.14\text{ N}, \theta = 45^\circ]$$

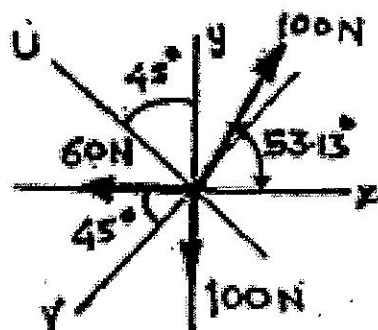


Figure 1.1-3

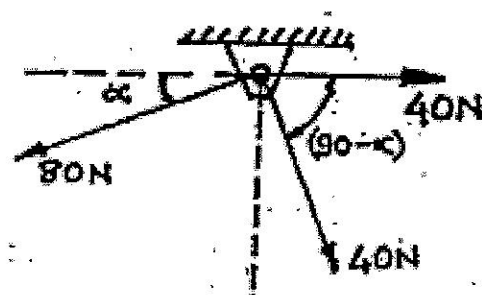


Figure 1.1-4

4. Three coplanar forces act at a point on a bracket as shown in Figure 1.1-4. Determine the value of angle α such that the resultant of the system is vertical. Also find the resultant of the system.

$$[\text{Ans : } \alpha = 36.87^\circ, R = 80\text{N}]$$

5. Find the force F_4 so as to give the resultant of the force system as shown in Figure 1.1-5.

{MU December 2016, 4 Marks} [$F_4 = 1219.5 \text{ N}$, $\theta = 40.73^\circ$]

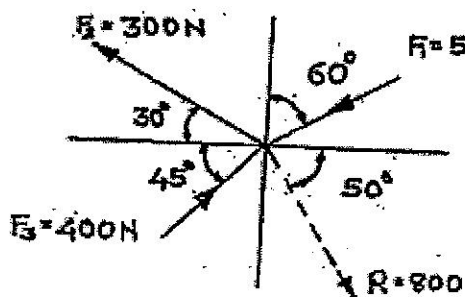


Figure 1.1-5

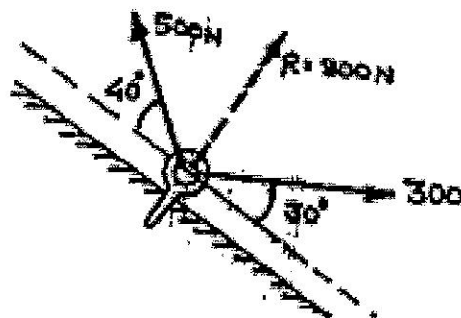


Figure 1.1-6

6. To pull a hook from an inclined surface, total pull required is 800N, perpendicular to the inclined surface. Three forces are applied on the hook for the purpose. Two of them are shown in the Figure 1.1-6. Find the third force. [Ans: $F_3 = 350.95 \text{ N}$, $\theta = 69.45^\circ$]

7. A force of 1000 N is to be resolved into two components along line a – a and b – b as shown in Figure 1.1-7. If the component along line b – b is 350N. Find the angle α and the component along a – a.

[$\alpha = 14.33^\circ$, $F_{a-a} = 1216.39 \text{ N}$]

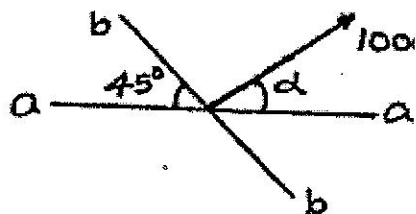


Figure 1.1-7

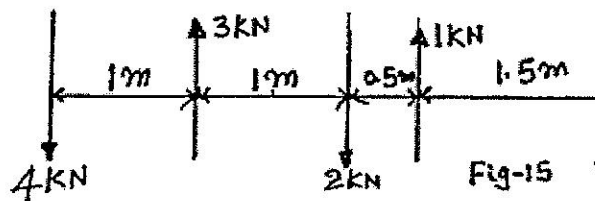


Figure 1.1-8

8. Find the resultant of forces as shown in the Figure 1.1-8 [Ans: $R = 5 \text{ kN}(\downarrow)$ at 2.1m from 4 kN force]

9. Find the resultant of forces as shown in the Figure 1.1-9 and locate with respect to "O", radius is 1 m.

[Ans: $R = 80 \text{ N}$ left wards, $Y = 2.078 \text{ m}$]

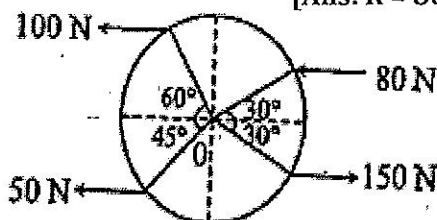


Figure 1.1-9

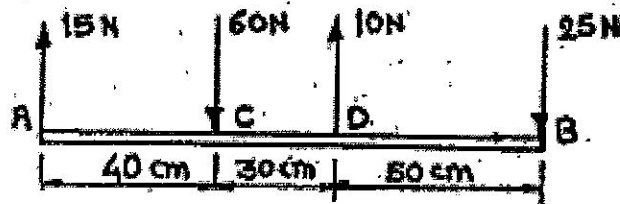


Figure 1.1-10

10. A right bar is subjected to a system of parallel forces as shown in Figure 1.1-10. Reduce this system to (1) A single force (2) A single force moment system at A (3) A single force moment system at B.

[Ans: (1) $R = 60 \text{ N}$ at 0.783 m from A (2) 60 N , 47 N-m (3) 60 N , 25 N-m]

1.1.2 SCF-RESULTANT - Surprise Test Questions

1. Define and explain Law of transmissibility of force.
2. State and prove Varignon's theorem or law of moments. {MU, Dec 2017, 5 Marks}
3. A hook is being pulled from a wall. Three forces are applied on the hook as shown in Find the resultant pull on hook. Refer Figure 1.1-17

[$R = 136.25 \text{ N}$, $\theta = 30.40^\circ$]

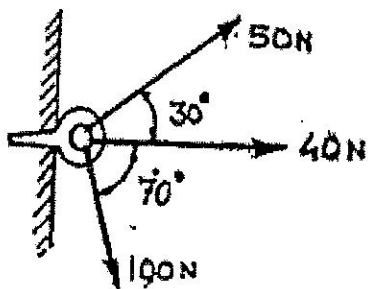


Figure 1.1-17

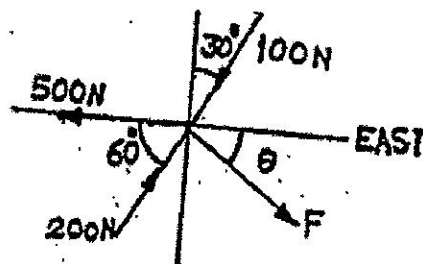


Figure 1.1-18

4. If the resultant of the forces shown in the Figure 1.1-18 acts due east, away from the point and its magnitude is 1000 N , find the value of F and θ .

[$F = 1452.58 \text{ N}$, $\theta = 3.42^\circ$]

5. Find the resultant of forces as shown in Figure 1.1-19.

[$R = 300 \text{ N}$ up at 9.25 m from 1st force.]

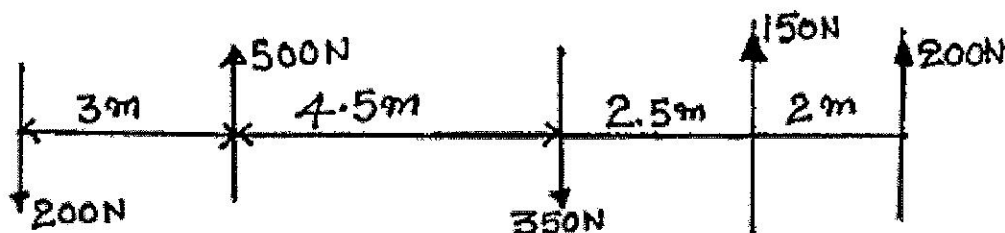


Figure 1.1-19

6. Replace the loading on the frame by a force and moment at point A. Ref Figure 1.1-20
 $[R = 921.95\text{ N}, \theta = 77.47^\circ, M_A = 3200\text{ N}\cdot\text{m}]$

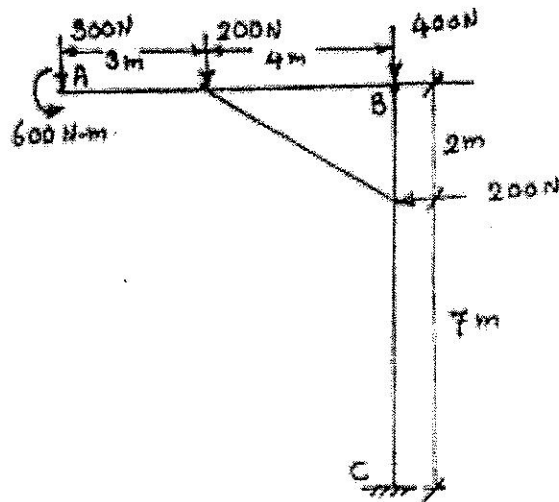


Figure 1.1-20

1.1.1 SCF-RESULTANT - Tutorial cum Assignment Questions

1. Six forces acting on a particle. Determine the magnitude and direction of their resultant of the forces as shown in Figure 1.1-21
 $[R = 27.207\text{ kN}, \theta = 54.47^\circ]$

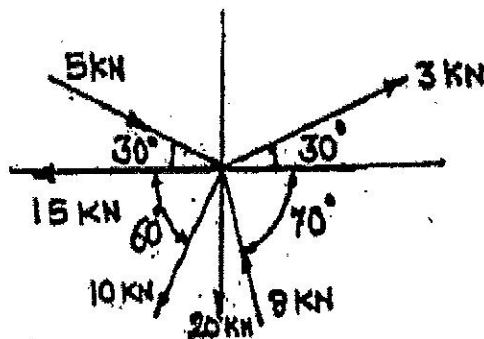


Figure 1.1-21

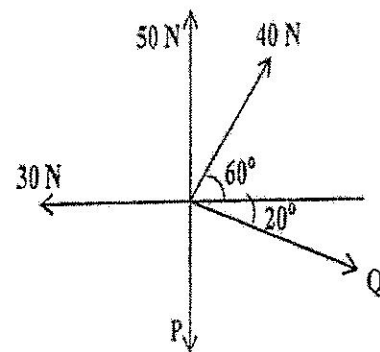


Figure 1.1-22

2. Five concurrent coplanar forces act on a body as shown in Figure 1.1-22. Find the force P & Q such that the resultant of the five forces is zero.
 $[P = 81.02\text{ N}, Q = 10.64\text{ N}]$
3. The striker of carom board is being pulled by 4 players as shown in Figure 1.1-23. The players are sitting exactly at the centre of the four sides. Determine the resultant force in magnitude and direction.
 $[R = 29.09\text{ N}, \theta = 45.89^\circ]$