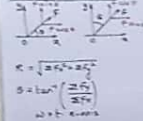


Concurrent \rightarrow SM
 Parallel \rightarrow (or) SM
 General

Resolution of force

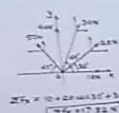
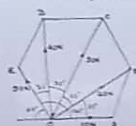


$$R = \sqrt{a^2 + b^2}$$

$$\theta = \tan^{-1} \left(\frac{a}{b} \right)$$

$$\omega = 6.28 \times 10^{-8} \text{ s}$$

Find Resultant of given force system



$$\Sigma F_x = 10 + 20 \cos 30^\circ + 30 \cos 60^\circ - 10 \cos 60^\circ$$

$$\Sigma F_x = 17.32 \text{ N} \quad (-)$$

$$\Sigma F_y = 20 \sin 30^\circ + 30 \sin 60^\circ + 10 \sin 60^\circ$$

$$\Sigma F_y = 11.5 \text{ N} \quad (+)$$

$$R = \sqrt{17.32^2 + 11.5^2} = 20.52 \text{ N}$$

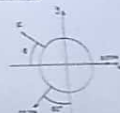
$$\theta = 33.7^\circ$$

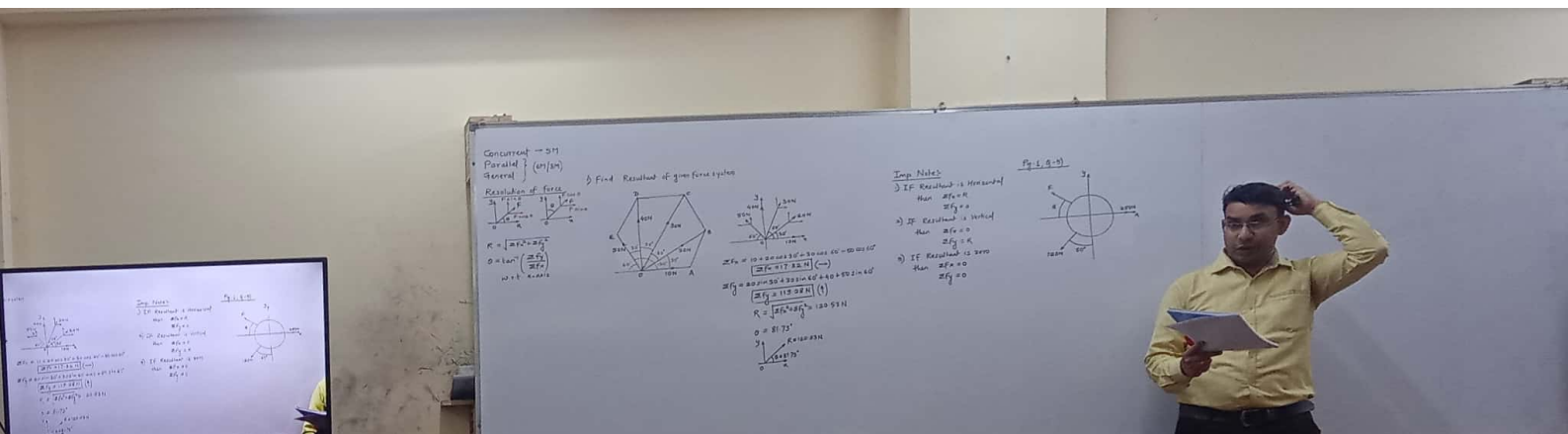
$$\phi = 102.5^\circ$$

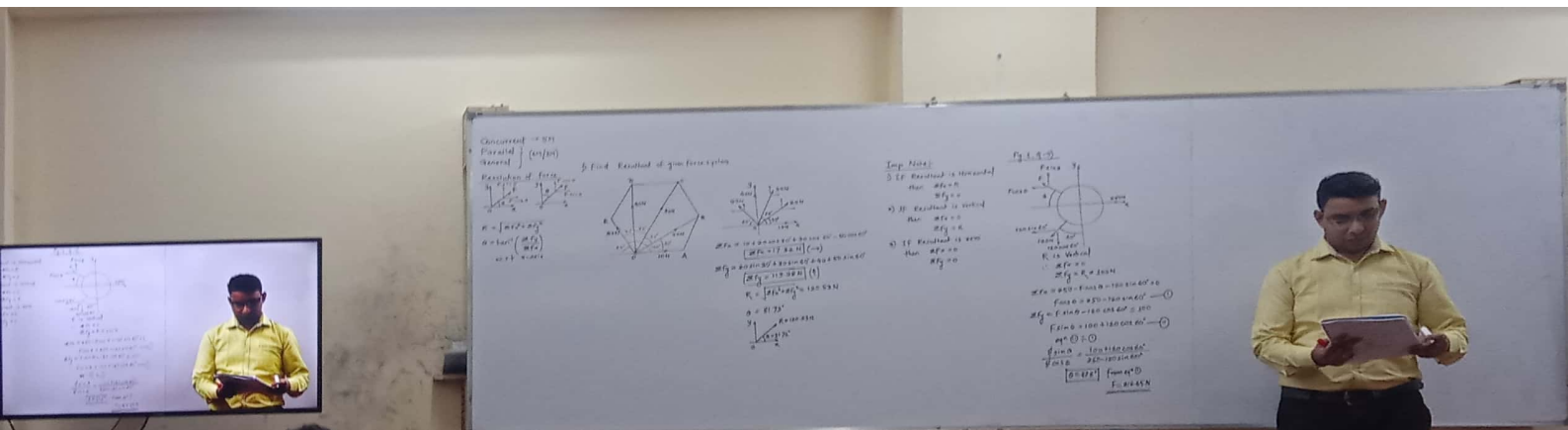
Imp Note:

- 1) If Resultant is horizontal then $\Sigma F_y = 0$
- 2) If Resultant is vertical then $\Sigma F_x = 0$
- 3) If Resultant is zero then $\Sigma F_x = 0$ and $\Sigma F_y = 0$

Fig 2.8-9

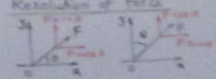






Concurrent → SM
 Parallel } (an/yn)
 General }

Resolution of force

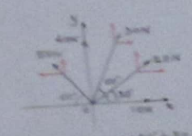
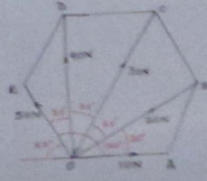


$$R = \sqrt{R_x^2 + R_y^2}$$

$$\theta = \tan^{-1} \left(\frac{R_y}{R_x} \right)$$

or $\theta = \sin^{-1} \left(\frac{R_y}{R} \right)$

Find Resultant of given force system



$$\sum F_x = 10 + 20 \cos 60^\circ + 30 \cos 120^\circ + 40 \cos 180^\circ + 50 \cos 240^\circ + 60 \cos 300^\circ$$

$$\sum F_x = 10 + 10 - 10 - 40 + 10 - 30 = -60 \text{ N}$$

$$\sum F_y = 20 \sin 60^\circ + 30 \sin 120^\circ + 40 \sin 180^\circ + 50 \sin 240^\circ + 60 \sin 300^\circ$$

$$\sum F_y = 17.32 \text{ N}$$

$$R = \sqrt{(\sum F_x)^2 + (\sum F_y)^2} = 120.53 \text{ N}$$

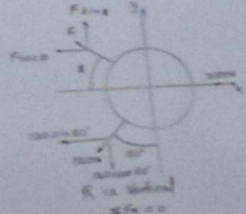
$$\theta = 21.7^\circ$$

$$R = 120.53 \text{ N}$$

Imp Note:-

- 1) If Resultant is Horizontal
 Then $\sum F_y = 0$
- 2) If Resultant is Vertical
 Then $\sum F_x = 0$
- 3) If Resultant is zero
 Then $\sum F_x = 0$ and $\sum F_y = 0$

Fig 1.8-10



$$\sum F_x = 250 - F \cos 60^\circ - 100 \sin 60^\circ = 0$$

$$F \cos 60^\circ = 250 - 100 \sin 60^\circ$$

$$\sum F_y = F \sin 60^\circ - 100 \cos 60^\circ = 200$$

$$F \sin 60^\circ = 100 + 100 \cos 60^\circ$$

$$\frac{F \sin 60^\circ}{F \cos 60^\circ} = \frac{100 + 100 \cos 60^\circ}{250 - 100 \sin 60^\circ}$$

$$\tan \theta = \frac{100 + 100 \cos 60^\circ}{250 - 100 \sin 60^\circ}$$

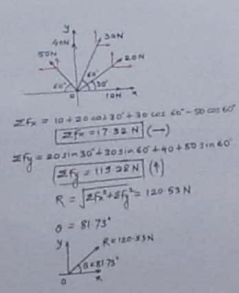
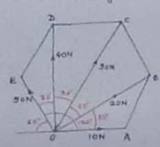
$$\theta = 45^\circ$$

Force = 450 N

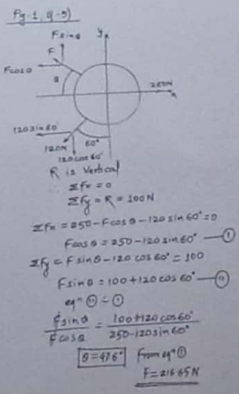
Concurrent \rightarrow SM
 Parallel \rightarrow (SM/SM)
 General

Resolution of force
 $\Sigma F_x = 0$
 $\Sigma F_y = 0$
 $R = \sqrt{\Sigma F_x^2 + \Sigma F_y^2}$
 $\theta = \tan^{-1} \left(\frac{\Sigma F_y}{\Sigma F_x} \right)$
 w.r.t. x-axis

Find Resultant of given force system



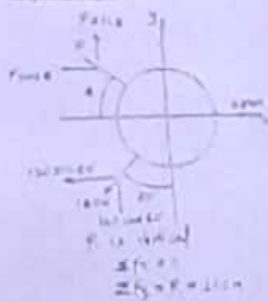
Imp Note:-
 1) If Resultant is Horizontal then $\Sigma F_y = 0$
 2) If Resultant is Vertical then $\Sigma F_x = 0$
 3) If Resultant is zero then $\Sigma F_x = 0$ and $\Sigma F_y = 0$



Imp Note:

- 1) If resultant is horizontal
then $\Sigma F_y = 0$
 $\Sigma F_x = ?$
- 2) If resultant is vertical
then $\Sigma F_x = 0$
 $\Sigma F_y = ?$
- 3) If resultant is zero
then $\Sigma F_x = 0$
 $\Sigma F_y = 0$

Fig. 1.8-5

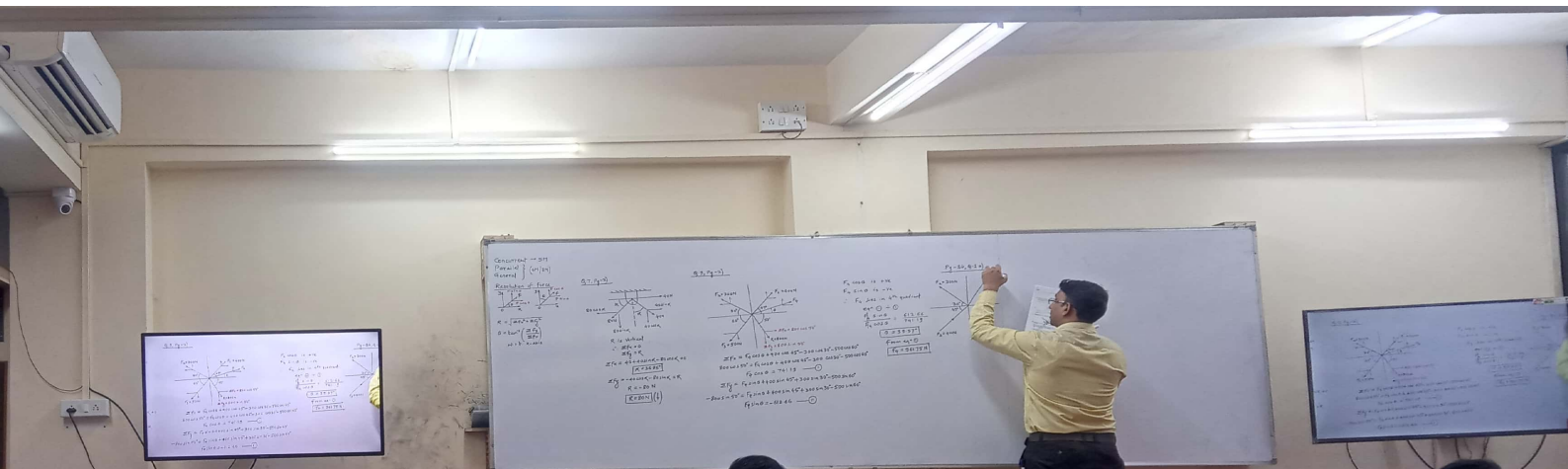


$$\Sigma F_x = 0 \Rightarrow F_1 + F_2 \cos \theta = 0 \Rightarrow F_2 \cos \theta = -F_1 \quad \text{--- (1)}$$

$$\Sigma F_y = 0 \Rightarrow F_2 \sin \theta = 0 \Rightarrow F_2 \sin \theta = 0 \quad \text{--- (2)}$$

$$\frac{F_2 \cos \theta}{F_2 \sin \theta} = \frac{-F_1}{0} \Rightarrow \cot \theta = \infty \Rightarrow \theta = 0^\circ$$





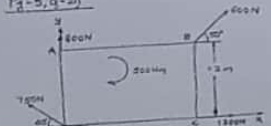
Concurrent \rightarrow SM
 Parallel } (SM/SM)
 General }

Variation's Theorem :-
 $\sum M_A^F = M_A^R$

Resolution of force
 1) $\sum F_x = 0$
 2) $\sum F_y = 0$
 $R = \sqrt{\sum F_x^2 + \sum F_y^2}$
 $\theta = \tan^{-1}(\sum F_y / \sum F_x)$

Parallel and General force
 1) Resolution
 2) $\sum F_x$
 3) $\sum F_y$
 4) Resultant (R)
 5) Direction (θ)

Pg-5, Q-2)



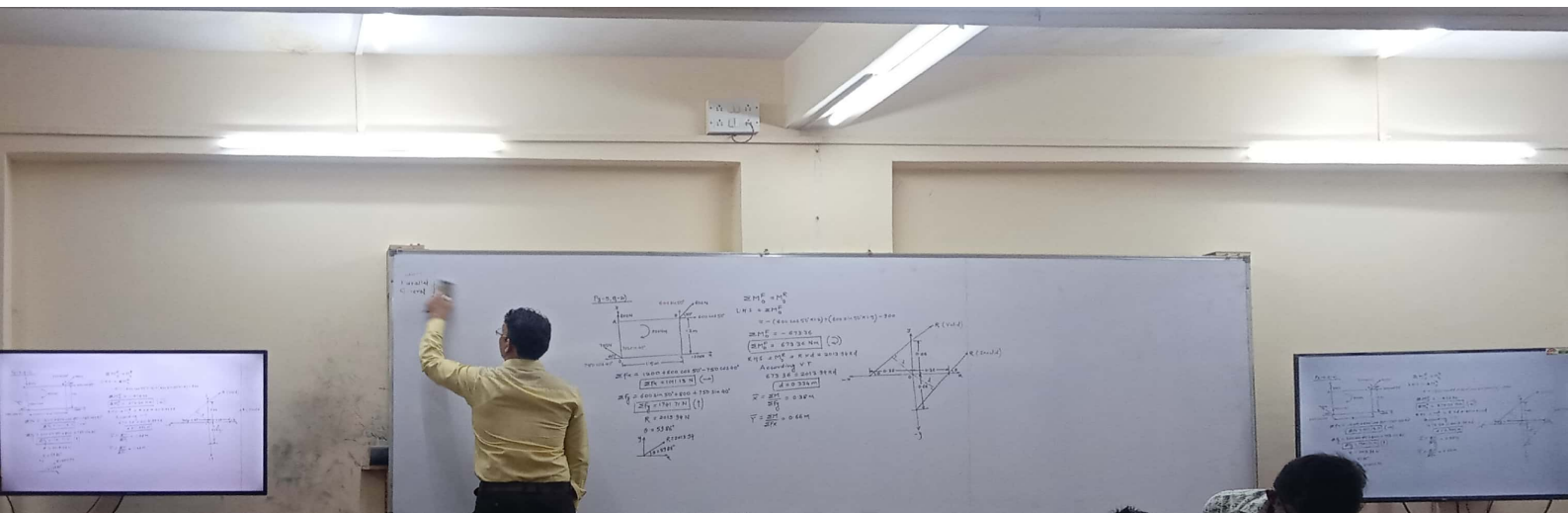
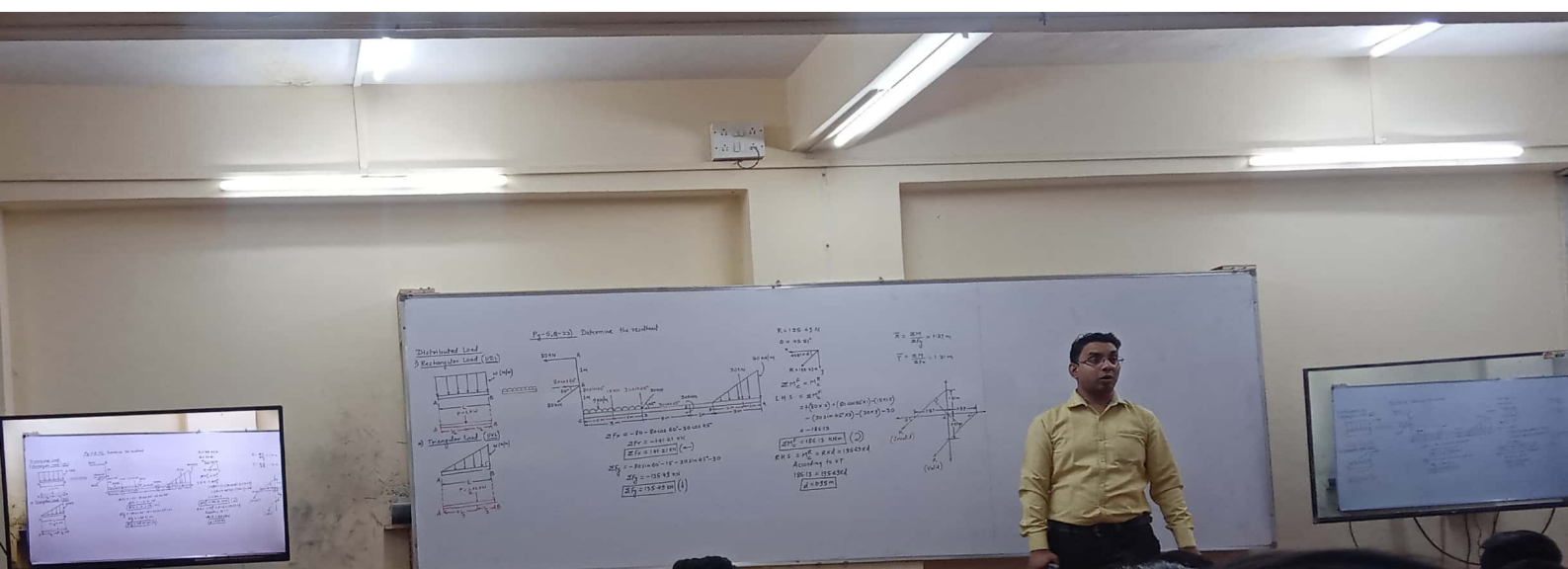


Diagram of a rectangular block with dimensions 10m, 10m, and 10m. The block is divided into two parts by a vertical line. The left part is labeled 'Part 1' and the right part is labeled 'Part 2'. The weight of the block is $W = 100 \text{ kN}$. The weight of Part 1 is $W_1 = 50 \text{ kN}$ and the weight of Part 2 is $W_2 = 50 \text{ kN}$. The weight of Part 1 acts at a distance of 5m from the left edge. The weight of Part 2 acts at a distance of 5m from the right edge. The weight of the block acts at a distance of 5m from the left edge. The weight of the block acts at a distance of 5m from the right edge. The weight of the block acts at a distance of 5m from the left edge. The weight of the block acts at a distance of 5m from the right edge.

Diagram of a rectangular block with dimensions 10m, 10m, and 10m. The block is divided into two parts by a vertical line. The left part is labeled 'Part 1' and the right part is labeled 'Part 2'. The weight of the block is $W = 100 \text{ kN}$. The weight of Part 1 is $W_1 = 50 \text{ kN}$ and the weight of Part 2 is $W_2 = 50 \text{ kN}$. The weight of Part 1 acts at a distance of 5m from the left edge. The weight of Part 2 acts at a distance of 5m from the right edge. The weight of the block acts at a distance of 5m from the left edge. The weight of the block acts at a distance of 5m from the right edge. The weight of the block acts at a distance of 5m from the left edge. The weight of the block acts at a distance of 5m from the right edge.



Pg-5, 6-12) Determine the resultant

Distributed Load

1) Rectangular Load (UDL)

2) Triangular Load (UDL)

3) Trapezoidal Load (UDL)

4) Parabolic Load (UDL)

5) Semicircular Load (UDL)

6) Elliptical Load (UDL)

7) Hyperbolic Load (UDL)

8) Sinusoidal Load (UDL)

9) Cosinusoidal Load (UDL)

10) Exponential Load (UDL)

11) Logarithmic Load (UDL)

12) Power Law Load (UDL)

13) Piecewise Linear Load (UDL)

14) Piecewise Constant Load (UDL)

15) Piecewise Quadratic Load (UDL)

16) Piecewise Cubic Load (UDL)

17) Piecewise Quartic Load (UDL)

18) Piecewise Quintic Load (UDL)

19) Piecewise Sextic Load (UDL)

20) Piecewise Septic Load (UDL)

21) Piecewise Octic Load (UDL)

22) Piecewise Nonic Load (UDL)

23) Piecewise Decic Load (UDL)

24) Piecewise Undecimic Load (UDL)

25) Piecewise Duodecimic Load (UDL)

26) Piecewise Tredecimic Load (UDL)

27) Piecewise Quattuordecimic Load (UDL)

28) Piecewise Quindecimic Load (UDL)

29) Piecewise Sexdecimic Load (UDL)

30) Piecewise Septendecimic Load (UDL)

31) Piecewise Octodecimic Load (UDL)

32) Piecewise Nonadecimic Load (UDL)

33) Piecewise Vigintimic Load (UDL)

34) Piecewise Unvigintimic Load (UDL)

35) Piecewise Duovigintimic Load (UDL)

36) Piecewise Trivigintimic Load (UDL)

37) Piecewise Quadrivigintimic Load (UDL)

38) Piecewise Quinquivigintimic Load (UDL)

39) Piecewise Sexvigintimic Load (UDL)

40) Piecewise Septuagintimic Load (UDL)

41) Piecewise Octogintimic Load (UDL)

42) Piecewise Nonagintimic Load (UDL)

43) Piecewise Centimic Load (UDL)

44) Piecewise Centummic Load (UDL)

45) Piecewise Centummic Load (UDL)

46) Piecewise Centummic Load (UDL)

47) Piecewise Centummic Load (UDL)

48) Piecewise Centummic Load (UDL)

49) Piecewise Centummic Load (UDL)

50) Piecewise Centummic Load (UDL)

51) Piecewise Centummic Load (UDL)

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78) Piecewise Centummic Load (UDL)

79) Piecewise Centummic Load (UDL)

80) Piecewise Centummic Load (UDL)

81) Piecewise Centummic Load (UDL)

82) Piecewise Centummic Load (UDL)

83) Piecewise Centummic Load (UDL)

84) Piecewise Centummic Load (UDL)

85) Piecewise Centummic Load (UDL)

86) Piecewise Centummic Load (UDL)

87) Piecewise Centummic Load (UDL)

88) Piecewise Centummic Load (UDL)

89) Piecewise Centummic Load (UDL)

90) Piecewise Centummic Load (UDL)

91) Piecewise Centummic Load (UDL)

92) Piecewise Centummic Load (UDL)

93) Piecewise Centummic Load (UDL)

94) Piecewise Centummic Load (UDL)

95) Piecewise Centummic Load (UDL)

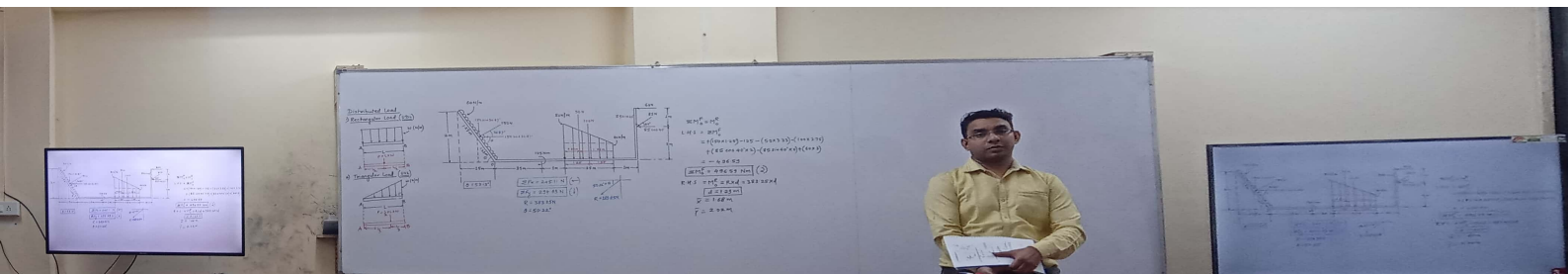
96) Piecewise Centummic Load (UDL)

97) Piecewise Centummic Load (UDL)

98) Piecewise Centummic Load (UDL)

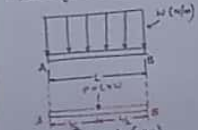
99) Piecewise Centummic Load (UDL)

100) Piecewise Centummic Load (UDL)

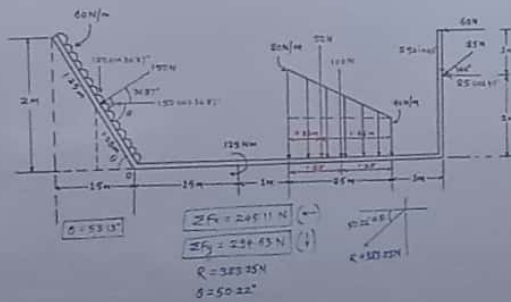
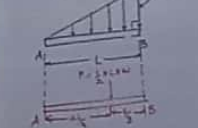


Distributed Load

1) Rectangular Load (UDL)



2) Triangular Load (UVL)



$$\begin{aligned} \sum F_x &= 245.11 \text{ N} \\ \sum F_y &= 224.63 \text{ N} \\ R &= 323.35 \text{ N} \\ \theta &= 50.22^\circ \end{aligned}$$

$$\begin{aligned} \sum M_O^R &= M_O^R \\ LHS &= \sum M_O^R \\ &= + (60 \times 2) - 125 - (50 \times 3.33) - (100 \times 2.75) \\ &\quad + (80 \times 2 \cos 40^\circ \times 2) - (80 \sin 40^\circ \times 2) + (60 \times 2) \\ &= -436.53 \\ \sum M_O^R &= 436.53 \text{ Nm} \quad (2) \\ RHS &= M_O^R = R \times d = 323.35 \times d \\ d &= 1.35 \text{ m} \\ x &= 1.68 \text{ m} \\ y &= 2.02 \text{ m} \end{aligned}$$



