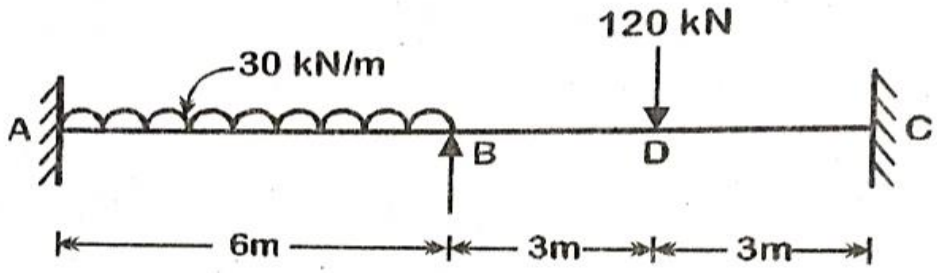
3.2 ANALYSIS OF CONTINUOUS BEAMS IN MOMENT DISTRIBUTION METHOD.

3.2.1 NUMERICAL EXAMPLES ON(CONTINUOUS BEAMS):

PROBLEM NO:01

For the continuous beam shown in figure,Calculate the support moments distribution method.Draw the SF and BM diagrams.

Solutions:



- **Fixed End Moments:**

  MFAB = $-Wl^2/12 = -30x6^2/12 = -90$ kNm

  MFBA = $Wl^2/12 = 30x6^2/12 = 90$ kNm

  MFBC = $-Wl/8 = -120X6/8 = -90$ kNm

  MFCB = $Wl/8 = 120X6/8 = 90$ kNm

- **Distribution Factor Table:**

Joint	Member	k	Σk	Distribution factor (k/Σk)
B	BA	4EI/l = 4EI/6	4EI/3	0.5
	BC	4EI/l = 4EI/6		0.5

- **Reactions:**

  Moment About B,

$$MB = RAx6 - 30x6x6/2 + MA$$

$$-90 = 6RA – 540 – 90$$

$$6RA = 540;\ RA = 90KN$$

Moment About B,

$$MB = RC \times 6 – 120 \times 3 + MC$$

$$-90 = 6RC – 360 – 90$$

$$6RC = 360;\ RC = 60KN$$

$$RB = \text{Total load} – (RA + RC) = 30 \times 6 + 120 – (90 + 60)$$

$$= 300 – 150 = 150KN$$

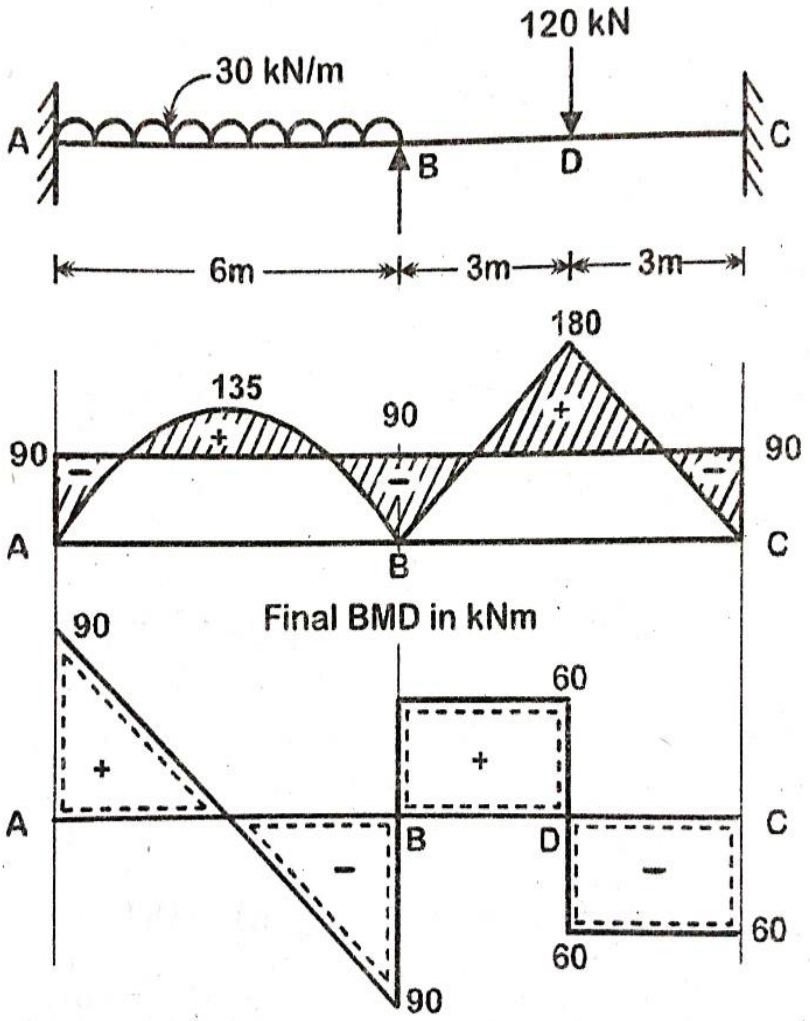
- **Moment Distribution Table**:

Joint	A	B		C
Member	AB	BA	BC	CB
D.F	-	0.5	0.5	-
F.E.M	-90	90	-90	90
Distribute	-	0	0	-
Final Moments	-90	90	-90	90
Conventional Moments	-90	-90	90	-90

- **Free BMD:**

$MAB = Wl^2/8 = 30 \times 6^2/8 = 135kNm$

$MBC = Wl/4 = 120 \times 6/4 = 180kNm$



- **Final Bending Moments:**

MA = -90kNm; MB = -90kNm; MC = -90kNm

PROBLEM NO:02

For the continuous beam as shown in fig; Find the support moment carry out two cycles of distribution.

Solutions:

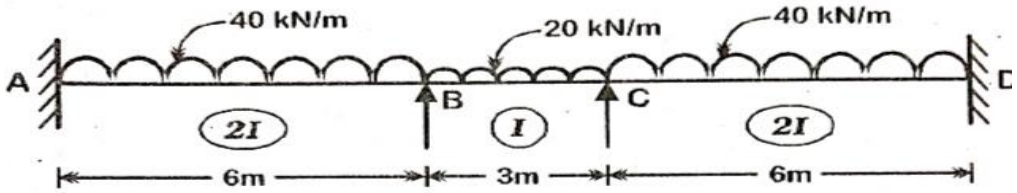


Fig. 3.9(a)

- **Fixed End Moments:**

MFAB = $-Wl^2/12 = -40x6^2/12 = -120$ kNm;

MFBA = $Wl^2/12 = 40x6^2/12 = 120$ kNm;

MFBC = $-Wl^2/12 = -20x3^2/12 = -15$ kNm;

MFBC = $Wl^2/12 = 20x3^2/12 = 15$ kNm;

MFCD = $-Wl^2/12 = -40x6^2/12 = -120$ kNm;

MFDC = $Wl^2/12 = 40x6^2/12 = 120$ kNm;

- **Distribution Factor Table:**

Joint	Member	k	Σk	Distribution factor (k/Σk)
B	BA	4E(2I)/l = 4EI/3	7EI/3	0.57
	BC	3EI/l = 3EI/3		0.43
C	CB	3EI/l = 3EI/3	7EI/3	0.43
	CD	4E(2I)/l = 4EI/3		0.57

- **Free BMD:**

MAB = $Wl^2/8 = 40 \times 6^2/8 = 180$kNm;

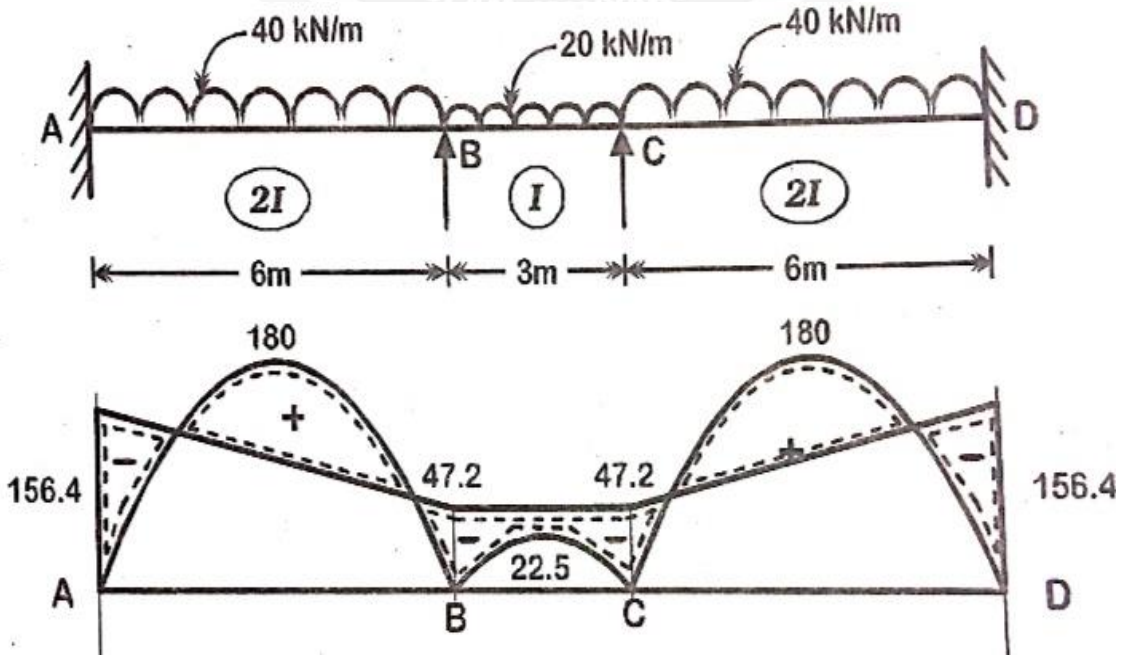
MBC = $Wl^2/8 = 20 \times 3^2/8 = 22$kNm;

MCD = $Wl^2/8 = 40 \times 6^2/8 = 180$kNm.

- **Moment Distribution Table:**

Joint	A	B		C		D
Member	AB	BA	CB	BC	CD	DC
D.F	-	0.57	0.43	0.43	0.57	-
F.E.M	-120	120	-15	15	-120	120
Distribute		-59.9	-45.1	45.1	59.9	
Carry over	-29.95		22.6	-22.6		29.95
Distribute		-12.9	-9.7	9.7	12.9	
Carry over	-6.45					6.45
Final Moments	-156.4	47.2	-47.2	47.2	-47.2	156.4
Conventional Moments	-156.4	-47.2	-47.2	-47.2	-47.2	-156.4

- **Moment Diagram:**



- **Final Moments:**

MA = -156.40kNm; MB = -47.20kNm; MC = -156.40kNm

PROBLEM NO:03

A continuous beam ABCD, simply supported at A,B,C and D is loaded as shown in fig. EI is constsnt.

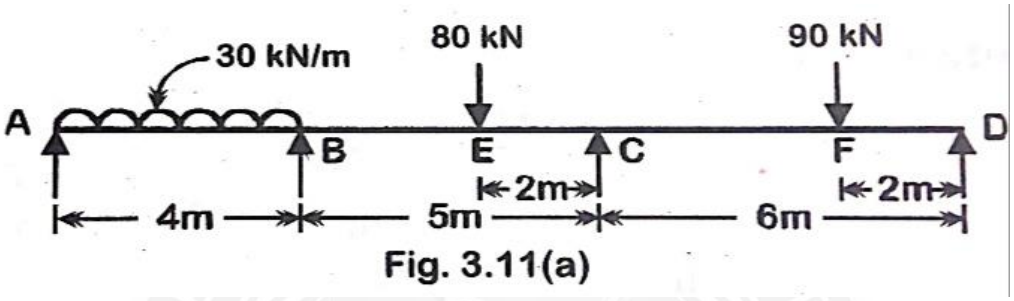


Fig. 3.11(a)

Solutions:

- **Fixed End Moments:**

MFAB = $-Wl^2/12 = -30x4^2/12 = -40$ kNm;

MFBA = $Wl^2/12 = 30x4^2/12 = 40$ kNm;

MFBC = $-Wab^2/l^2 = -80x3x2^2/5^2 = -38.4$ kNm;

MFBC = $Wa^2b/l^2 = 20x3^2x2/5^2 = 57.6$ kNm;

MFCD = $-Wab^2/l^2 = -90x4x2^2/6^2 = -40$ kNm;

MFDC = $Wa^2b/l^2 = 90x2^2x4/6^2 = 80$ kNm.

- **Distribution Factor Table:**

Joint	Member	k	Σk	Distribution factor (k/Σk)
B	BA	3EI/l = 3EI/4	27EI/20	0.56
	BC	3EI/l = 3EI/5		0.44
C	CB	3EI/l = 3EI/5	11EI/10	0.5
	CD	3EI/l = 3EI/6		0.5

- **Free BMD:**

  MAB = $Wl^2/8$ = 30 x $4^2/8$ = 60kNm;

  MBC = Wab/l = 80 x 2 x 3/5 = 96kNm;

  MCD = Wab/l = 90 x 4 x 2/5 = 120kNm

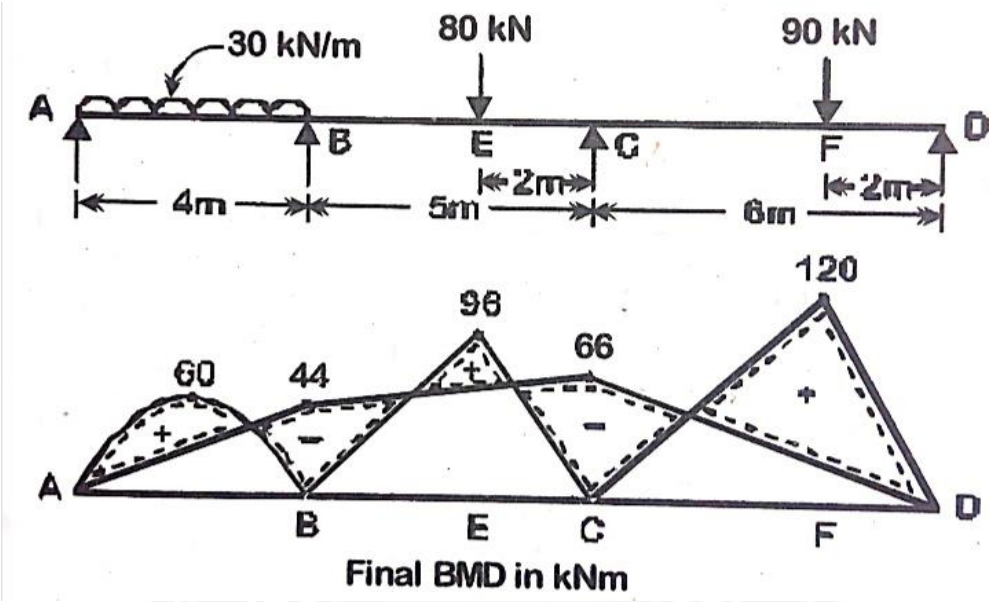
- **Moment Distribution Table:**

Joint	A	B		C		D
Member	AB	BA	CB	BC	CD	DC
D.F	-	0.56	0.44	0.5	0.5	-
F.E.M	-40	40	-38.4	57.6	-40	80
Release C & D	40					-80
carry over		20			-40	
Initial moments	0	60	-38.4	57.6	-80	0
Distribute		-12.096	-9.504	11.2	11.2	
Carry over		0	5.6	-4.552	0	
Distribute		-3.136	-2.464	2.376	2.376	
Carry over		0	1.188	-1.232	0	
Distribute		-0.66	-0.52	0.61	0.61	
Carry over			0.308	-0.26		
Final Moments	0	44	-44	66	-66	0
Conventional Moments	0	-44	-44	-66	-66	0

- **Final Moments:**

  MA = 0kNm; MB = -44kNm; MC = -66kNm; MD = 0kNm.

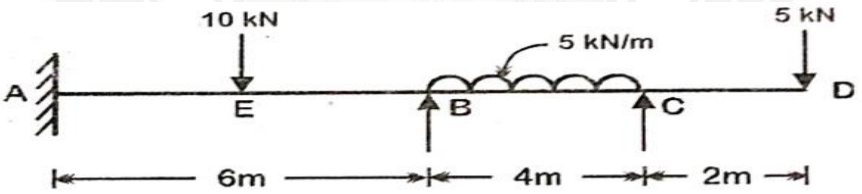
- **Final Moments Diagram:**



Final BMD in kNm

PROBLEM NO:04

Find the support moments for the continuous beam using moment distribution method. EI is constant.



Solutions:

- **Fixed End Moments:**

  MFAB = -Wl/8 = -10X6/8 = -7.5 kNm

  MFBA = Wl/8 = 10X6/8 = 7.5 kNm

  MFBC = $-Wl^2/12 = -5x4^2/12$ = -6.67 kNm

  MFCB = $Wl^2/12 = 5x4^2/12$ = 6.67 kNm

  MFCD = -Wxl= -5X2 = -10 kNm

- **Free BMD:**

  MAB = Wl/4 = 10 x 6/4 = 15kNm

  MBC = $Wl^2/8 = 5 \times 4^2/8$ = 10kNm

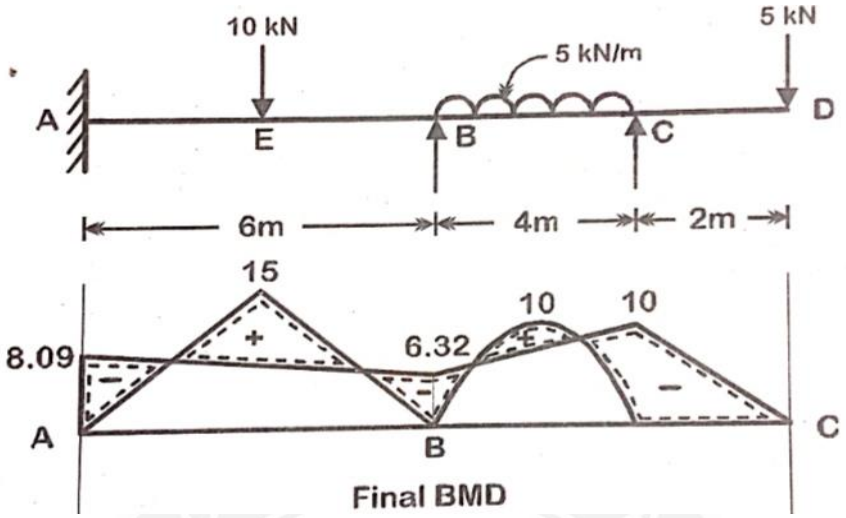
- **Distribution factor table:**

Joint	Member	k	Σk	Distribution factor (k/Σk)
B	BA	4EI/l = 4EI/6	17EI/12	0.47
	BC	3EI/l = 3EI/4		0.53
C	CB	4EI/l = 3EI/4	3EI/4	1
	CD	0		0

- **Moment Distribution table:**

Joint	A	B		C	
Member	AB	BA	BC	CB	CD
D.F	-	0.47	0.53	1	0
F.E.M	-7.5	7.5	-6.67	6.67	-10
Release C & carry over	-	-	1.67	3.33	0
Initial moments	-7.5	7.5	-5	10	-10
Distribute	-	-1.18	-1.32	-	-
Carry over	-0.59	-	-	-	-
Final Moments	-8.09	6.32	-6.32	10	-10
Conventional Moments	-8.09	-6.32	-6.32	-10	-10

- **Final Moments Diagram:**



- **Final Moments:**

MA = -8.09kNm; MB = -6.32kNm; MC = -10kNm