

# Assignment:

NAME:

M Jehan

ID:

15420

SUBJECT:

Theory of structure(IT)

# -: ASSIGNMENT :-

1. Choose the best options:-

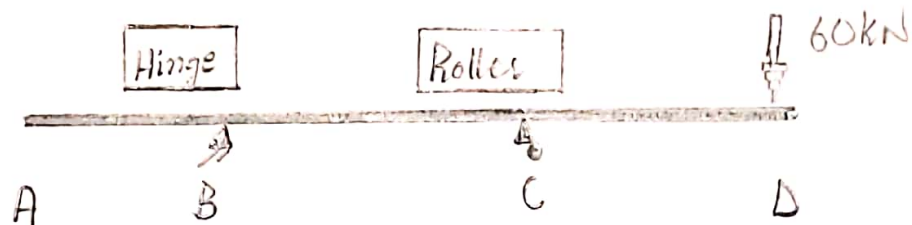
B is a hinge support and C is roller support. A and D are free ends. A load of 60 kN acts (ind) in downward direction at point D. Sign conventions are as usual.

$AB = CD = 1\text{m}$  and  $BC = 3\text{m}$ .

All force options are in kNm.

All deformation options are in M.

E and I are given.



7:- The ratio of shear stress and shear strain of an elastic material, is

- a) Modulus of Rigidity
- b) Shear Modulus
- c) Modulus of Elasticity
- d) Both (a) and (b)

ANSWER:-

D

8:- Stress may be defined as

- a) Force per Unit length
- b) Force per Unit volume
- c) Force per Unit area
- d) None of these

ANSWER:-

C

9:- Stress may be expressed in Newtons

- a) Per millimeter square ( $N/mm^2$ )
- b) Per centimeter square ( $N/cm^2$ )
- c) Per meter square ( $N/m^2$ )
- d) None of these

ANSWER:-

A

16. According to Muller Breslau theorem on conjugate beam slope is equal

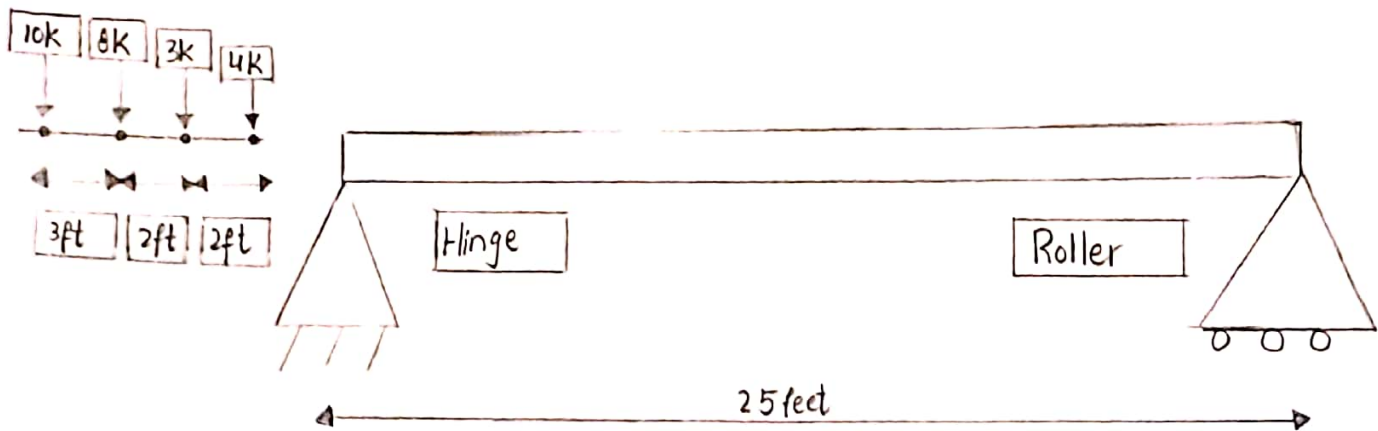
- a) Moment
- b) Shear
- c) Deflection
- d) None of these

ANSWER:-

B

## Question No 2

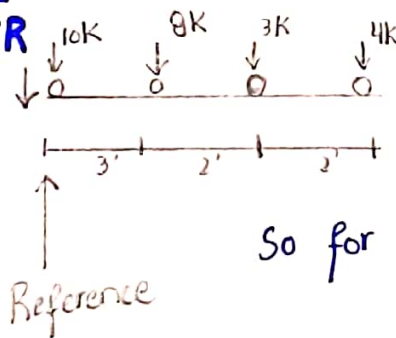
Find maximum live moment in girder by using Absolute max shear and max moment method.



### APPROACH:-

- (1) Calc force resultant ( $F_R$ )
- (2) Place each concentrated load equidistance from the centerline as resultant ( $F_R$ )
- (3) Use statics and equation.

### ① FORCE RESULTANT $F_R$



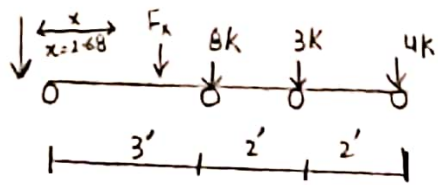
So for finding force resultant

$$x = \frac{\sum F_x}{\sum F} \quad (\text{so taking one side reference})$$

$$= \frac{(10)(0) + 8(3) + 3(5) + 4(7)}{10 + 8 + 3 + 4}$$

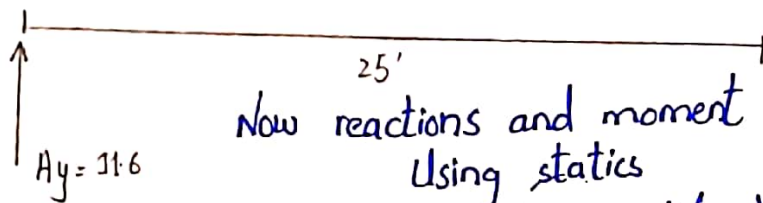
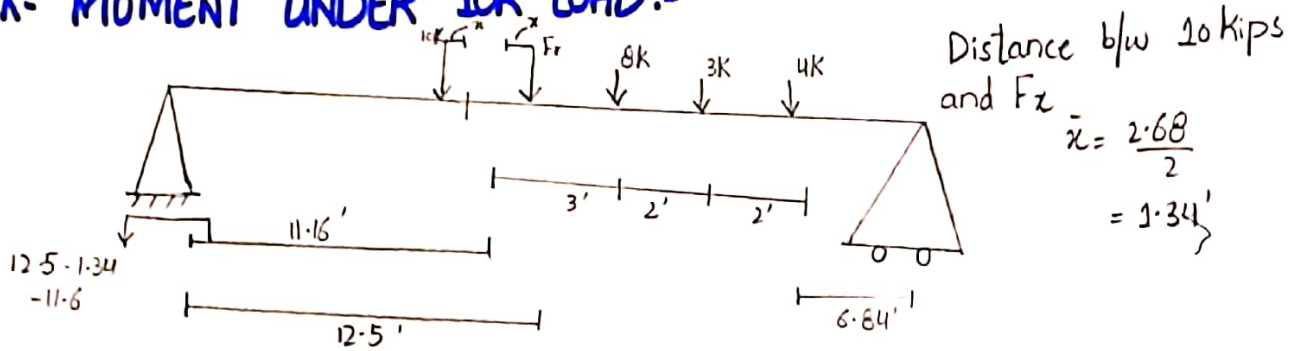
$$\bar{x} = 2.68 \text{ ft}$$

So we got net force resultant if taking reference from left.



Now likely brute force method  
 I need this first side load 10k and  $F_r$  to be equidistance from centerline

**(ii) MAX. MOMENT UNDER 10K LOAD:-**

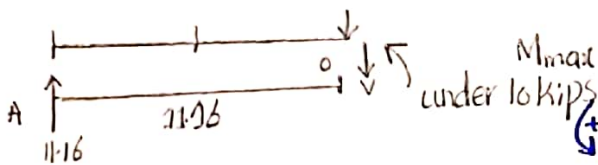


Now reactions and moment  
 Using statics

$$\sum M_B = 0 : 4(6.34) + 3(8.84) + 8(10.84) + 10(13.84) - A_y(25) = 0$$

$$A_y = 11.16 \text{ kips}$$

For Finding moment let us use  
 Cut and sectioning



$$\sum M_o = - (11.16)(11.16) + M_{max} = 0$$

$$M_{max} \text{ at } 10 \text{ kips} = 124.55 \text{ kips ft}$$

**(iii) Max. MOMENT UNDER 8 KIPS:**

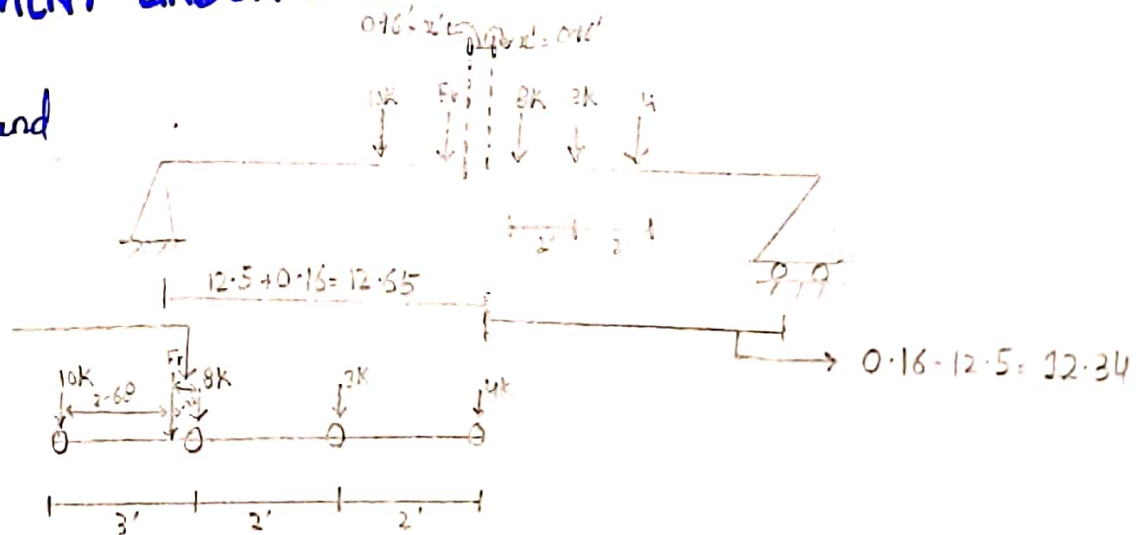
(Distance b/w  $F_r$  and 8 kips)

$$= 3 - 2.68$$

$$= 0.32$$

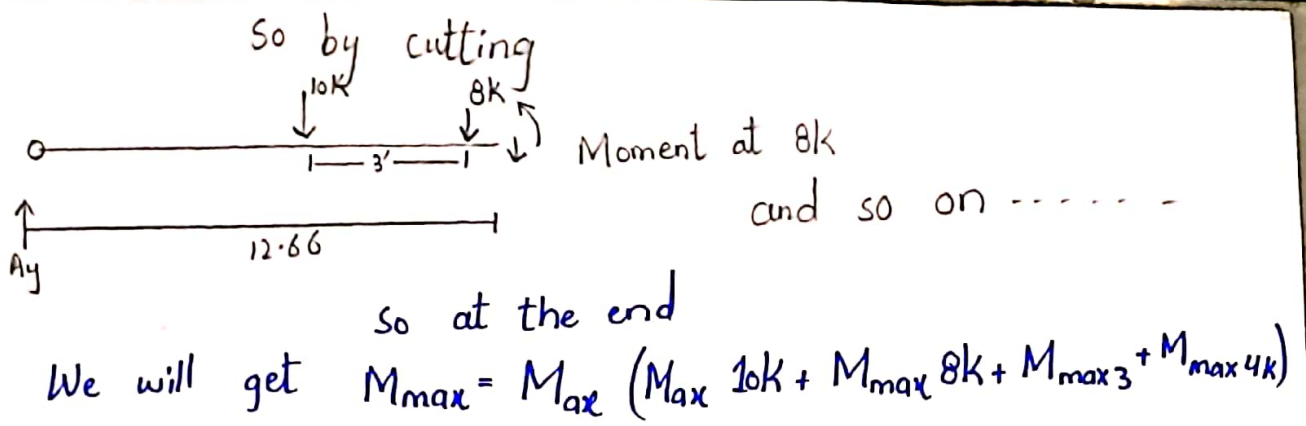
$$\bar{x} = \frac{0.32}{2}$$

$$= 0.16$$



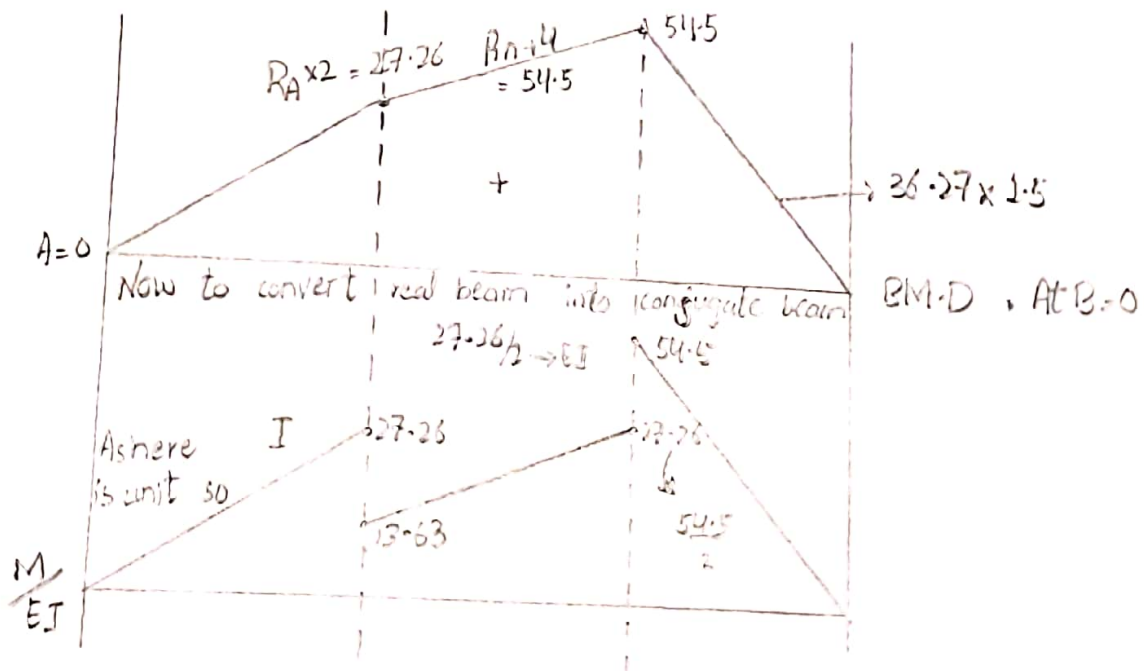
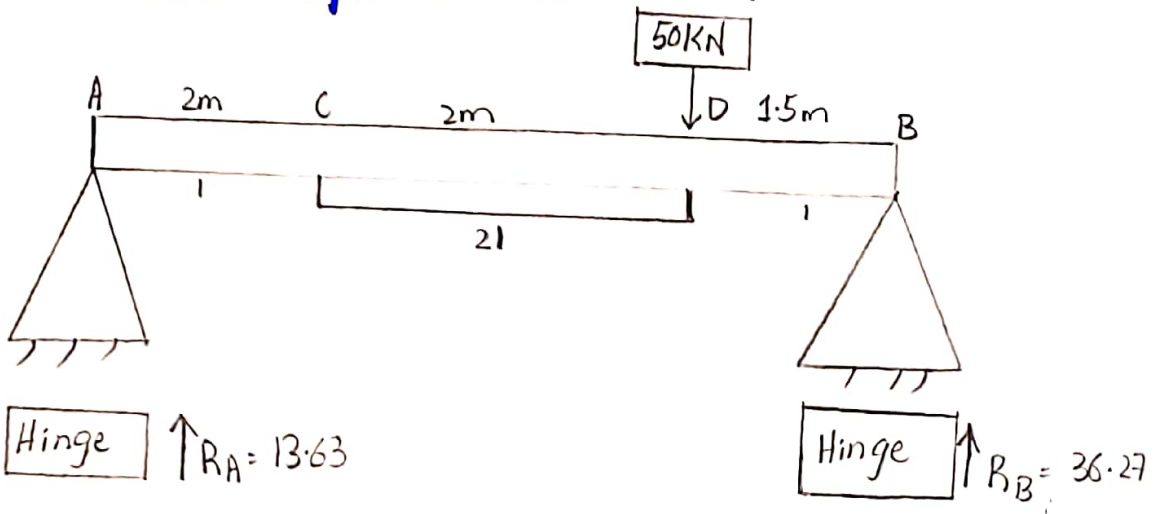
Now its time for reaction and moment





Question :- 3

Find slope at A, and deflection at D?



Reactions :-

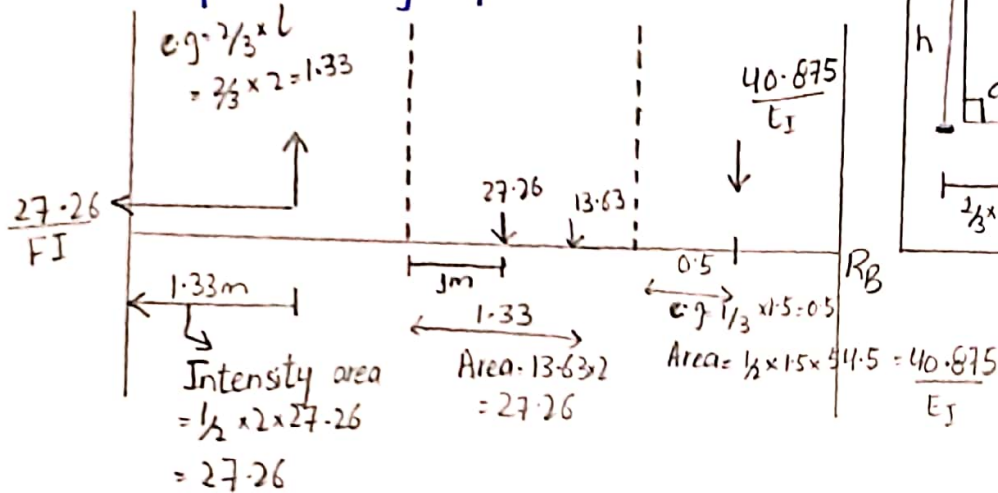
$$R_{Ax} = 5.5 - 50 \times 1.5$$

$$R_A = \frac{50 \times 1.5}{5.5} = 13.63 \text{ kN} \uparrow$$

$$R_B = \frac{50 \times 4}{5.5} = 36.37 \text{ kN} \uparrow$$

Step 2:

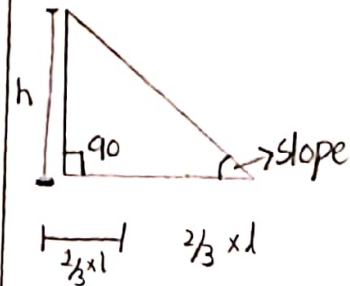
So all are positive so it means forces <sup>are</sup> acting upward.



HINT



Assymetrical  
Triangle Area =  $\frac{1}{2} \times 1 \times h$



FOR SLOPE =  $\frac{2}{3} \times (h) = \frac{2}{3} \times 2 = 1.33$

$$\text{AREA} = \frac{1}{2} \times 2 \times (27.26 - 13.03)$$

$$= 13.63$$

To find reaction

Conjugate beam calculations:

$$M_{0A} = 0$$

$$= \left( \frac{27.26 \times 1.33}{EI} \right) + \left( \frac{27.26 \times 3}{EI} \right) + \left( \frac{13.63 \times 3.33}{EI} \right)$$

$$+ \left( \frac{40.875 \times 4.5}{EI} \right) - (R_B \times 5.5) = 0$$

$$R_B = \frac{63.15}{EI} \text{ kN} \uparrow$$



$$+ \uparrow \Sigma F_y = 0$$

$$R_A + R_B = 27.26 + 27.26 + 13.63 + 40.875$$

$$R_A = \frac{45.205}{EI} \text{ kN}(\uparrow)$$

(a) Now slope at (A)

$$\theta_A = \frac{S.F.}{r} = A$$

$$R_A = \frac{45.205}{EI} \text{ Radian}$$

(b) Deflection @ D

$$\Delta D = B.M.D \text{ @ D}$$

$$= (R_B \times 1.5) - \left( \frac{40.875}{EI} \times 0.5 \right)$$

$$= \frac{74.2875}{EI} \text{ m}(\uparrow)$$