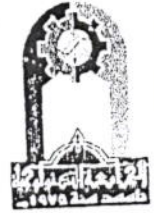




University Of Technology  
 Building and Construction Eng. Dept.  
 Final Exam/1<sup>st</sup> Attempt -2014/2015  
 Subject : Theory of Structures

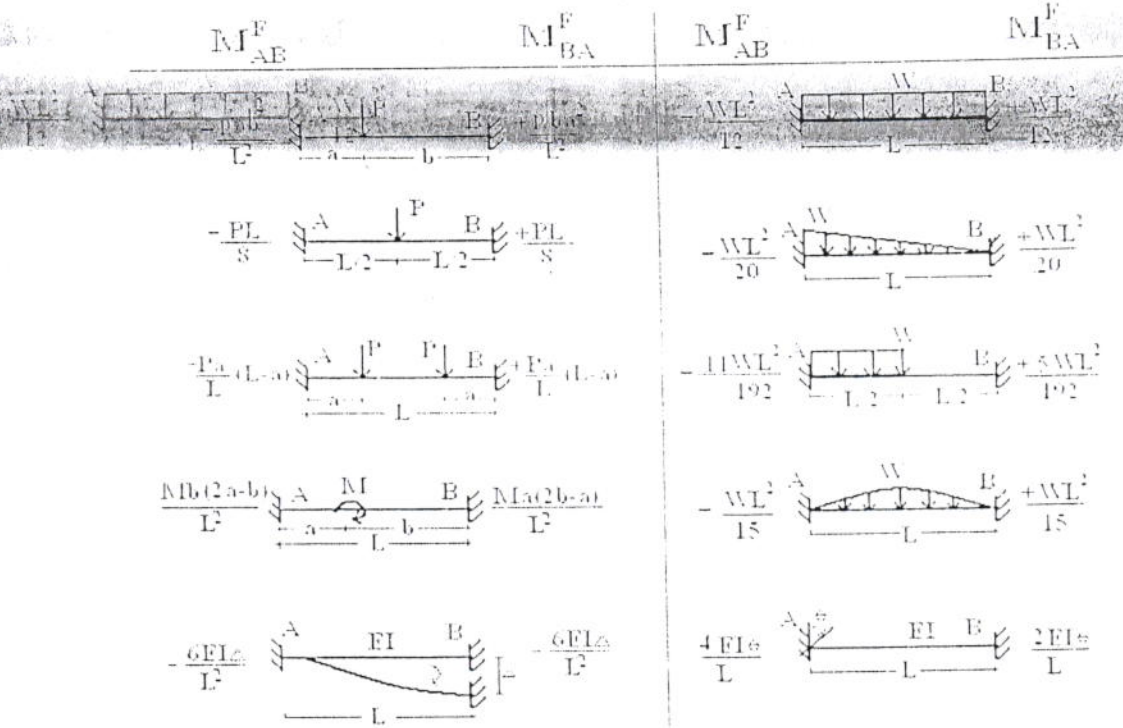


Class: third  
 Division: Sanitary & Env. Eng.

Time : 180 Mints\*  
 Date :28/ 5/ 2015

Answer Four Questions Only

- Q1) For the loaded frame shown in fig.(1):  
 A- Check determinacy and stability.  
 B- Draw shear force and bending moment diagrams. (25 Marks)
- Q2) For the truss shown in fig.(2):  
 A- Check determinacy and stability.  
 B- Determine the supports reactions and forces in all members, using the joint method (25 Marks)
- Q3) For the beam shown in fig.(3) plot influence lines for  $R_A$ ,  $R_B$ ,  $R_C$ ,  $V_D$  and  $V_{B|left}$ . (25 Marks)
- Q4) Determine the end moments in the members of the portal frame shown in fig.(4) by the slope deflection method. (25 marks)
- Q5) Analyze the beam shown in fig.(5).by using the moment distribution method, also draw the shear force and bending moment diagrams. (25 marks)



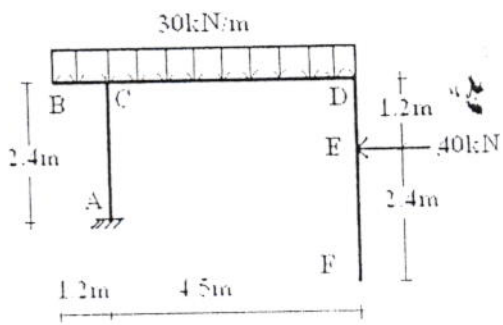


Fig.(1)

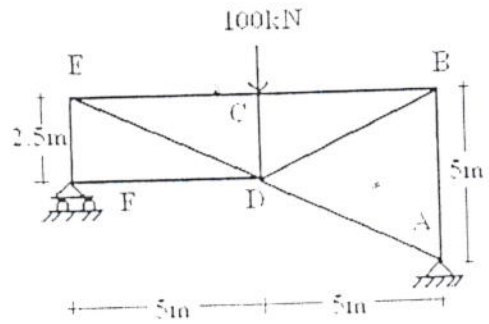


Fig.(2)

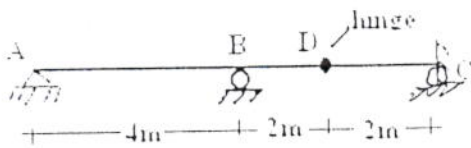


Fig.(3)

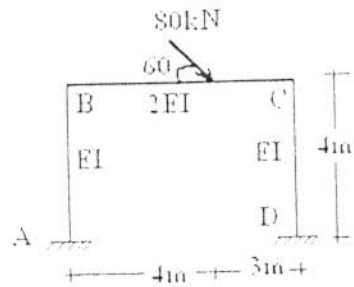


Fig.(4)

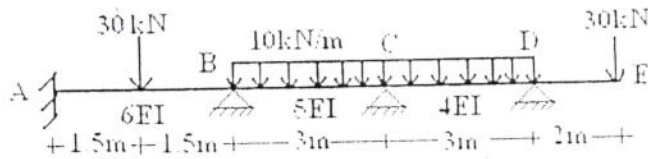
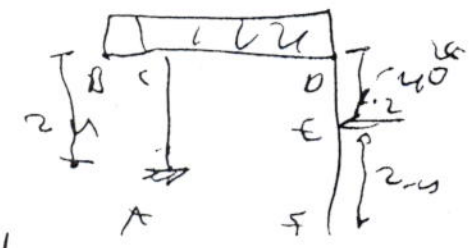


Fig.(5)

Q.11  
 a - Determine if stable  
 $3m + r = 3j + c$

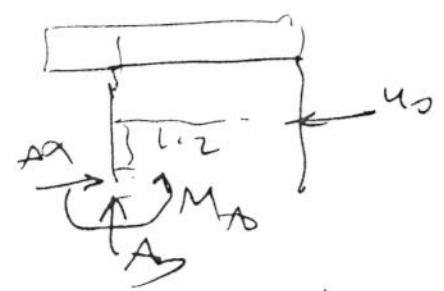
$m = 4$   
 $r = 3$   
 $j = 5$   
 $c = 0$

$3(4) + 3 = 3(5) + 0$   
 $15 = 15$  Determinate  
 & stable



b - Reactions

$\sum F_x = 0 \Rightarrow A_x = 40 \text{ KN} \rightarrow$   
 $\sum F_y = 0 \Rightarrow A_y = 171 \text{ KN} \uparrow$

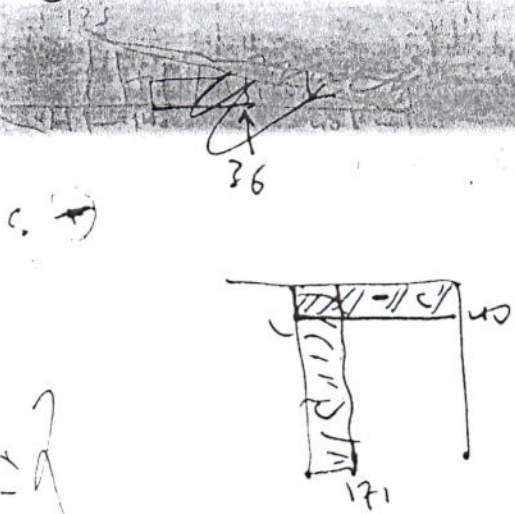


$\sum M_A = 0$   
 $-M_A + 30(4.5)(2.25) - 30(1.2)(0.6) - 40(1.2) = 0$   
 $M_A = 234.15 \text{ KN}\cdot\text{m} \uparrow$

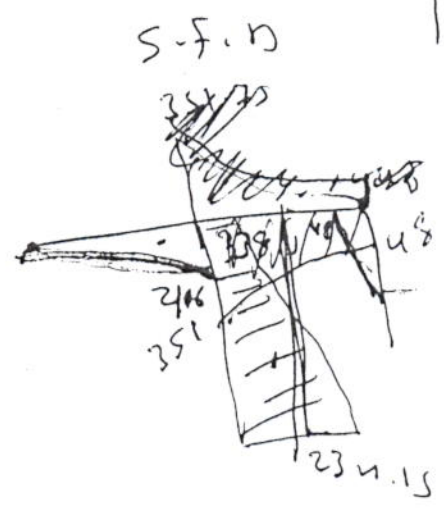
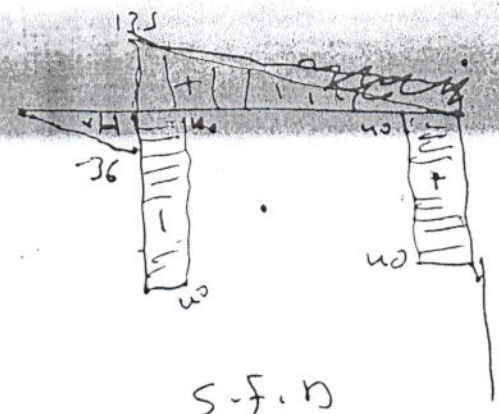
c) Draw

(+) (-)  $\uparrow \downarrow$

+	+
-	-
+	+



A-F.P





2

Determinacy & stability

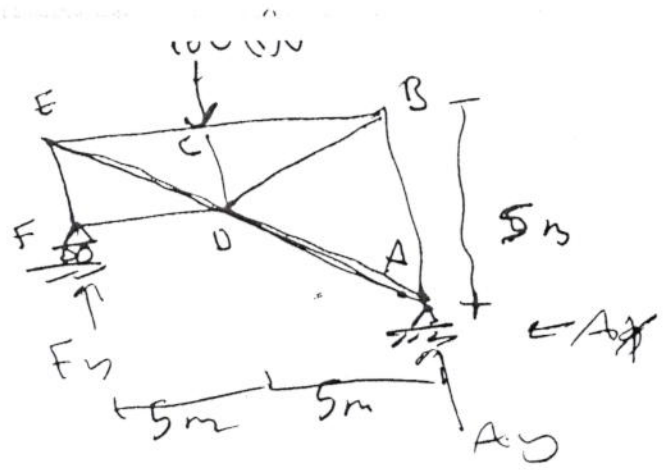
$$r = 3$$

$$m = 9$$

~~$$J = 6$$~~

$$m + r = 2J$$

$9 + 3 = 2(6) = 12$  Determinate & stable



Reactions

$$\sum F_x = 0 \Rightarrow A_x = 0$$

$$\sum M_F = 0 \Rightarrow 100(5) + A_y(10) = 0 \Rightarrow A_y = 50 \text{ kN } \uparrow$$

$$\sum F_y = 0 \Rightarrow 50 - 100 + F_y = 0 \Rightarrow F_y = 50 \text{ kN } \uparrow$$

~~Joint E~~

Joint F

$$\sum F_y = 0 \Rightarrow F_y = 50 \text{ kN}$$

$$\sum F_x = 0$$

Joint E

$$\sum F_y = 0 \Rightarrow EF - ED \left(\frac{4}{5}\right) = 0$$

$$\sum F_x = 0 \Rightarrow ED \left(\frac{3}{5}\right) - EC = 0$$

Joint C

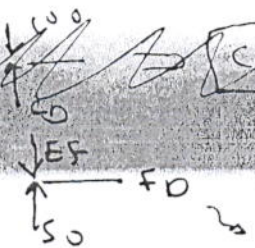
$$\sum F_y = 0 \Rightarrow EC = 100$$

$$\sum F_x = 0$$

Joint B

$$\sum F_x = 0 \Rightarrow 100 - BD \left(\frac{2}{5}\right) = 0$$

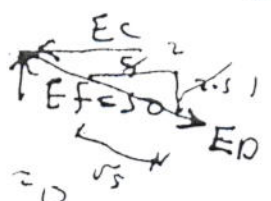
$$\sum F_y = 0 \Rightarrow AB - BD \left(\frac{4}{5}\right) = 0$$



$$CD = 100 \text{ kN C}$$

$$EF = 50 \text{ kN C}$$

$$FD = 0$$



$$ED = 111.8 \text{ kN T}$$

$$EC = 100 \text{ kN C}$$

$$CD = 100 \text{ kN C}$$

$$CB = 100 \text{ kN C}$$

$$BD = 111.8 \text{ kN T}$$

$$AB = 50 \text{ kN C}$$

