Ministry of Higher Education
Giza Higher Institute for Eng. & Tech.
Civil Engineering Department
Course Name: **Theory of Structures (1)**
Course Code : **CIV 201**

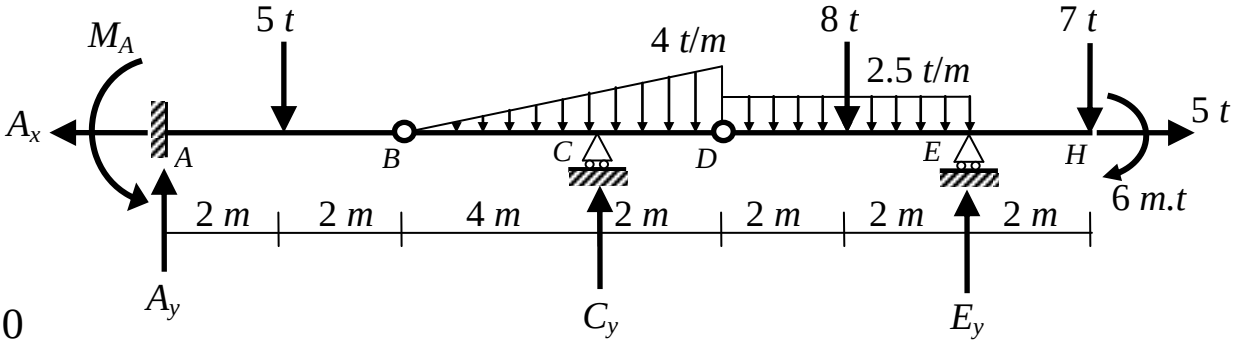
Academic Year : **2014-2015**
Semester : **First**
Level : **Second**
Time : **3 Hours**
Date : **4 / 1 / 2015**
Examiner: ***Dr. M. Abdel-Kader***

Solution of
First Semester Final Exam

Question (1-a): (10 Marks)

(a) For the shown beam, determine the reactions at the supports *A*, *C* and *E*.

Note: *In your answer sheet, draw the final reactions (direction and magnitude) on the beam.*



$+\rightarrow \sum F_x = 0$

$-A_x + 5 = 0 \quad \therefore \; A_x = +5 \leftarrow$ $\qquad$ $A_x = 5\ t \leftarrow$

$+\circlearrowleft \sum_{D}^{H} M_D = 0$

$8(2) + 10(2) - E_y(4) + 7(6) + 6 = 0 \rightarrow E_y = 21\ t \uparrow$ $\qquad$ $E_y = 21\ t \uparrow$

$+\circlearrowleft \sum_{B}^{H} M_B = 0$

$12(4) - C_y(4) + 18(8) - 21(10) + 7(12) + 6 = 0 \rightarrow C_y = 18\ t \uparrow$ $\qquad$ $C_y = 18\ t \uparrow$

$+\uparrow \sum F_y = 0$

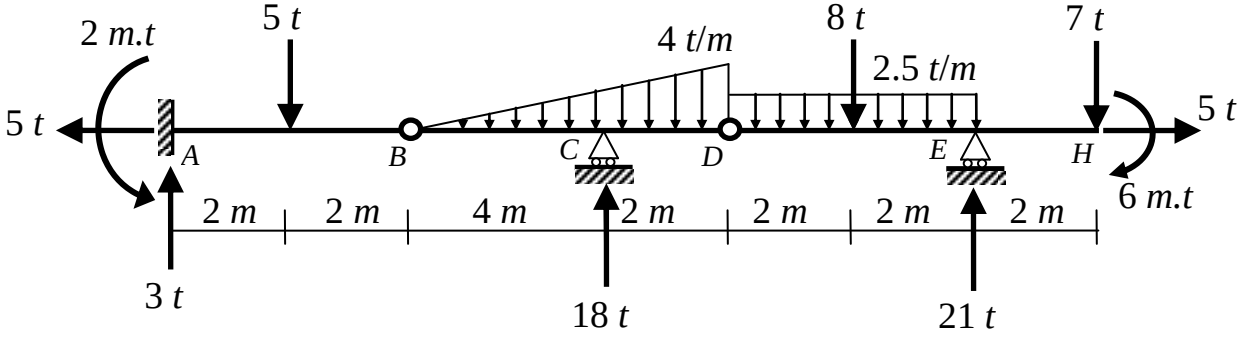
$A_y - 5 - 12 + 18 - 18 + 21 - 7 = 0 \rightarrow A_y = 3\ t \uparrow$ $\qquad$ $A_y = 3\ t \uparrow$

$+\circlearrowleft \sum_{B}^{A} M_B = 0$

$3(4) - M_A - 5(2) = 0 \rightarrow M_A = 2\ m.t \circlearrowleft$ $\qquad$ $M_A = 2\ m.t \circlearrowleft$

Chech:

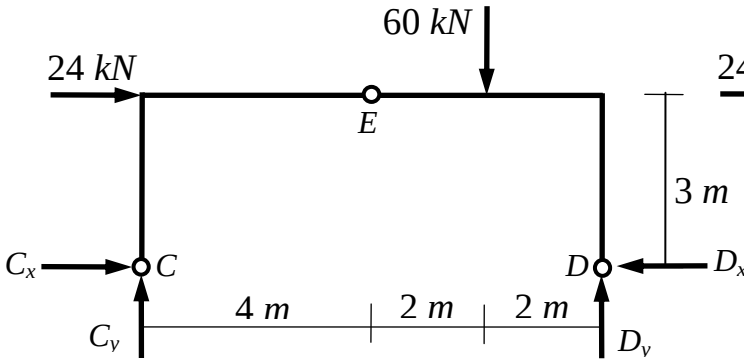
$+\circlearrowleft \sum M_H = 3(16) - 2 - 5(14) + 18(8) - 12(8) - 18(4) + 21(2) + 6 = 0$ $\qquad$ ***O.K***

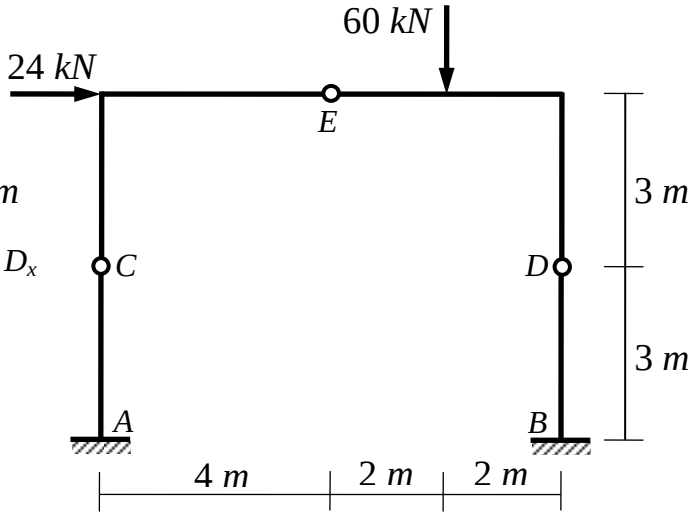


Question (1-b): (10 Marks)

(b) For the shown frame, determine the reactions at the supports *A* and *B*.

***Note**: In your answer sheet, draw the final reactions (direction and magnitude) on the frame.*





Part *CED*:

$+\circlearrowleft \sum M_C = 0$

$24(3) + 60(6) - D_y(6) = 0$

$D_y = 54\ kN \uparrow$

$+\circlearrowleft \sum_E^D M_E = 0$

$60(2) - D_x(3) - 54(4) = 0$

$D_x = 32\ kN \leftarrow$

$+\uparrow \sum F_y = 0$

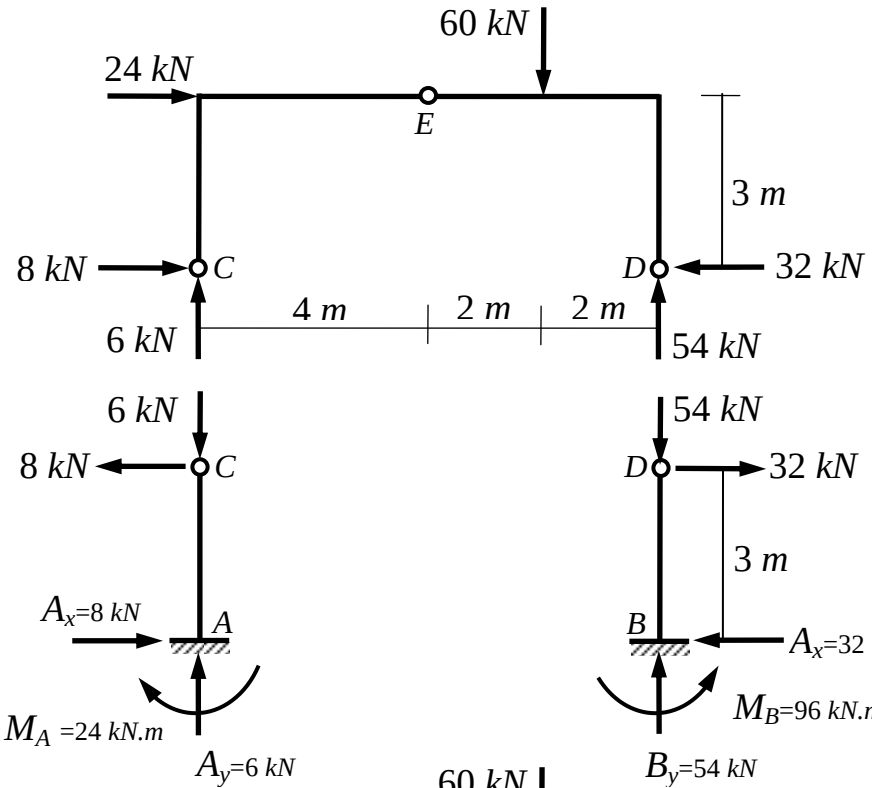
$C_y - 60 + 54 = 0$

$C_y = 6\ kN \uparrow$

$+\rightarrow \sum F_x = 0$

$C_x + 24 - 32 = 0$

$C_x = 8\ kN \leftarrow$



Part *AC*:

$A_x = 8\ kN \rightarrow$

$A_y = 6\ kN \uparrow$

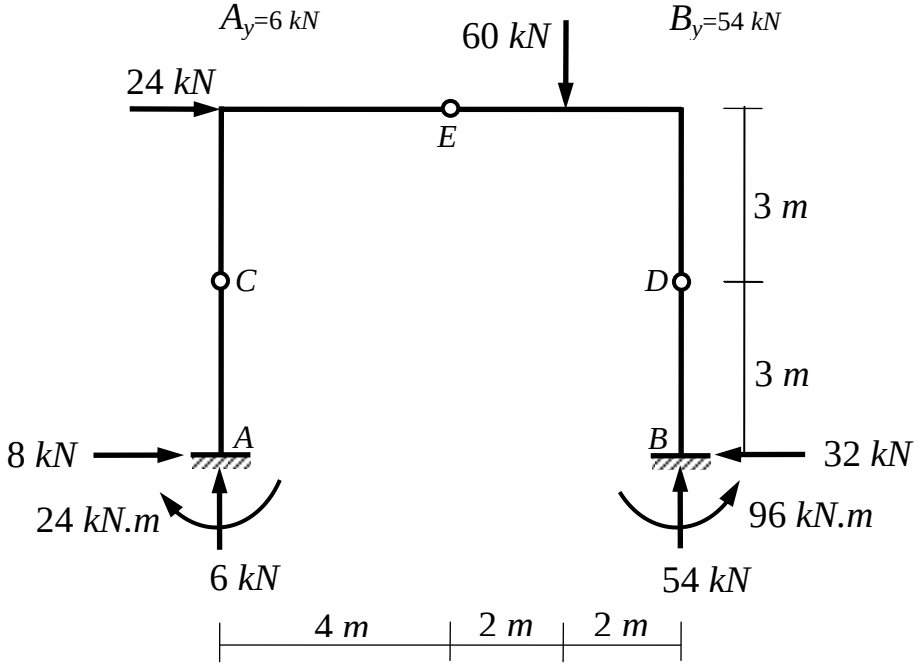
$M_A = 24\ kN.m \circlearrowleft$

Part *BD*:

$B_x = 32\ kN \leftarrow$

$B_y = 54\ kN \uparrow$

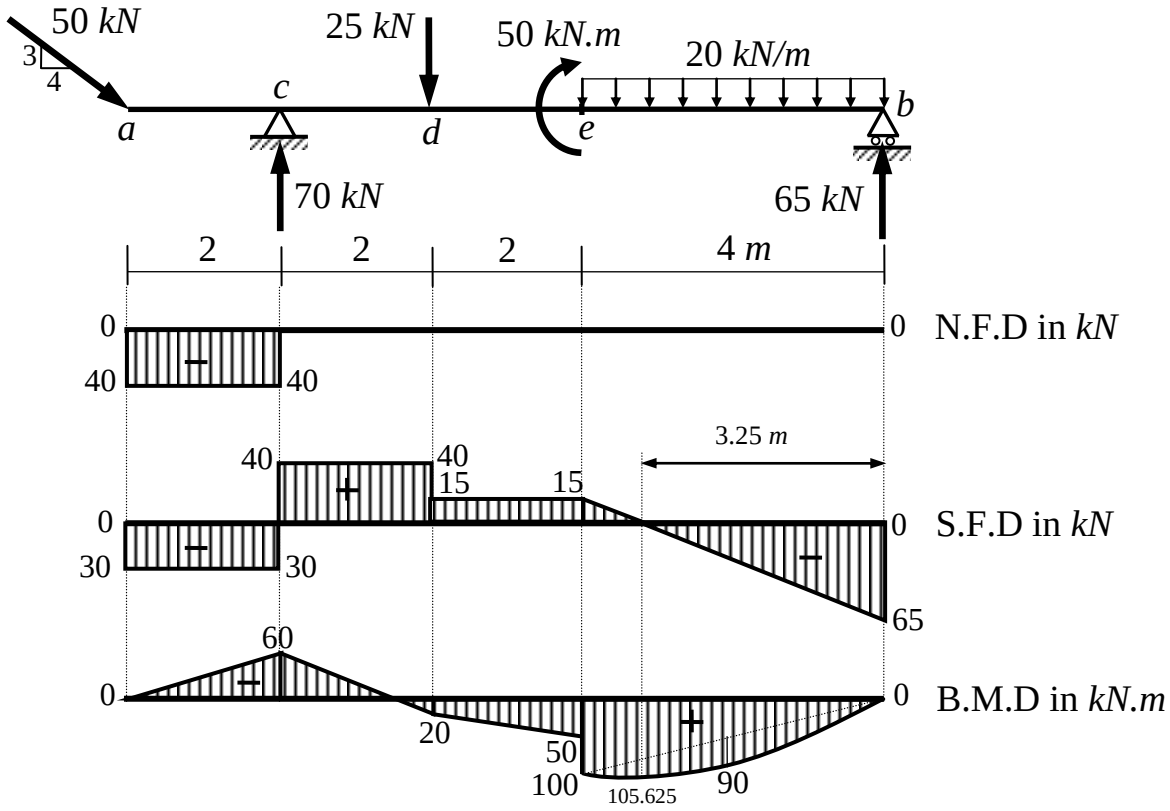
$M_B = 96\ kN.m \circlearrowleft$



Question (2-a): (10 Marks)

(a) For the shown beam, draw the normal force, shear force and bending moment diagrams.

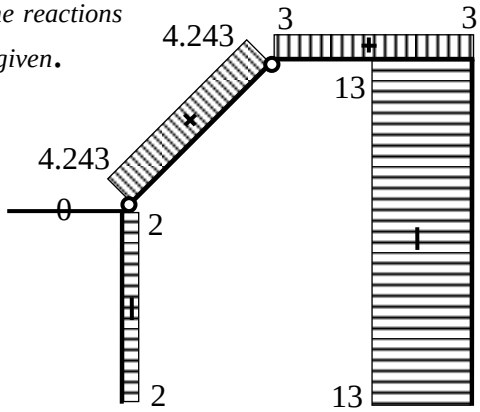
Note: *Only the vertical reactions are given.*



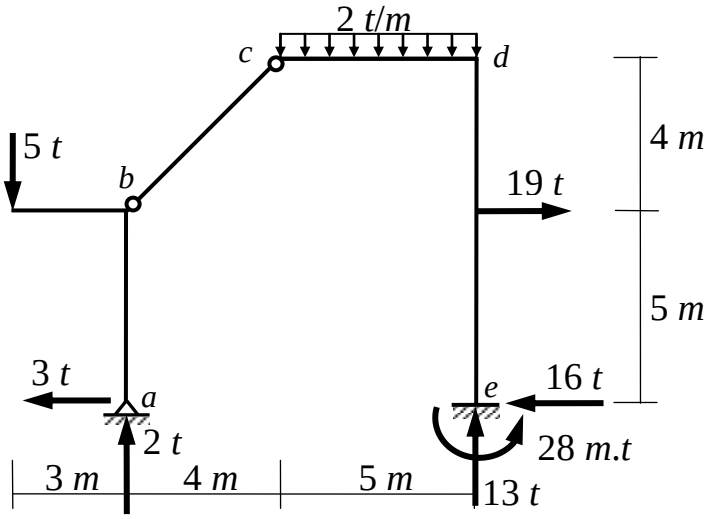
Question (2-b): (10 Marks)

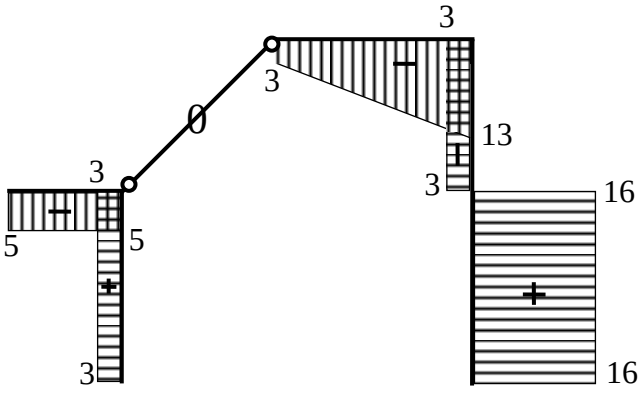
(b) For the shown frame, draw the normal force, shear force and bending moment diagrams.

Note: *The reactions are given*.

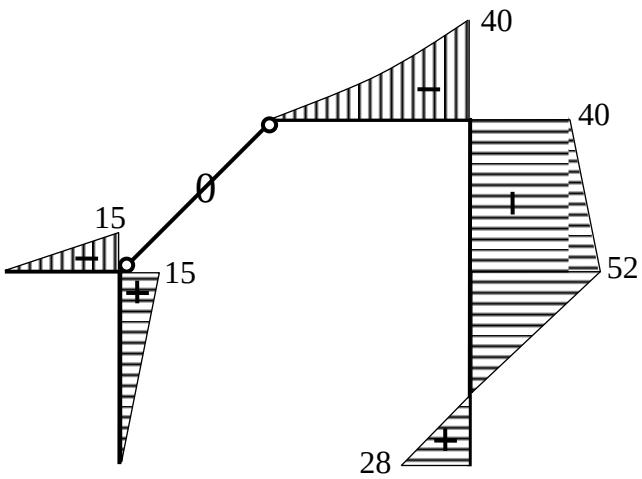


N.F.D in *ton*





S.F.D in *ton*



B.M.D in *m.t*

Question (3-a): (11 Marks)

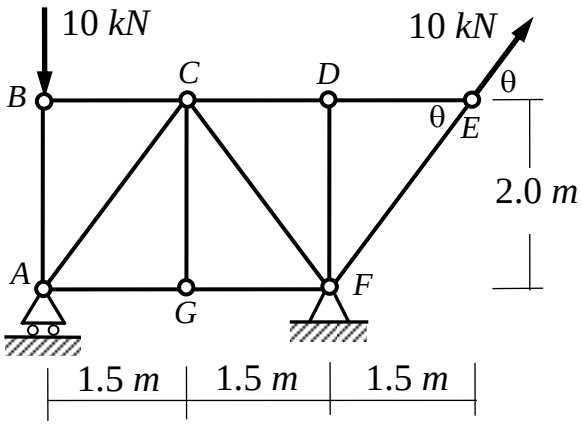
(a) For the shown truss:

(i) Determine the reactions at the supports *A* and *F*.

(ii) Determine the forces in all truss members.

(iii) Using the method of sections, determine the force in member CF.

Note: *In your answer sheet, draw the truss and put the force magnitude and the indication (Tension or Compression) on each member.*



$\cos\theta = 1.5/2.5 = 0.6$ $\sin\theta = 2/2.5 = 0.8$

$+\rightarrow \sum F_X = 0$

$10\cos\theta - F_X = 10 \times 0.6 - F_X = 0$

$===> F_X = +6\ kN \leftarrow$ $===>$ $\boxed{F_X = 6\ kN \leftarrow}$

$+\uparrow \sum F_Y = 0$

$F_Y + A_Y - 10 + 10\sin\theta = F_Y + 10 - 10 + 10 \times 0.8 = 0$

$===> F_Y = -8\ kN \uparrow$ $===>$ $\boxed{F_Y = 8\ kN \downarrow}$

(ii) The forces in members using the method of joints

Joint B:

$F_{BA} = 10$ kN (Comp.) and $F_{BC} = 0$

Joint E:

$F_{EF} = 10$ kN (Tension) and $F_{ED} = 0$

Joint D:

$F_{DF} = 0$ and $F_{DC} = 0$

Joint A:

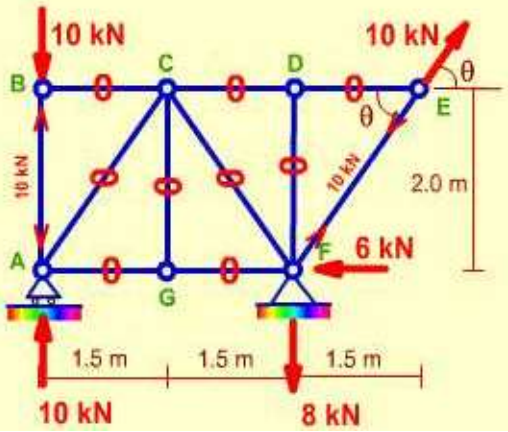
$F_{AC} = 0$ and $F_{AG} = 0$

Joint G:

$F_{GF} = 0$ and $F_{GC} = 0$

Joint C:

$F_{CF} = 0$



(iii) For left Part: $+\uparrow \sum F_y = 0$: $10 - 10 - F_{CF}\sin\theta = 0$ → $\boxed{F_{CF} = 0}$

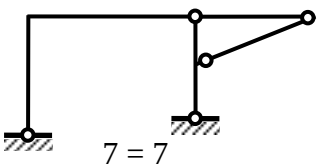
Question (3-b): (9 Marks)

(b) Determine whether each of the shown structures is stable or unstable. If stable, determine whether it is statically determinate or indeterminate.

4 = 4

Stable + Statically Determinate

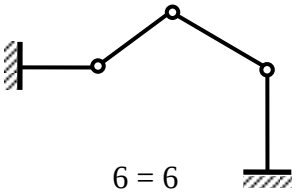
(1)



7 = 7

Stable + Statically Determinate

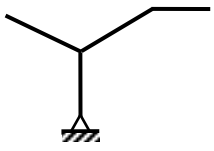
(2)



6 = 6

Stable + Statically Determinate

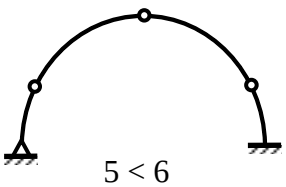
(3)



2 < 3

Unstable

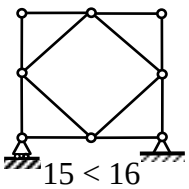
(4)



5 < 6

Unstable

(5)



15 < 16

Unstable

(6)

With my best wishes

Dr. M. Abdel-Kader