Ministry of Higher Education
Giza Higher Institute of Engineering & Technology
Civil Engineering Department
Course Name: **Theory of Structures (1)A**
Course Code : **CIV 111** Date : **29 / 12 / 2018**

Academic Year : **2018/2019**
Semester : **First**
Level : **1st Civil**
Time : **3 Hours**
Examiner: ***Dr. M. Abdel-Kader***

Answer of Final Exam

Total Marks: **90** No. of Questions:**3** (Attempt all questions)

Question (1): (30 Marks)

Entire (Total) Structure

$+\circlearrowleft \sum M_A = 0:$ $\quad B_x(4) + 50(2) - 60(7) - 40(2) = 0$

$\therefore\ B_x = +100 \rightarrow$ $\quad B_x = 100\ kN \rightarrow$

$+\rightarrow \sum F_x = 0:$ $\quad 50 + 100 - A_x = 0$

$\therefore\ A_x = +150 \leftarrow$ $\quad A_x = 150\ kN \leftarrow$

Part *BC*:

$+\circlearrowleft \sum_{C}^{B} M_C = 0:$ $\quad 50(2) + 100(4) - B_y(4) = 0$

$\therefore\ B_y = 125 \uparrow$ $\quad B_y = 125\ kN \uparrow$

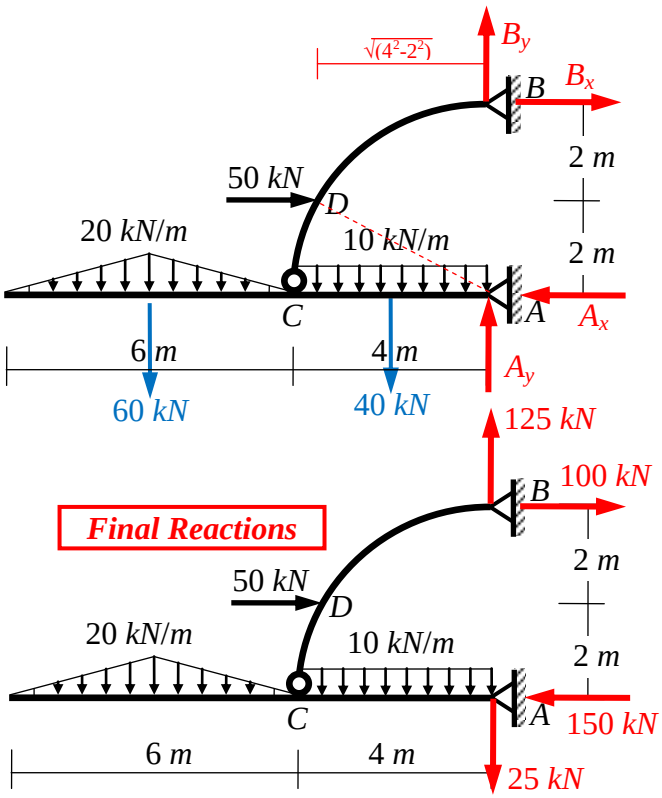
Entire Structure

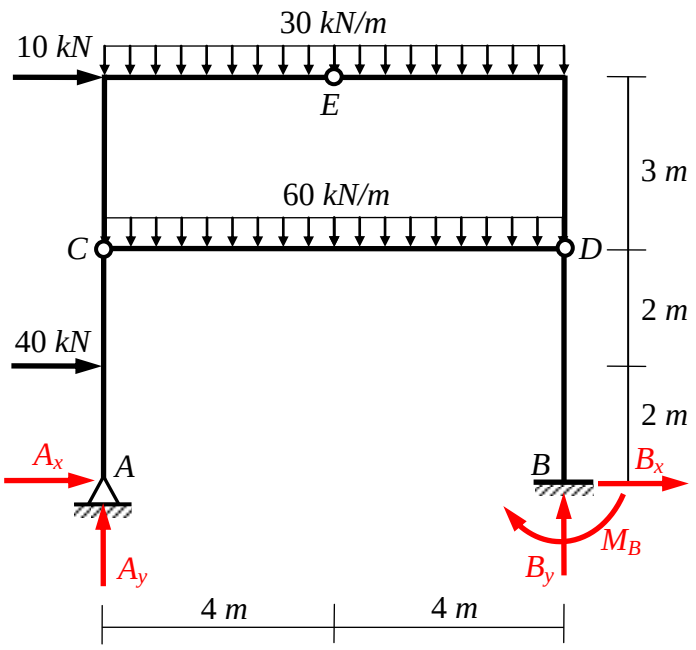
$+\uparrow \sum F_y = 0:$ $\quad A_y + 125 - 60 - 40 = 0$

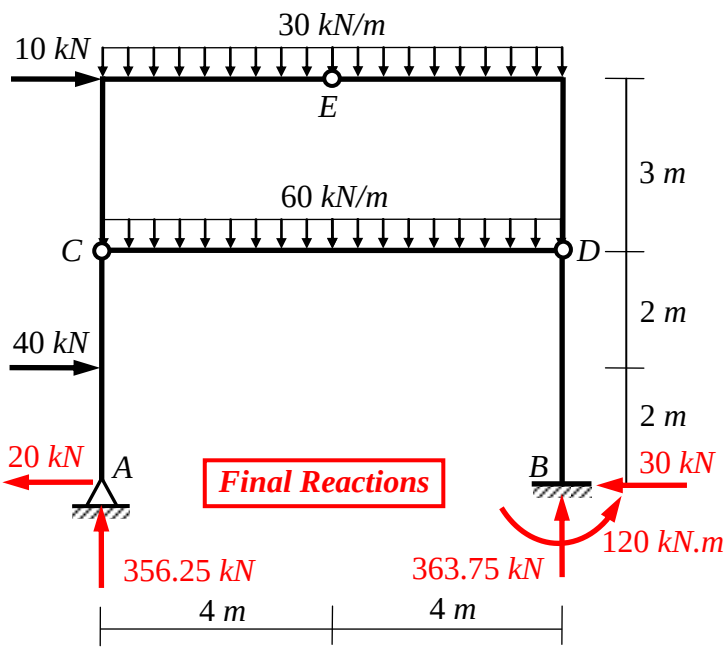
$\therefore\ A_y = -25 \uparrow$ $\quad A_y = 25\ kN \downarrow$

Moment at *D* $= 125(\sqrt{(4^2-2^2)}) - 100(2)$

$= 233\ kN.m \circlearrowleft$ $\quad M_D = 233\ kN.m$







Part *AC*: $\quad +\circlearrowleft \sum M_C = 0 \quad -40(2) - A_x(4) = 0$ $\quad A_x = 20\ kN \leftarrow$

Entire (Total) Frame: $\quad +\rightarrow \sum F_x = 0 \quad -20 + 40 + 10 + B_x = 0$ $\quad B_x = 30\ kN \leftarrow$

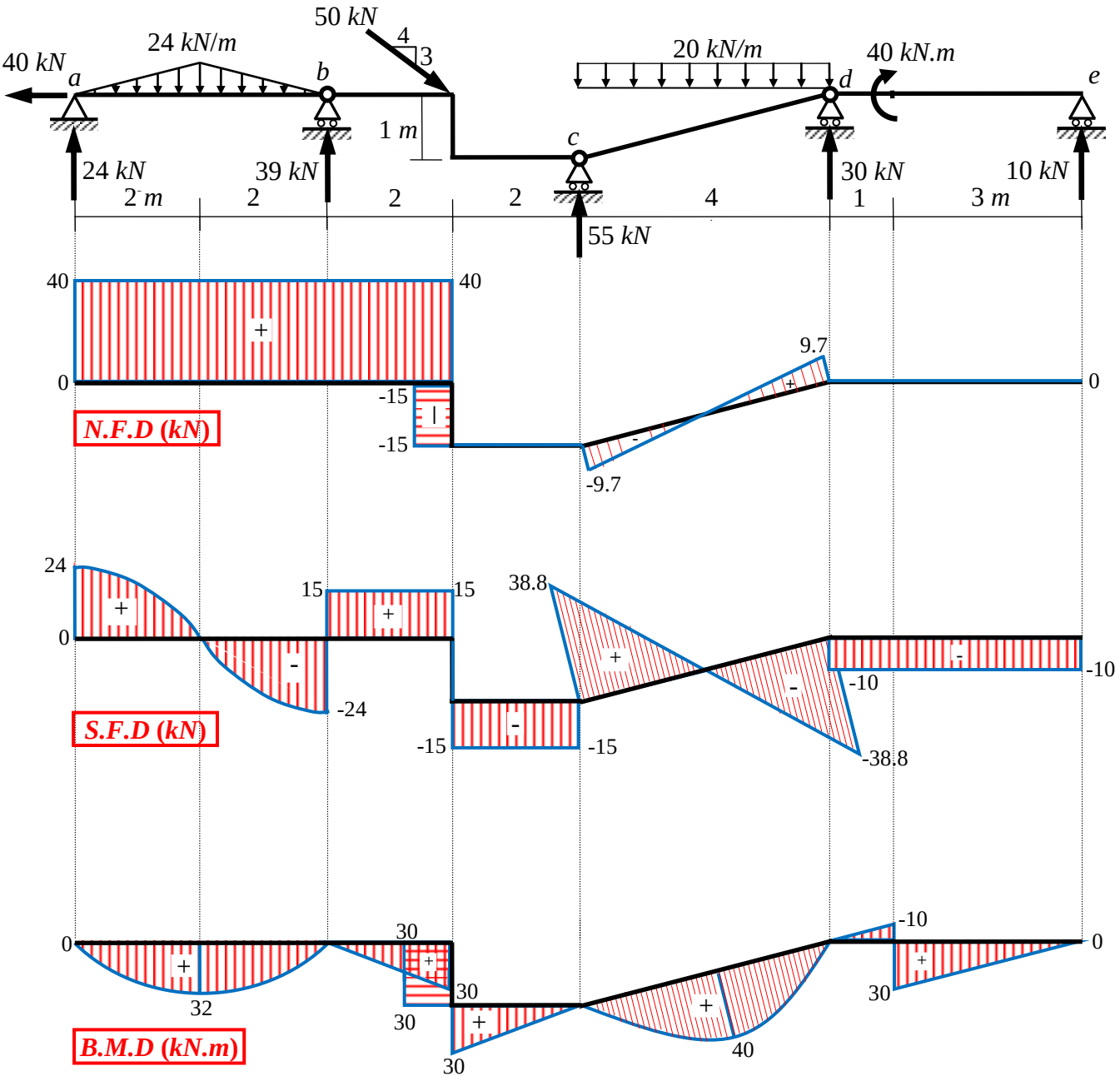
Part *BD*: $\quad +\circlearrowleft \sum M_D = 0 \quad 30(4) + M_B = 0$ $\quad M_B = 120\ kN.m \circlearrowleft$

Entire (Total) Frame: $\quad +\circlearrowleft \sum M_A = 0 \quad 40(2) + 10(7) + (4) - 120 - B_y(8) = 0$ $\quad B_y = 363.75\ kN \uparrow$

$+\uparrow \sum F_y = 0 \quad A_y - 30\times 8 - 60\times 8 + 363.75 = 0$ $\quad A_y = 356.25\ kN \uparrow$

With my best wishes
Dr. M. Abdel-Kader

Question (2a): (15 Marks)



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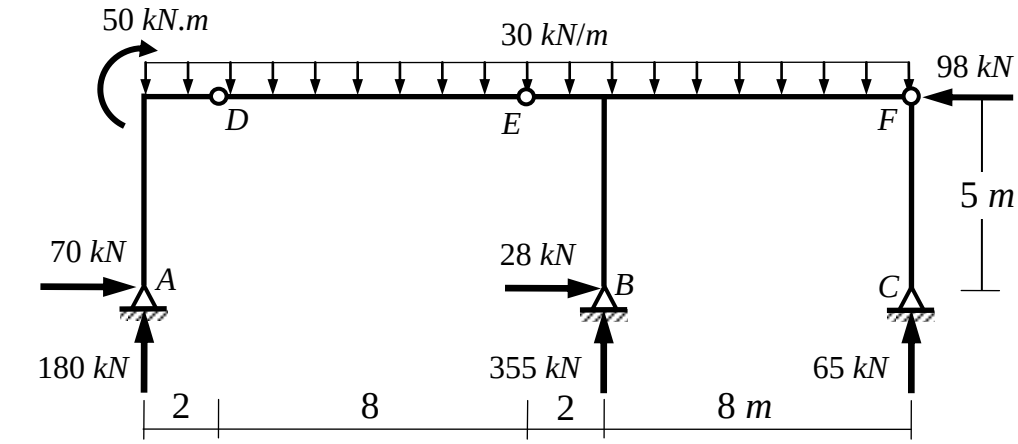
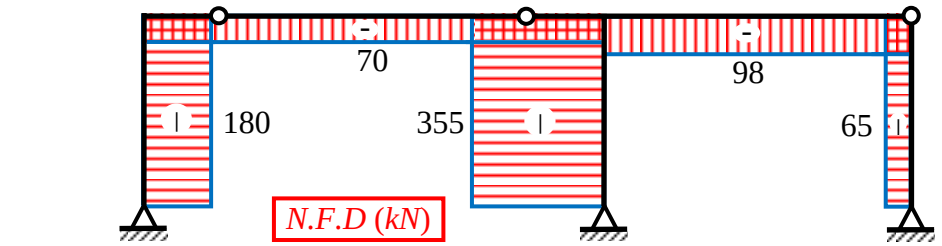
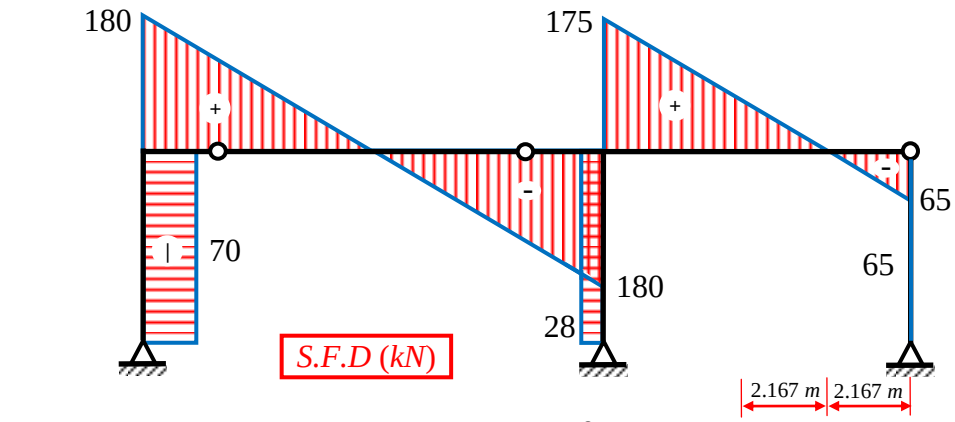
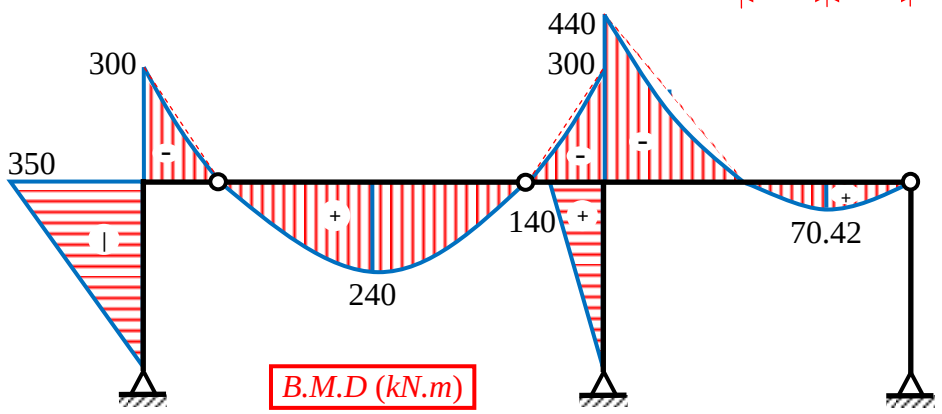
Question (2b): (15 Marks)









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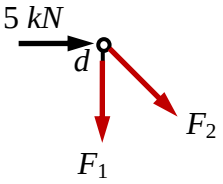
Question (3): (30 Marks)

(i) Zero-force members are 7 and 11. 7 and 11

(ii) Method of joints:



Joint d

Joint d:

$+\rightarrow \sum F_x = 5 + F_2/\sqrt{2} = 0$

$\therefore \quad F_2 = -5\sqrt{2} = -7.07$ $F_2 = 7.07$ *kN* Compression

$+\uparrow \sum F_y = -F_1 - F_2/\sqrt{2} = -F_1 - (-5\sqrt{2})/\sqrt{2} = -F_1 + 5 = 0$

$\therefore \quad F_1 = +5$ $F_1 = 5$ *kN* Tension

Joint c:

$+\rightarrow \sum F_x = 0 \quad \therefore \quad F_3 = -10$ $F_3 = 10$ *kN* Compression

(iii) Method of sections:

- $+\circlearrowleft \sum M_b = 0$

$10(4) + 5(8) + 5(4) + F_6(4) = 0$

$\therefore \quad F_6 = -25$ $F_6 = 25$ *kN* Compression

- $+\circlearrowleft \sum M_e = 0$

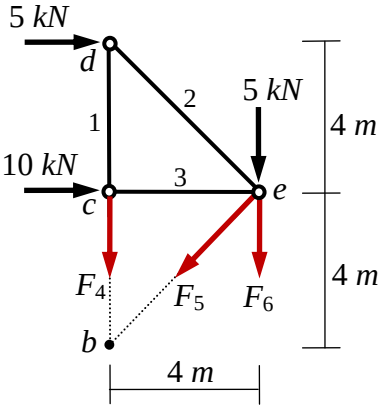
$5(4) - F_4(4) = 0$

$\therefore \quad F_4 = 5$ $F_4 = 5$ *kN* Tension

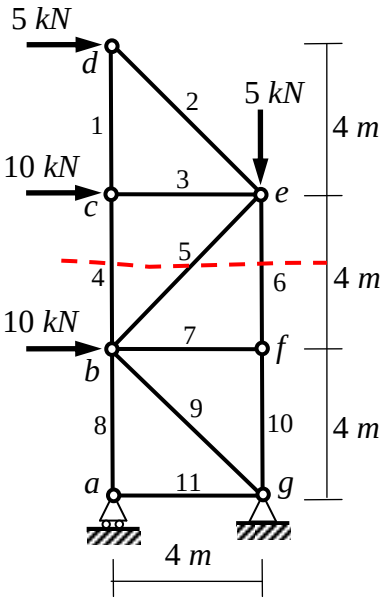
- $+\rightarrow \sum F_x = 5 + 10 - F_5/\sqrt{2} = 0$

$\therefore \quad F_5 = 15\sqrt{2} = 21.2$

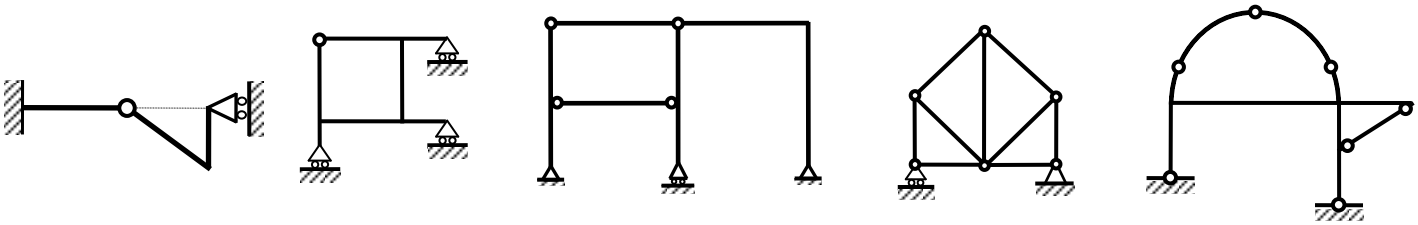
$F_5 = 21.2$ *kN* Tension



FBD of the upper part



(b)



Unstable (1) | Unstable (2) | Stable + Stat. Det. (3) | Stable + Stat. Det. (4) | Stable + Stat. Indet. to the 2nd degree. (5)

With my best wishes

Dr. M. Abdel-Kader