มหาวิทยาลัยสงขลานครินทร์

คณะวิศวกรรมศาสตร์

สอบปลายภาค ประจำภาคการศึกษา 2 ปีการศึกษา 2547

วันที่ 24/2/2548 เวลา 9.00 – 12.00 น.

วิชา 220-302 **Structural Analysis I**

ห้องสอบ R 201

ชื่อ-สกุล..... รหัส.....

<u>คำชี้แจง</u>

1.ข้อสอบทั้งหมดมี 4 ข้อใหญ่ คะแนนรวม 130 คะแนน ดังแสดงในตารางข้างล่าง

2.ข้อสอบมีทั้งหมด 15 หน้า (รวมปก) ผู้สอบต้องตรวจสอบว่ามีครบทุกหน้าหรือไม่ (ก่อนลงมือทำ) ห้ามฉีกหรือแกะข้อสอบออกจากเล่ม

3.ให้ทำหมดทุกข้อลงในกระดาษคำถามนี้ หากไม่พอให้ใช้หน้าว่างด้านซ้ายมือ

4.ห้ามนำเอกสารใดๆ เข้าห้องสอบ ทุจริตในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น และพักการเรียน 1 ภาคการศึกษา โทษสูงสุด ให้ออก

5.อนุญาตให้ใช้เครื่องคิดเลขได้ทุกชนิด

6.ห้ามหยิบ หรือยืมสิ่งของใดๆ ของผู้อื่นในห้องสอบ

7. อนุญาตให้ตอบด้วยดินสอดำได้ (ควรใช้ชนิด B)

8. ให้เขียน รหัส ที่หัวกระดาษทุกแผ่น

9. ***Good Luck***

ตารางคะแนน

ข้อที่	คะแนนเต็ม	ได้
1	30	
2	30	
3	40	
4.1	15	
4.2	15	
รวม	130	

By Dr. Suchart Limkatanyu

Quitter Never Win
Winner Never Quite

รหัส.....

Problem 1: (30 Points)

For the pin-jointed truss structure shown in Figure 1:
(*a*) Determine the support reactions and the forces in the members when subjected to the force as shown in Figure 1. (Use F_{AD} and R_{Ey} as redundant forces) **(25 Points)**
(*b*) Outline your analysis procedure if support E is subjected to 2-mm vertical settlement. **(5 Points)**

NOTE: $\left(\frac{EA}{L}\right) = 10\frac{kN}{mm}$ for all members

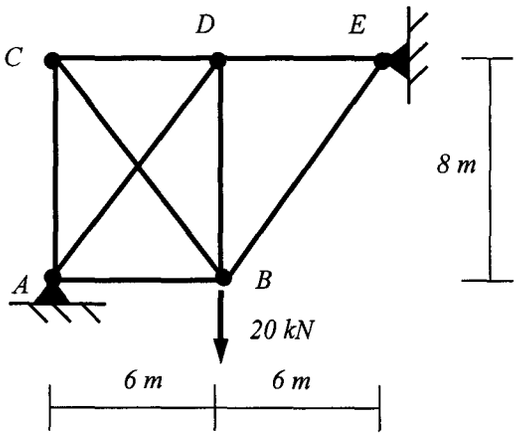


Figure 1

รหัส.....

Problem 2: (30 Points)

For the frame as shown in Figure 2

(a) Determine all of the reaction forces when subjected to the force system as shown. Note: **Use** R_D as redundant force (20 Points)

(b) Construct the axial force diagram, shear force diagram and moment diagram (10 Points)

$E = 30 \times 10^6$ *psi*. Cable Area = 1.0 in^2. I = 2000 in^4. and A = 16.0 in^2 for all bending members.

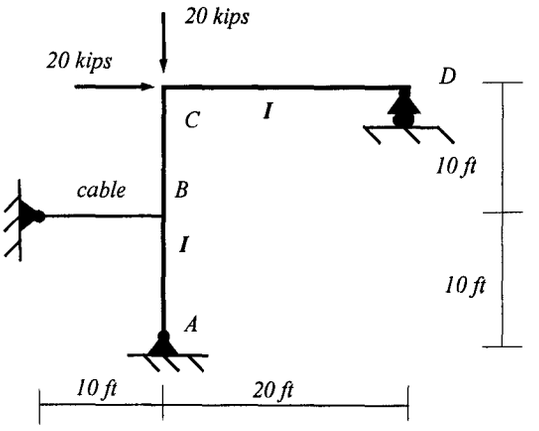


Figure 2

Problem 3: (40 Points)

For the frame shown in Figure 3, use the slope-deflection method to determine:

(*a*) The support reactions (15 Points)

(*b*) End moments for each member (15 Points)

(c) Shear Force Diagram and Bending Moment Diagram (10 Points)

Note: Neglect Axial Deformation

$E = 200\ GPa$ and $I = 250 \times 10^6\ mm^4$

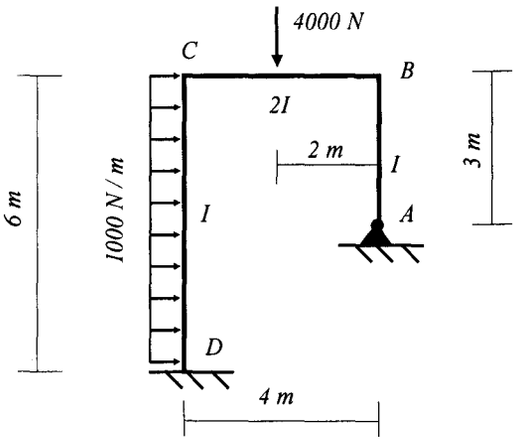


Figure 3

Problem 4: (30 Points)

Problem 4.1 (15 Points)

For the beam shown, construct the influence lines for the following quantities:
(*a*) The vertical component of reaction at *A*
(*b*) The vertical component of reaction at *C*
(*c*) The vertical component of reaction at *E*
(*d*) The moment at A

Hint: *use Müller – Breslau Principle*

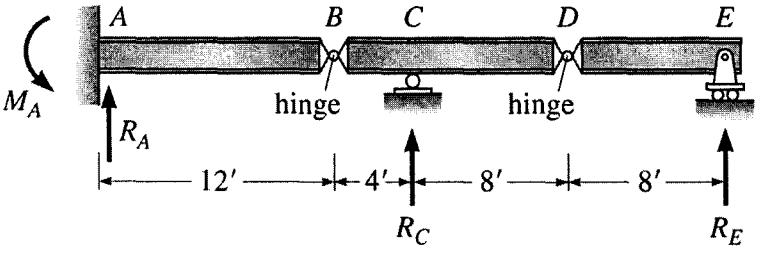


Figure 4

Problem 4.2 (15 Points)

For a unit load moving from *A* to *G* on the truss shown, construct the influence lines for bar forces in members *ML* and *FH*, and Reaction at *K*. If the live load is applied through the lower chord panel points.

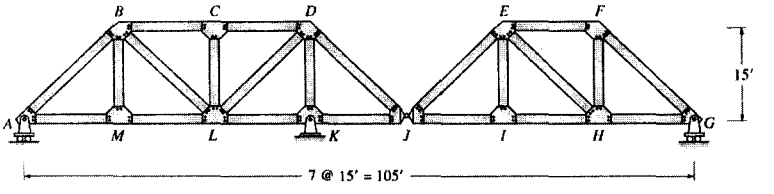
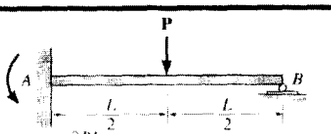
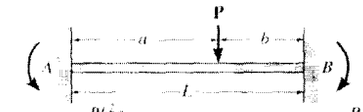


Figure 5

$(FEM)_{AB} = \frac{PL}{8}$ $(FEM)_{BA} = \frac{PL}{8}$

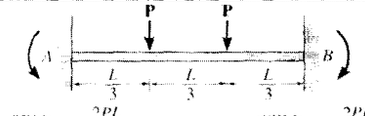


$(FEM)'_{AB} = \frac{3PL}{16}$

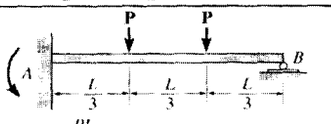


$(FEM)_{AB} = \frac{Pb^2a}{L^2}$ $(FEM)_{BA} = \frac{Pa^2b}{L^2}$

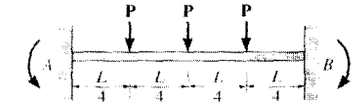
$(FEM)'_{AB} = (\frac{P}{L^2})(b^2a + \frac{a^2b}{2})$



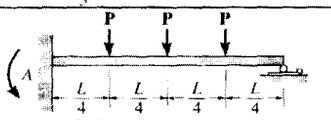
$(FEM)_{AB} = \frac{2PL}{9}$ $(FEM)_{BA} = \frac{2PL}{9}$



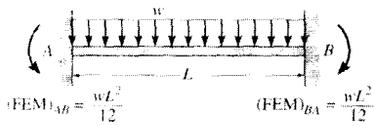
$(FEM)'_{AB} = \frac{PL}{3}$



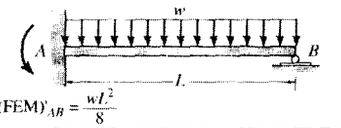
$(FEM)_{AB} = \frac{15PL}{48}$ $(FEM)_{BA} = \frac{15PL}{48}$



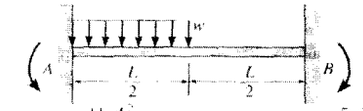
$(FEM)'_{AB} = \frac{45PL}{96}$



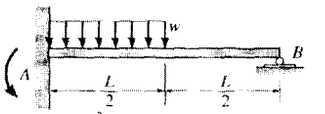
$(FEM)_{AB} = \frac{wL^2}{12}$ $(FEM)_{BA} = \frac{wL^2}{12}$



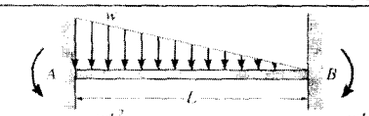
$(FEM)'_{AB} = \frac{wL^2}{8}$



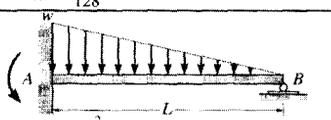
$(FEM)_{AB} = \frac{11wL^2}{192}$ $(FEM)_{BA} = \frac{5wL^2}{192}$



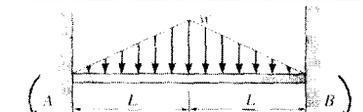
$(FEM)'_{AB} = \frac{9wL^2}{128}$



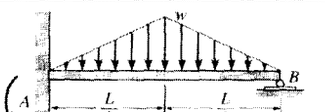
$(FEM)_{AB} = \frac{wL^2}{20}$ $(FEM)_{BA} = \frac{wL^2}{30}$



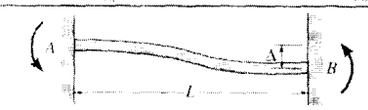
$(FEM)'_{AB} = \frac{wL^2}{15}$



$(FEM)_{AB} = \frac{5wL^2}{96}$ $(FEM)_{BA} = \frac{5wL^2}{96}$



$(FEM)'_{AB} = \frac{5wL^2}{64}$



$(FEM)_{AB} = \frac{6EI\Delta}{L^2}$ $(FEM)_{BA} = \frac{6EI\Delta}{L^2}$

$(FEM)'_{AB} = \frac{3EI\Delta}{L^2}$