มหาวิทยาลัยสงขลานครินทร์

คณะวิศวกรรมศาสตร์

สอบปลายภาค ประจำภาคการศึกษา 1 ปีการศึกษา 2550

วันที่ 10 ตุลาคม 2550 เวลา 09.00 – 12.00.

วิชา CE 220-302,221-302: Structural Analysis 1 ห้องสอบ R 200

ชื่อ-สกุล

รหัส

คำชี้แจง

1.ข้อสอบทั้งหมดมี 6 ข้อ คะแนนรวม 100 คะแนน ดังแสดงในตารางข้างล่าง

2.ข้อสอบมีทั้งหมด 14 แผ่น (รวมปก) ผู้สอบต้องตรวจสอบว่ามีครบทุกหน้าหรือไม่ (ก่อนลงมือทำ)

3.ให้ทำหมดทุกข้อลงในตัวข้อสอบถ้าไม่พอให้ใช้หน้าหลังได้

4.อนุญาตให้ใช้เครื่องคิดเลขได้ทุกชนิด

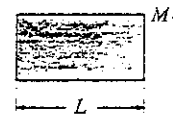
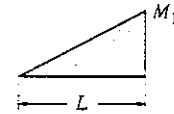
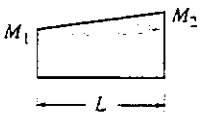
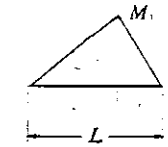
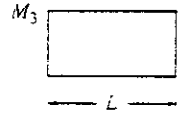
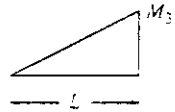
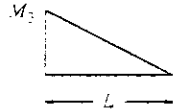
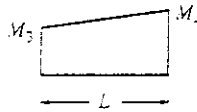
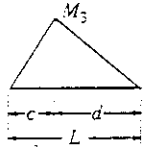
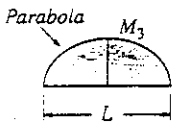
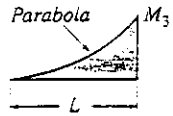
5.ห้ามหยิบ หรือยืมสิ่งของใดๆ ของผู้อื่นในห้องสอบ ทุจริตติดE

6. ***GOOD LUCK***

ตารางคะแนน

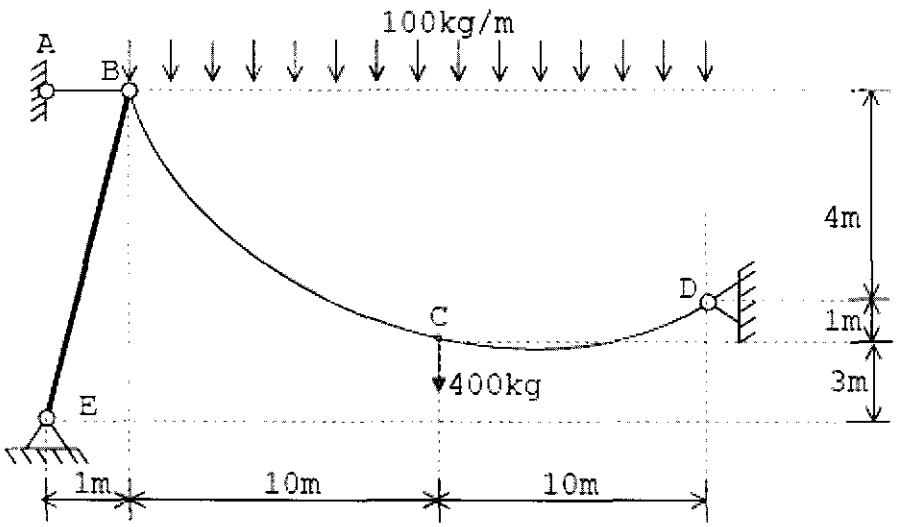
ข้อที่	คะแนนเต็ม	ได้
1	15	
2	10	
3	15	
4	20	
5	20	
6	20	
รวม	100	

Table 4: Values of Product Integrals $\int_{x=0}^{x=L} M_Q M_P \, dx$

M_P \ M_Q				
	M_1M_3L	$\frac{1}{2}M_1M_3L$	$\frac{1}{2}(M_1 + M_2)M_3L$	$\frac{1}{2}M_1M_3L$
	$\frac{1}{2}M_1M_3L$	$\frac{1}{3}M_1M_3L$	$\frac{1}{6}(M_1 + 2M_2)M_3L$	$\frac{1}{6}M_1M_3(L + a)$
	$\frac{1}{2}M_1M_3L$	$\frac{1}{6}M_1M_3L$	$\frac{1}{6}(2M_1 + M_2)M_3L$	$\frac{1}{6}M_1M_3(L + b)$
	$\frac{1}{2}M_1(M_3 + M_4)L$	$\frac{1}{6}M_1(M_3 + 2M_4)L$	$\frac{1}{6}M_1(2M_3 + M_4)L$ $+\frac{1}{6}M_2(M_3 + 2M_4)L$	$\frac{1}{6}M_1M_3(L + b)$ $+\frac{1}{6}M_2M_4(L + a)$
	$\frac{1}{2}M_1M_3L$	$\frac{1}{6}M_1M_3(L + c)$	$\frac{1}{6}M_1M_3(L + d)$ $+\frac{1}{6}M_2M_3(L + c)$	for $c \le a$: $\left(\frac{1}{3} - \frac{(a-c)^2}{6ad}\right)M_1M_2L$
	$\frac{2}{3}M_1M_3L$	$\frac{1}{3}M_1M_3L$	$\frac{1}{3}(M_1 + M_2)M_3L$	$\frac{1}{3}M_1M_3\left(L + \frac{ab}{L}\right)$
	$\frac{1}{3}M_1M_3L$	$\frac{1}{4}M_1M_3L$	$\frac{1}{12}(M_1 + 3M_2)M_3L$	$\frac{1}{12}M_1M_3\left(3a + \frac{a^2}{L}\right)$

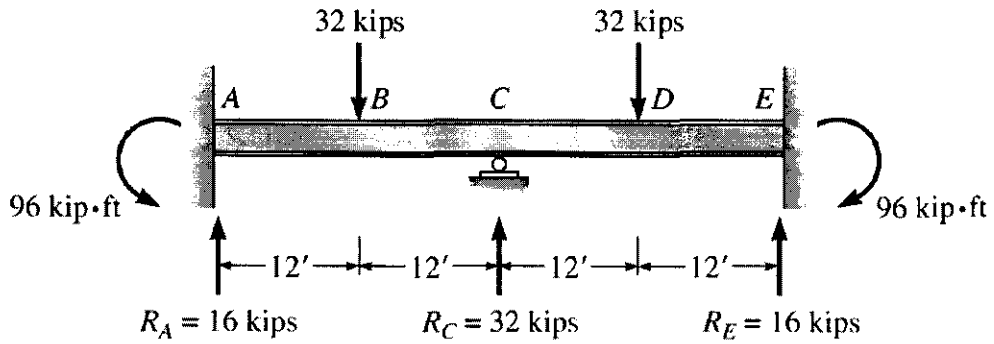
Problem 1 (15 Points)

For the cable structure shown below, compute the maximum and minimum tension in the cable BD, the tension in cable AB, the support reactions at D and the resultant force in member BE.



Problem 2 (10 Points)

Using the moment-area method, compute the slope and deflection under 32 kips load at B. Reactions are given. $I = 510\ \text{in}^4$ and $E = 29{,}000\ \text{kips/in}^2$. Sketch the deflected shape.



Problem 3 (15 Points)

From the beam below, Use the virtual work method to determine:
(a) If $P = 50$ kN is applied at the mid-span C, what would be the displacement at point C. Due to shear and bending moment.

(b) If the temperature at the top surface of the beam is 35 °C , the temperature at the bottom surface is 55 °C and the room temperature is 20 °C.
What would be the vertical deflection of the beam at its midpoint C and the horizontal displacement of the beam at support B.

(c) If (a) and (b) are both accounted, what would be the vertical displacement of the beam at its midpoint C.

Take $\alpha = 12(10^{-6})/$ °C. $E = 200$ GPa, $G = 80$ GPa, $I = 200(10^6)$ mm^4 and $A = 35$ (10^3) mm^2. The cross-section area is rectangular ($K = 1.2$).

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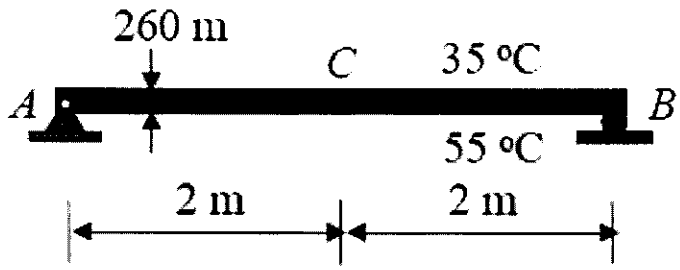
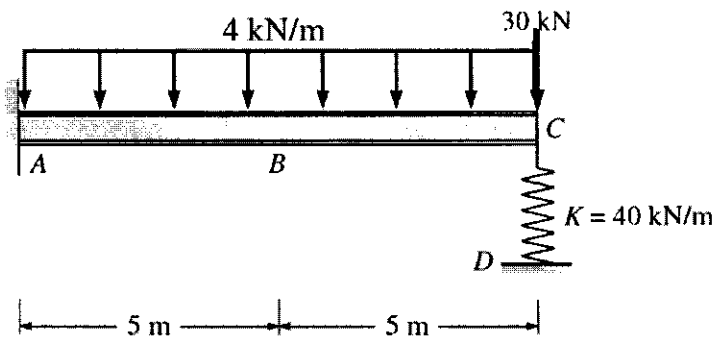


Problem 4 (20 Points)

For the beam shown below, in addition to the applied load, the support at D settles by 0.2 m. EI is constant for the beam. $E = 200\text{GPa}$, $I = 160(10^6)\,\text{mm}^4$.

(a) Compute the reactions at A and C and also vertical displacement at C by the virtual work method.

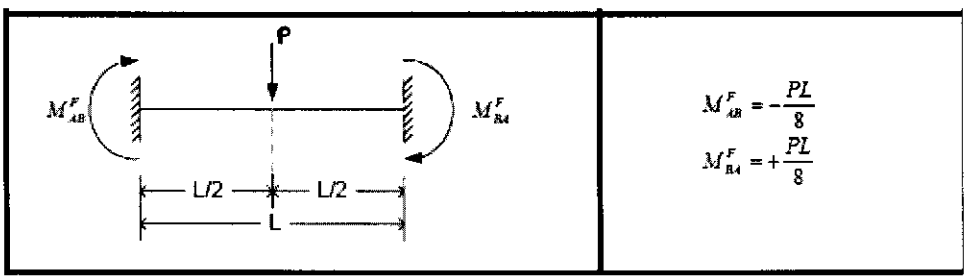
(b) Draw the shear and moment curves.



Problem 5 (20 Points)

Analyze the structure in the following figure by the slope-deflection method. In addition to the applied load, support A rotates counterclockwise by 0.015 rad. Also P = 100 kN , EI is constant for all members, E = 200 GPa, $I = 25\times10^{6}\text{mm}^4$.

Hint:

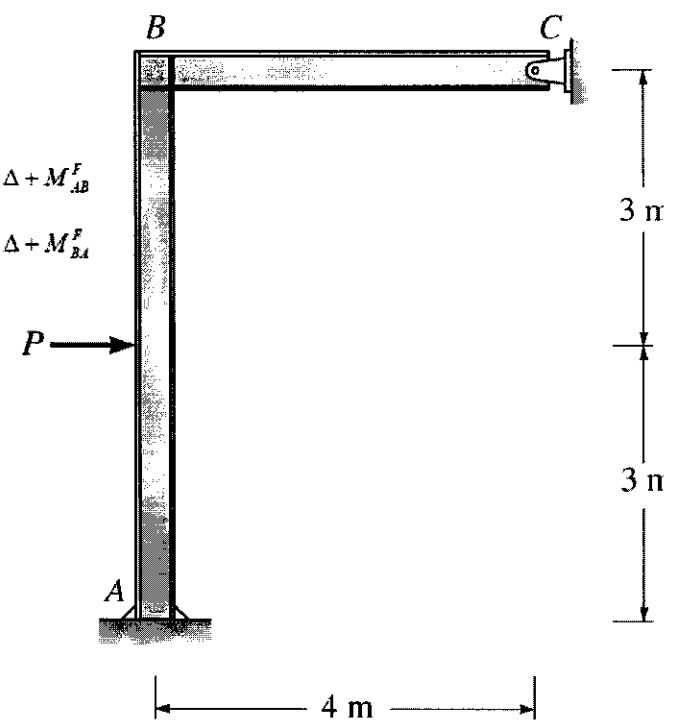


$$M_{AB}^F = -\frac{PL}{8}$$

$$M_{BA}^F = +\frac{PL}{8}$$

$$M_{AB} = \frac{4EI}{L}\theta_A + \frac{2EI}{L}\theta_B - \frac{6EI}{L^2}\Delta + M_{AB}^F$$

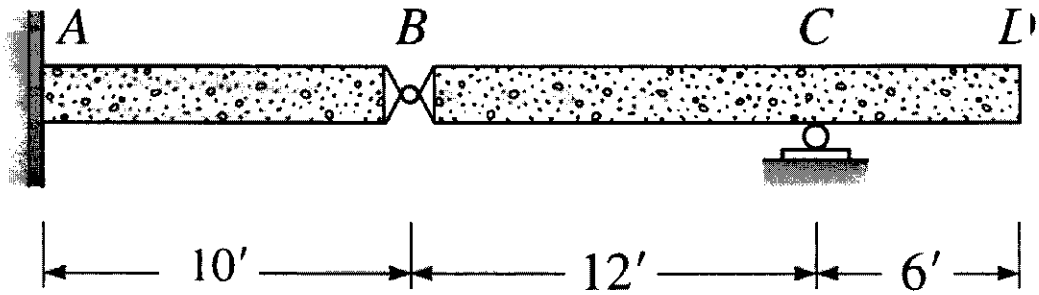
$$M_{BA} = \frac{2EI}{L}\theta_A + \frac{4EI}{L}\theta_B - \frac{6EI}{L^2}\Delta + M_{BA}^F$$



Problem 6 (20 Points)

Using the Muller-Breslau principle,

a) Draw the influence lines for the moment and vertical reaction at A, the moment at C and the shear at the left of support C.



b) For the beam shown below, draw the influence lines for the reactions at A, B and F, the end moment at F, shears to the left and right of support B and shear at E.