

มหาวิทยาลัยสงขลานครินทร์

คณะวิศวกรรมศาสตร์

สอบกลางภาค ประจำปีภาคการศึกษา 1

ปีการศึกษา 2552

วันที่ 2 สิงหาคม 2552

เวลา 13.30 – 16.30.

วิชา CE 220-302,221-302: Structural Analysis 1

ห้องสอบ R 200

ชื่อ-สกุล.....

รหัส.....

คำชี้แจง

- 1.ข้อสอบทั้งหมดมี 6 ข้อ คะแนนรวม 130 คะแนน ดังแสดงในตารางข้างล่าง
- 2.ข้อสอบมีทั้งหมด 13 แผ่น (รวมปก) ผู้สอบต้องตรวจสอบว่ามีครบทุกหน้าหรือไม่ (ก่อนลงมือทำ)
- 3.ให้ทำหมดทุกข้อลงในตัวข้อสอบถ้าไม่พอให้ใช้หน้าหลังได้
- 4.อนุญาตให้ใช้เครื่องคิดเลขได้ทุกชนิด
- 5.ห้ามหยิบ หรือยืมสิ่งของใดๆ ของผู้อื่นในห้องสอบ ทุกจริตติตE
6. **GOOD LUCK**

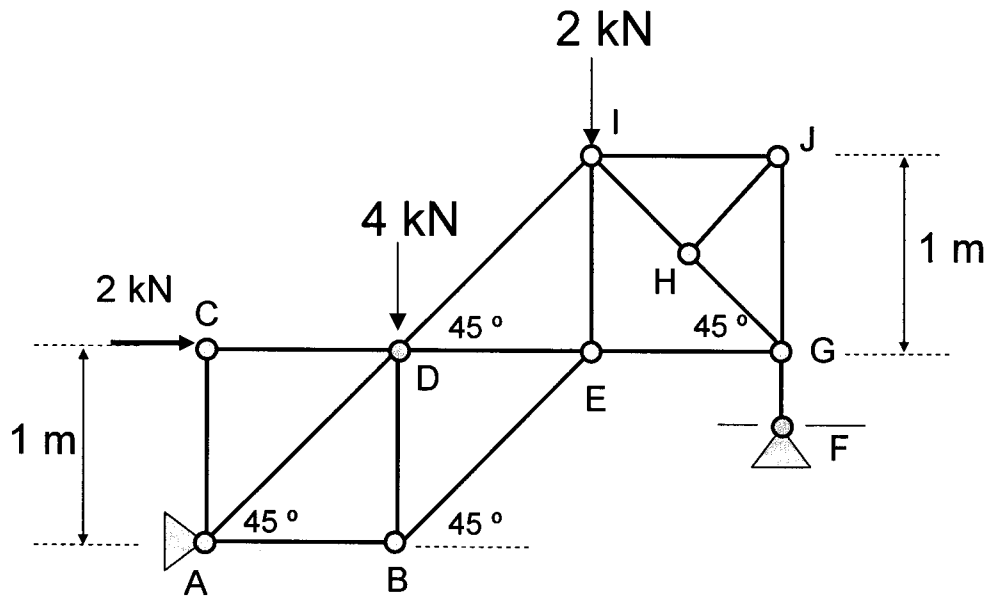
ตารางคะแนน

ข้อที่	คะแนนเต็ม	ได้
1	20	
2	15	
3	20	
4	25	
5	30	
6	20	
รวม	130	

**Problem 1 (20 Points)**

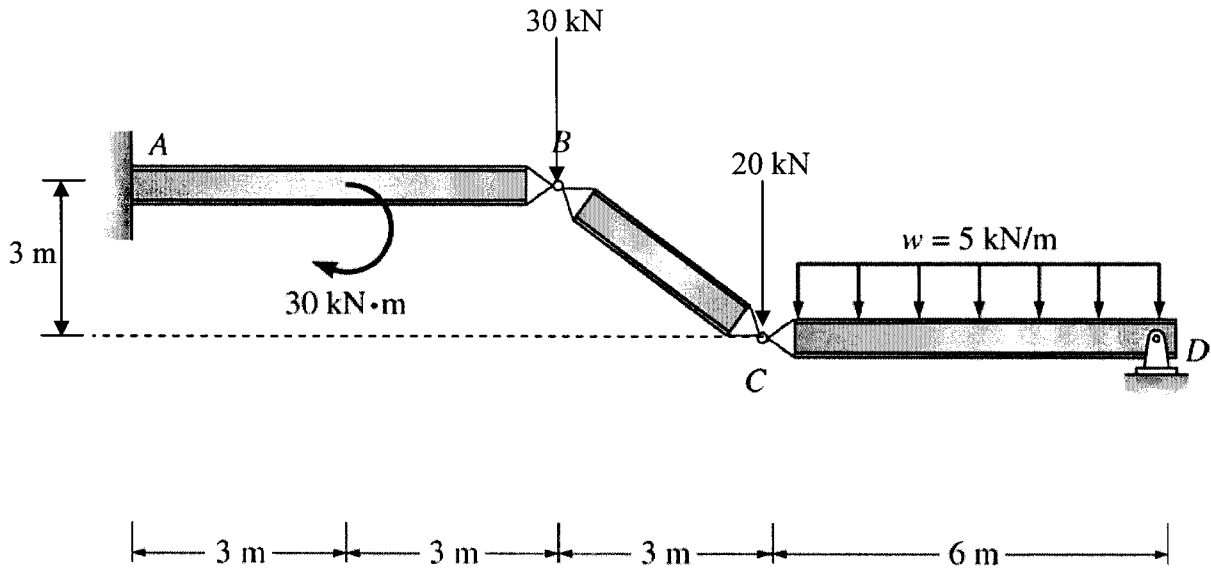
For the truss shown below:

- Determine the support reactions at A and F.
- Determine the member force in members CA, CD, AD and AB **by method of joint only**.
- Determine the member force in members DI, DE, and BE **by method of section only**.
- Determine the member force in member EG **by method of section only**.



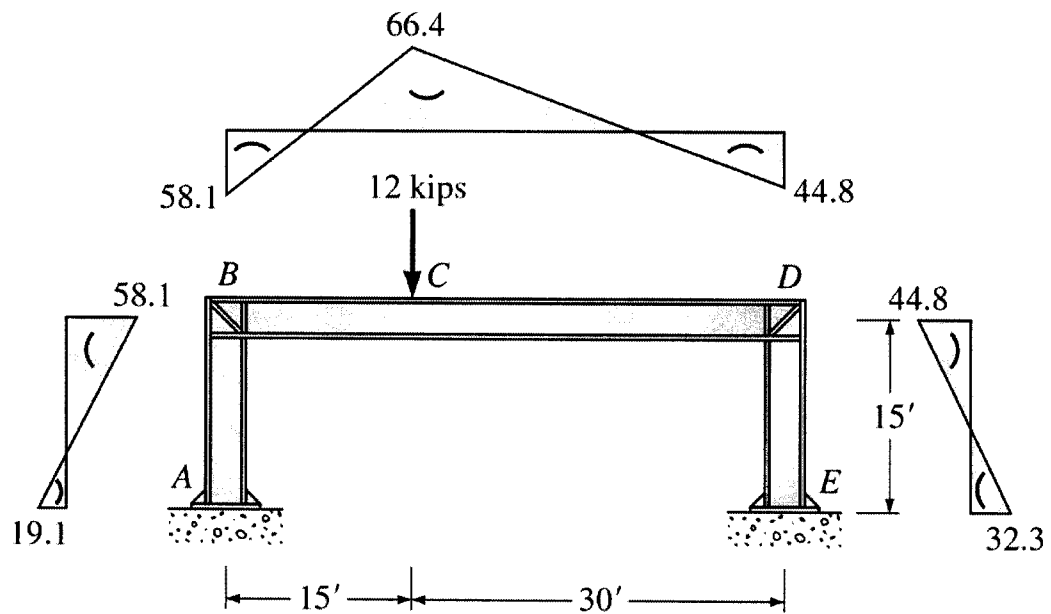
**Problem 2 (15 Points)**

From the following figure, compute the support reactions at A and D. (B and C are hinges.) Draw the shear and moment curves for each member of the frame. Sketch the deflected shape.



**Problem 3 (20 Points)**

- a) Compute the horizontal displacement of joint B by the moment-area method.  $EI$  is constant. The moment diagram produced by the 12-kip load is given in units of kip·ft. A and E are fixed supports.
- b) Sketch the deflected shape. What would be the horizontal displacement of joint D?
- Hint:** you don't need to calculate the horizontal displacement of joint D. It can be obtained automatically by sketching the deflected shape.

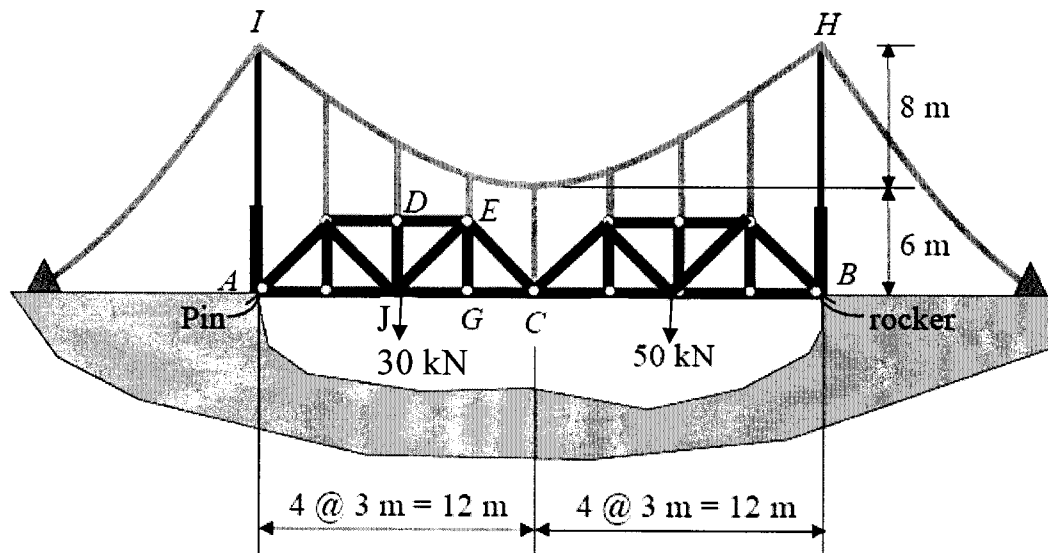


**Problem 4 (25 Points)**

The suspension bridge in the figure below is constructed using the two stiffening trusses that are pin connected at their ends  $C$  and supported by a pin at  $A$  and a rocker at  $B$ .

- a.) Determine the minimum and maximum tension in the cable  $IH$ .
- b.) Determine support reactions at  $A$  and  $B$ .
- c.) Determine member force in member  $DJ$  and  $EG$ .

The cable has a parabolic shape and the bridge is subjected to the two point loads of 30 kN and 50 kN as shown in the figure.



**Problem 5 (30 Points)**

From the beam below, use the virtual work method to determine:

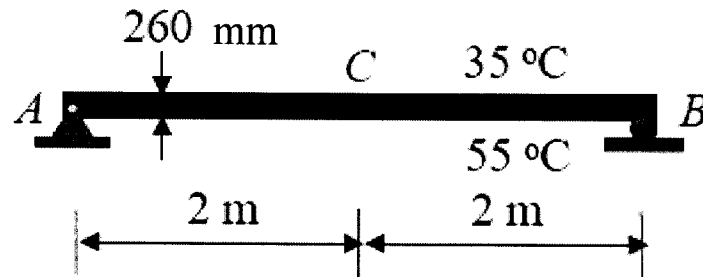
(a) If  $P = 40$  kN is applied at the mid-span  $C$ , what would be the displacement at point  $C$ . Due to shear and bending moment.

(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<sup>4</sup> and  $A = 35(10^3)$  mm<sup>2</sup> . The cross-section area is rectangular ( $K = 1.2$ ).



**Problem 6 (20 Points)**

By using the Castigliano's theorem, determine the horizontal displacement of point *C* on the frame.

Take  $E = 200 \text{ GPa}$ ,  $I = 200(10^6) \text{ mm}^4$

