UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2010/2011 Academic Session

April/May 2011

IWK 302 – WOOD ENGINEERING
[KEJURUTERAAN KAYU]

Duration: 3 hours
Masa: [3 jam]

Please check that this examination paper consists of ELEVEN pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEBELAS muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer FIVE questions. You may answer the questions either in Bahasa Malaysia or in English.

*[**Arahan:** Jawab LIMA soalan. Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]*

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.]

1. Write short notes on the followings:

   (a) Impact toughness

   (5 marks)

   (b) Elastic behavior

   (5 marks)

   (c) True stress-strain diagram

   (5 marks)

   (d) Three stages of a material fracture mechanism

   (5 marks)

2. (a) From Figure 1, determine the following using integration method.

   i) the area, A
   ii) the centroid
   iii) the moment of inertia, I_x

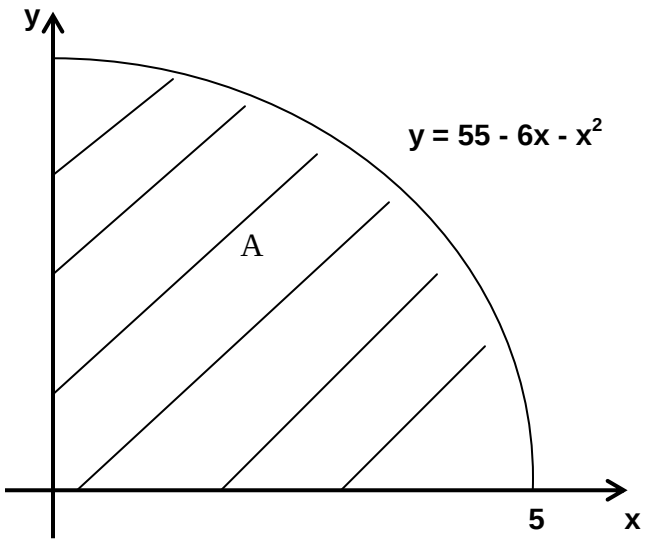


Figure 1

(10 marks)

(b) For the composite area shown in Figure 2, determine

i) the coordinate of the centroid
ii) the moment of inertia with respect to the x-axis, $I_{x.}$

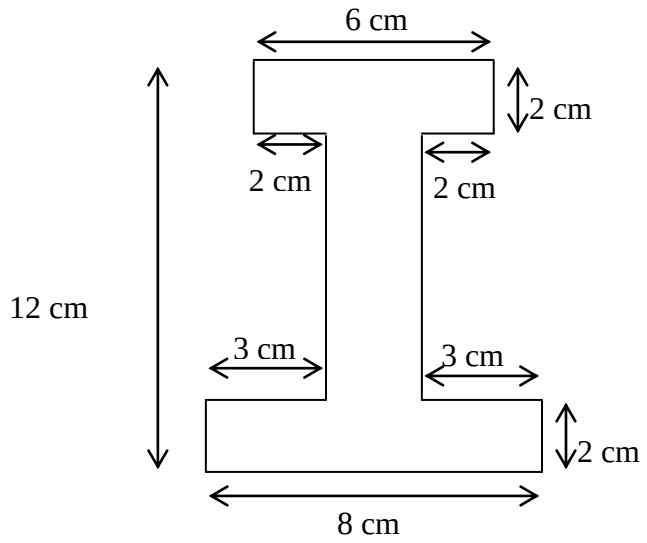


Figure 2

(10 marks)

3. A beam is loaded as shown in Figure 3, the specifications of the beam are as follow:

   F_{bo} = 7500 kN/m^2
   F_{vo} = 650 kN/m^2
   b = 30 cm

   Determine the allowable minimum depth (d)

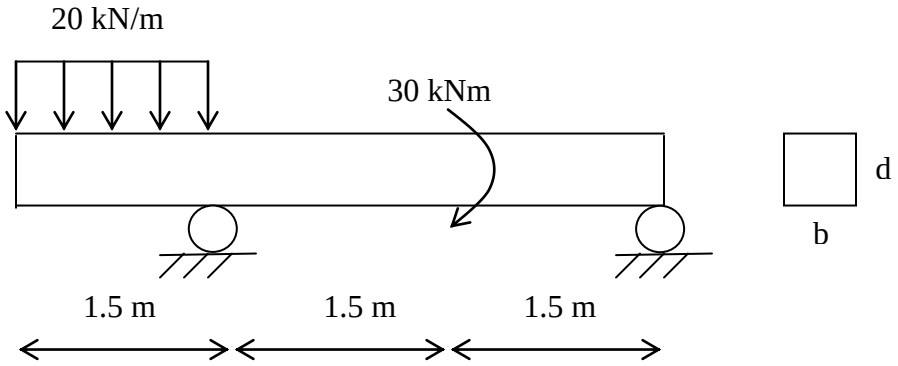


Figure 3

(20 marks)

4. A beam is loaded as shown in Figure 4. Determine the maximum deflection of the beam

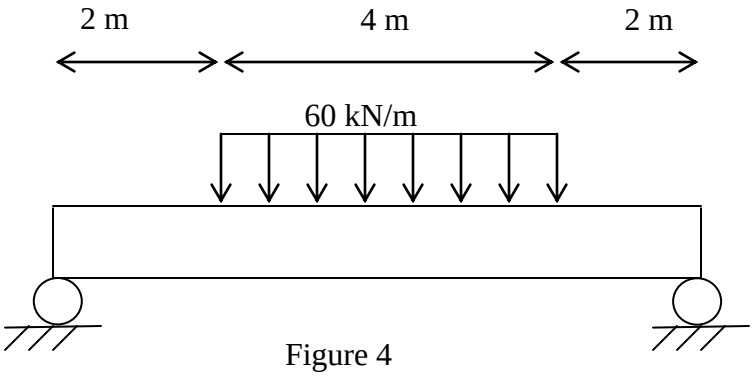


Figure 4

(20 marks)

…5/-

5. A roof made of solid wood has the following specifications:

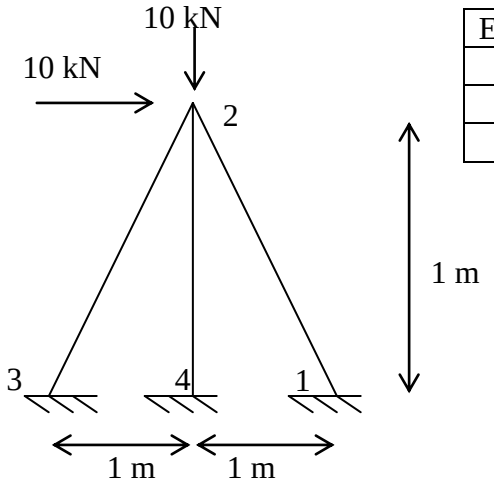
C_d = 1.05 (load duration factor)
L = 17ft (length of the beam)
S = 2ft (space between beams)
dl = 20lbf/ft^2 (dead load)
ll = 12 lbf/ft^2 (live load)
F_{bo} = 2500 lbf/in^2 (allowable bending stress)
F_{vo} = 700 lbf/in^2 (allowable shear stress)
E = 1600000 lbf/in^2 (modulus of elasticity)
P_o = L/180 (allowable deflection)

Test the suitability of a section with size 1.5 in x 9.25 in.

(20 marks)

6. A two dimensional structure in Figure 5 has dimensions in arbitrary units. Using Finite Element Method, determine

(a) the displacement of each node
(b) the reaction force at node 1, 3 and 4
(c) the axial force in each element



Element	E	A
12	1	1
23	1	1
24	1	1

Figure 5

(20 marks)

…6/-

List of formulae

Z = $bd^2/6$ (section modulus)
I = $bd^3/12$ (moment of inertia)
L_e = $L – 2d$ (effective length)
V = $wL_e/2$ (maximum shear force)
M = $wL^2/8$ (maximum bending moment)
F_b = M/Z (actual bending stress)
F_v = $3V/2A$ (actual shear stress)
P = $5wL^4/384EI$ (actual deflection)
C_f = $(12/d)^{1/9}$ (size factor)
C_c = $1 – 2000\ (t/R)^2$ (curve factor)
F_r = $3M/2R_mA$ (actual radius stress)

1. *Tuliskan nota ringkas yang berikut:*

   (a) Keliatan hentaman

   (5 markah)

   (b) Sifat elastik

   (5 markah)

   (c) Diagram tegasan-tegangan benar

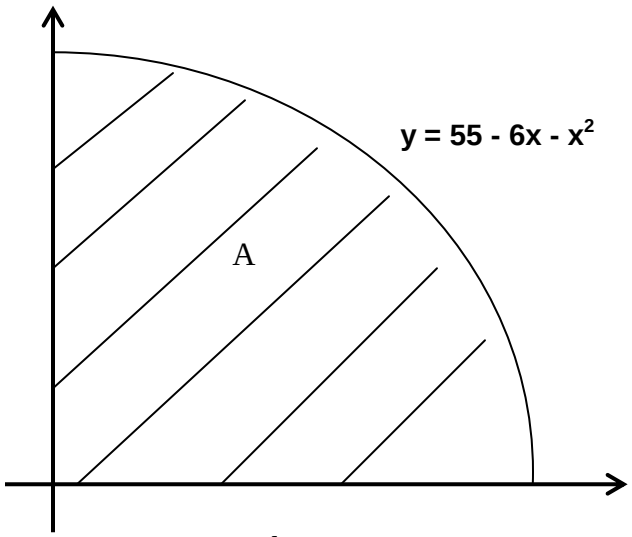
   (5 markah)

   (d) Tiga peringkat mekanisme peretakan sesuatu bahan

   (5 markah)

2. *(a) Bagi kawasan yang terlorek dalam Rajah 1, tentukan yang berikut dengan menggunakan kaedah pengamiran.*

   i) Keluasan
   ii) Pusat bentuk
   iii) Momen inersia terhadap paksi x, I_x

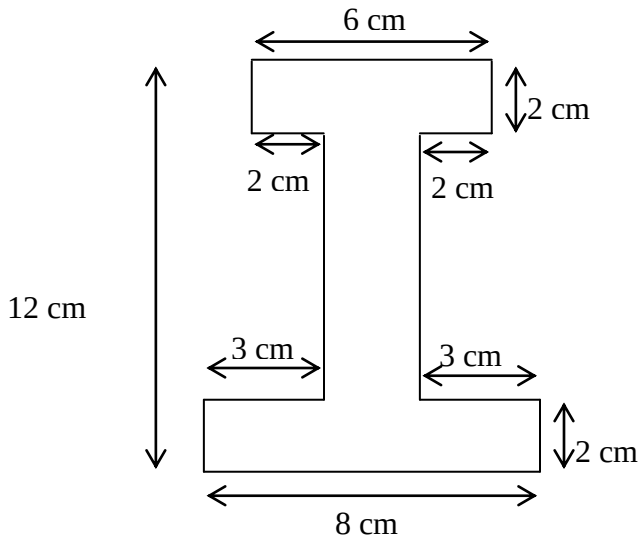


Rajah 1

(10 markah)

(b) Bagi rajah komposit yang ditunjukkan dalam Rajah 2, tentukan

i) Kordinat pusat bentuk
ii) Momen inersia terhadap paksi x, I_x.



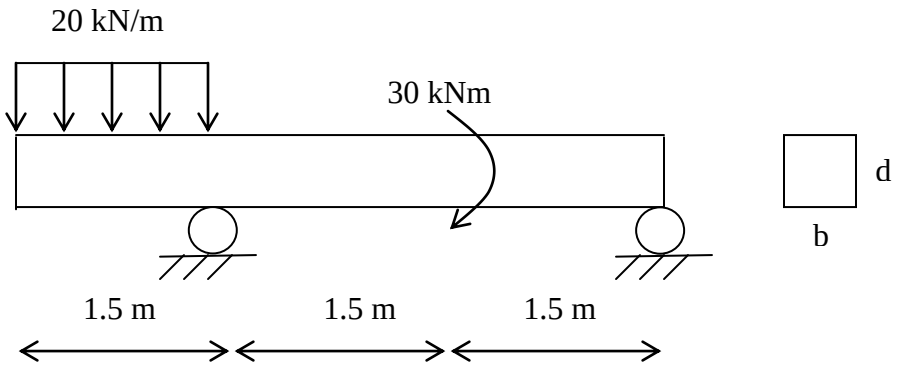
Rajah 2

(10 markah)

3. *Suatu bim dibebankan seperti yang ditunjukkan dalam Rajah 3 dan spesifikasi bim dalam seperti berikut*

F_{bo} = 7500 kN/m^2 *(tegasan lenturan izin)*
F_{vo} = 650 kN/m^2 *(tegasan ricih izin)*
b = 30 cm (lebar bim)

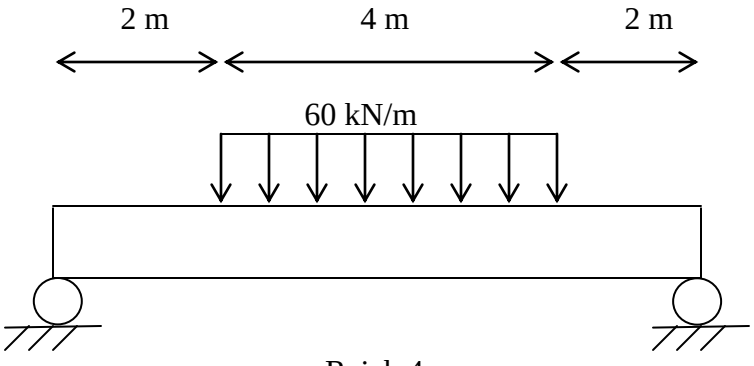
Tentukan kedalaman/ketebalan (d) minimum yang dibenarkan



Rajah 3

(20 markah)

4. *Suatu bim dibebankan seperti yang ditunjukkan dalam Rajah 4. Tentukan pesongan maksimum bim tersebut.*



Rajah 4

(20 markah)

…10/-

5. *Suatu bim bumbung lurus yang diperbuat daripada kayu pejal mempunyai spesifikasi berikut;*

C_d = *1.05 (factor tempoh masa pengenaan beban)*
L = *17ft (panjang bim)*
S = *2ft (jarak antara bim)*
dl = *20Ibf/ft^2 (beban mati)*
ll = *12 Ibf/ft^2 (beban hidup)*
F_{bo} = *2500 Ibf/in^2 (tegasan lenturan izin)*
F_{vo} = *700 Ibf/in^2 (tegasan ricih izin)*
E = *1600000 Ibf/in^2 (modulus kekenyalan)*
P_o = *L/180 (pesongan izin)*

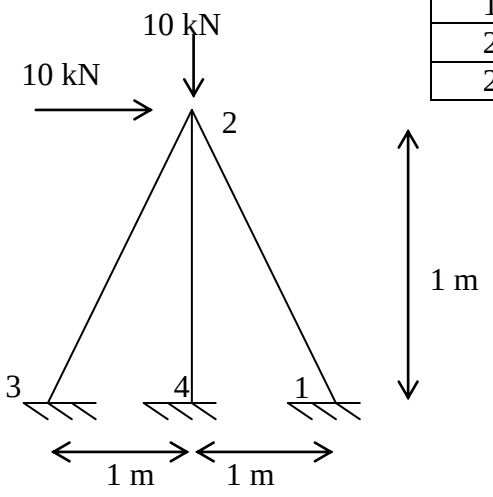
Uji kesesuaian keratan yang bersaiz 1.5 in x 9.25 in.

(20 markah)

6. *Suatu struktur dua dimensi dalam Rajah 5 dengan ukurannya diberikan dalam unit sebarangan. Dengan menggunakan Kaedah Elemen Terhingga, tentukan*

(a) Sesaran setiap nod
(b) Daya tindak balas pada nod 1, 3 and 4
(c) Daya paksian setiap elemen

Elemen	E	A
12	1	1
23	1	1
24	1	1



Rajah 5

(20 markah)

Senarai formula

Z = $bd^2/6$ *(modulus keratan)*
I = $bd^3/12$ *(momen inertia)*
L_e = $L - 2d$ *(panjang berkesan)*
V = $wL_e/2$ *(tegasan ricih maksimum)*
M = $wL^2/8$ *(momen lenturan maksimum)*
F_b = M/Z *(tegasan lenturan sebenar)*
F_v = $3V/2A$ *(tegasan ricih sebenar)*
P = $5wL^4/384EI$ *(pesongan sebenar)*
C_f = $(12/d)^{1/9}$ *(faktor saiz)*
C_c = $1 - 2000\ (t/R)^2$ *(faktor lengkukan)*
F_r = $3M/2R_mA$ *(tegasan jejarian sebenar)*

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