SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2015

DCC2063 : MECHANICS OF CIVIL ENGINEERING STRUCTURES

TARIKH : 22 OKTOBER 2015
TEMPOH : 8.30AM – 10.30AM (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.
BAHAGIAN A : STRUKTUR (2 SOALAN)
BAHAGIAN B: STRUKTUR (4 SOALAN)

Dokumen sokongan yang disertakan : ~~Kertas Graf~~, Formula ~~dsb / Tiada~~

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 50 MARKS
BAHAGIAN A : 50 MARKAH

INSTRUCTION:
This section consists of **TWO (2)** structured questions. Answer **ALL** the questions.

ARAHAN:
*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO1
C1

(a) Define direct stress and direct strain in civil engineering.
Takrifkan tegasan terus dan keterikan dalam kejuruteraan awam.

[5 marks]
[*5 markah*]

CLO1
C2

(b) **Figure A1(a)** shows a steel bar of 50.0 cm x 5.0 cm x 2.0 cm bears a compression load of 20 N. Determine the stresses and strains in the bar where the Young Modulus given is 215 GN/m^2.
***Rajah A1(a)** menunjukkan satu bar keluli bersaiz 50 cm x 5.0 cm x 2.0 cm yang dikenakan beban 20 N. Tentukan tegasan dan keterikan dalam bar tersebut dimana Modulus Keanjalan adalah 215 GN/m^2 .*

[8 marks]
[8 *markah*]

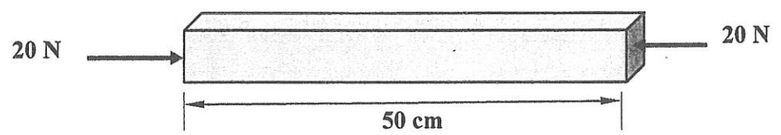

Figure A1(a) / *Rajah A1(a)*

CLO1
C2

(c) A reinforced concrete column with the size of 150 cm x 150 cm as in **Figure A1(b)** is reinforced with 4 steel bars of 3.0 cm diameter, one in each corner. The column is carrying compression a load of 250 kN. Determine the stresses in the concrete and steel bars.

(Given $E_{concrete} = 0.14 \times 10^6$ kN/cm^2 ; $E_{steel} = 2.1 \times 10^6$ kN/cm^2]

*Sebatang tiang konkrit tetulang 150 cm x 150 cm dalam **Rajah A1(b)** mempunyai empat bar tetulang bergaris pusat 3.0 cm di setiap penjurunya. Tiang tersebut membawa beban paksi 250 kN. Tentukan tegasan di dalam konkrit dan tetulang tersebut.*

[Diberi $E_{konkrit} = 0.14 \times 10^6$ kN/cm^2 ; $E_{keluli} = 2.1 \times 10^6$ kN/cm^2]

[12 marks]
[*12 markah*]

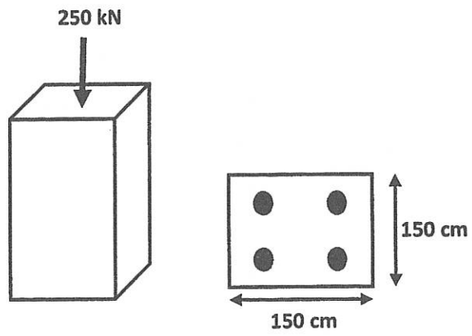

Figure A1(b) / *Rajah A1(b)*

QUESTION 2
SOALAN 2

Figure A2, shows an overhanging beam which carries point load and uniformly distributed load on the beams.

***Rajah A2**, menunjukkan rasuk tergantung yang menanggung beban tumpu dan beban teragih seragam di atas rasuk.*

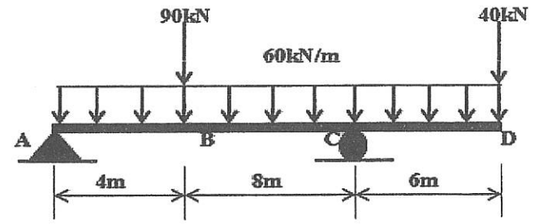

Figure A2/*Rajah A2*

CLO2
C1

(a) Draw free body diagram (FBD) of beam.
Lukiskan gambarajah jasad bebas bagi rasuk.

[3 marks]
[*3 markah*]

CLO2
C2

(b) Calculate the reaction of beam.
Kirakan daya tindakbalas rasuk tersebut.

[7 marks]
[*7 markah*]

CLO2
C3

(c) Draw shear force diagram **(SFD)** and bending moment diagram **(BMD)** of beam.
*Tentukan nilai dan lukis gambarajah daya ricih **(GDR)** dan gambarajah momen lentur **(GML)** rasuk.*

[15 marks]
[*15 markah*]

SECTION B : 50 MARKS
BAHAGIAN B : 50 MARKAH

INSTRUCTION:
This section consists of **FOUR (4)** structured questions. Answer **TWO (2)** questions only.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1

SOALAN 1

CLO2 C1

(a) i. Define bending /flexural stress.

Takrifkan tegasan lentur.

[3 marks]
[*3 markah*]

ii. Define neutral axis of beam.

Takrifkan paksi neutral pada rasuk.

[2 marks]
[*2 markah*]

CLO2 C2

(b) A beam has a rectangular cross section 80mm wide and 120mm deep. It is subjected to a bending moment of 15kNm at a certain point along its length. It is made from metal with a modulus of elasticity of 180 GPa. Calculate the maximum bending stress on the section.

Sebuah rasuk berkeratan segiempat tepat bersaiz 80mm lebar dengan kedalaman 120mm. Ia dikenakan momen lenturan sebanyak 15kNm pada titik yang tertentu di sepanjang rasuk tersebut. Bahan rasuk tersebut diperbuat dari besi yang mempunyai modulus keanjalan 180 GPa. Kirakan tegasan lenturan maksimum pada keratan tersebut.

[5 marks]
[*5 markah*]

CLO2 C3

(c) A simply supported beam with a symmetrical T-section as shown in **Figure B1** is subjected to a uniformly distributed load. The bending moment maximum, M_{max} is given as 40 x10^3kNmm.

*Sebuah rasuk tersokong mudah berkeratan simetri berbentuk I seperti dalam **Rajah B1** menanggung beban teragih seragam. Momen lentur yang diberi adalah $M_{max} = 40 x10^3$ kNmm.*

i. Calculate location of neutral axis, y of cross section.

Kirakan kedudukan paksi neutral, y bagi keratan rentas rasuk.

[3 marks]
[*3 markah*]

ii. Calculate second moment of area for beam cross section

Kirakan momen luas kedua bagi keratan rentas rasuk.

[5 marks]
[*5 markah*]

iii. Calculate bending stress for beam cross section.

Kirakan tegasan lentur untuk keratan rentas rasuk

[4 marks]
[*4 markah*]

iv. Sketch the bending stress distribution.

Lakarkan taburan tegasan lentur.

[3 marks]
[*3 markah*]

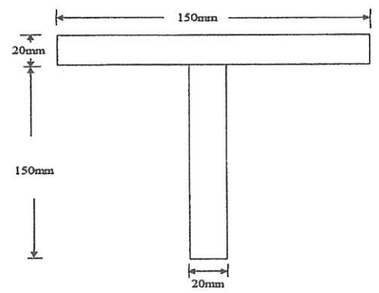

Figure B1 / *Rajah B1*

QUESTION 2
SOALAN 2

CLO2
C2

a) Three steel plates as shown in **Figure B2(a)** are connected together by 2 bolts of 16mm diameter. Calculate the shear stress in the bolt.
*Tiga keping plat keluli seperti ditunjukkan dalam **Rajah B2(a)** disambungkan menggunakan 2 bolt berdiameter 16mm. Kirakan tegasan ricih dalam bolt.*

[5 marks]
[*5 markah*]

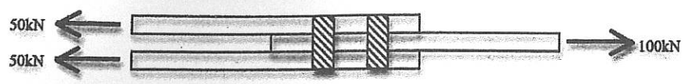

Figure B2(a) / *Rajah B2(a)*

CLO2
C3

b) A rectangular beam 100mm wide and 250mm as shown in **Figure B2(c)** deep are subjected to a maximum shear force of 50kN. Determine shear stress at a distance of 25mm above the neutral axis.
*Rasuk segiempat tepat 100mm lebar dan 250mm dalam seperti dalam **Rajah B2(b)** dikenakan tegasan ricih maksimum 50kN. Tentukan daya ricih pada jarak 25mm di atas paksi neutral.*

[5 marks]
[*5 markah*]

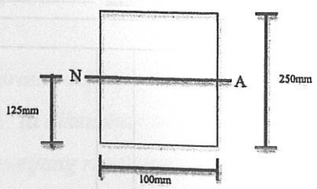

Figure B2(b) / *Rajah B2(b)*

CLO2
C3

c) A T-section beam as shown in **Figure B2(c)** is subjected to a shear force of 50kN. The second moment of area about the neutral axis is $314.221x10^4$ mm^4.
*Satu rasuk berkeratan-T seperti dalam **Rajah B2(c)** telah dikenakan daya ricih sebanyak 50kN. Nilai momen luas kedua pada paksi neutral ialah $314.221x10^4$ mm^4.*

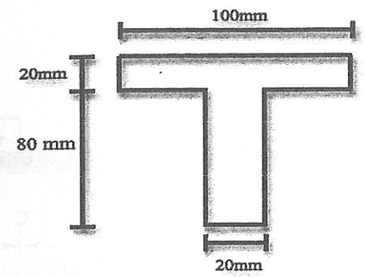

Figure B2(c) / Rajah B2(c)

i. Determine position of the neutral axis.
Tentukan kedudukan paksi neutral.

[3 marks]
[*3 markah*]

ii. Calculate shear stress at neutral axis, flange and junction of the web.
Kirakan tegasan ricih pada paksi neutral, bebibir dan persimpangan web

[9 marks]
[*9 markah*]

iii. Draw the shear stress distribution across the section.
Lukis taburan tegasan ricih keratan.

[3 marks]
[*3 markah*]

QUESTION 3
SOALAN 3

A beam is loaded as shown in **Figure B3.**
*Satu rasuk dikenakan beban seperti di dalam **Rajah B3**.*

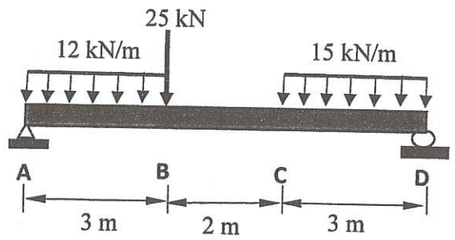

Figure B3 / *Rajah B3*

Based on **Figure B3**;
*Merujuk kepada **Rajah B3**;*

CLO2 C2 (a) Calculate the reaction forces at support A and D.

Kirakan daya tindakbalas pada penyokong A dan D.

[4 marks]
[4 *markah*]

CLO2 C3 (b) Derive the equations for this beam by using Macaulay Method.

Terbitkan persamaan bagi rasuk ini dengan menggunakan Kaedah Macaulay.

[6 marks]
[6 *markah*]

CLO2 C3 (c) Determine the slope and the deflection at point C by using Macaulay Method in term of EI.

Tentukan kecerunan dan pesongan pada titik C dengan menggunakan Kaedah Macaulay dalam sebutan EI.

[15 marks]
[*15 markah*]

QUESTION 4
SOALAN 4

Cantilever beam shown in **Figure B4** has a cross section (50mm wide by 150mm high). Given E=69 GPa. By using Moment Area Method:

***Rajah B4** menunjukkan rasuk julur yang mempunyai saiz keratan 50mm lebar dan 150mm tinggi. Diberi E=69 GPa. Dengan menggunakan Kaedah Momen Luas:*

CLO1 C1 a) Draw Free Body Diagram [FBD] of beam.
Lukiskan gambarajah jasad bebas rasuk.

[3 marks]
[*3 markah*]

CLO2 C2 b) Calculate the reaction of beam.
Kirakan nilai daya tindakbalas rasuk.

[7 marks]
[*7 markah*]

CLO2 C3 c) Compute the maximum deflection for cantilever beam.
Hitungkan nilai pesongan maksimum rasuk julur.

[15 marks]
[*15 markah*]

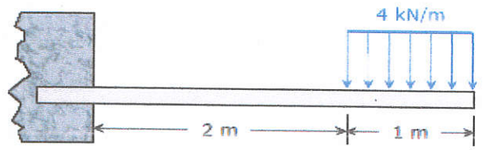

Figure B4/ Rajah B4

SOALAN TAMAT

LIST OF FORMULA FOR DCC2063

MECHANICS OF CIVIL ENGINEERING STRUCTURES

1. $\sigma = \frac{P}{A}$

2. $\varepsilon = \frac{\delta l}{L}$

3. $E = \frac{PL}{\delta l}$

4. $E = \frac{\sigma}{\varepsilon}$

5. $I_{xx} = \frac{bd^3}{12} + Ah^2$

6. $Z = \frac{I}{y_{max}}$

7. $\frac{M}{I} = \frac{\sigma}{y}$

8. $\tau = \frac{F}{A}$

9. $\tau = \frac{VAy}{I_{xx}b}$