SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2019

DCC2063 : MECHANICS OF CIVIL ENGINEERING STRUCTURES

TARIKH : 03 NOVEMBER 2019
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (4 soalan)
Dokumen sokongan yang disertakan : Formula, Kertas Graf

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** questions.

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

QUESTION 1
SOALAN 1

CLO1
C1

(a) Define mechanic, structures and mechanics of structures.
Takrifkan mekanik,struktur dan mekanik struktur.

[5 marks]
[5 *markah*]

CLO1
C2

(b) Explain types of force with the aid of sketch as below;
Terangkan jenis-jenis daya seperti yang ditunjukkan di bawah dengan bantuan lakaran;

i. Axial
Paksi
ii. Shear
Ricih
iii. Bending Moment
Momen Lentur
iv. Torsion
Kilasan

[8 marks]
[8 *markah*]

CLO1
C2

(c) Explain **THREE (3)** types of support and their internal reactions with the aid of diagram.
*Terangkan ke semua **TIGA (3)** jenis-jenis sokongan dan tindakbalas dalamannya dengan bantuan gambarajah.*

[12 marks]
[12 *markah*]

QUESTION 2
SOALAN 2

CLO1
C1

(a) Define the terms direct stress and Young's Modulus.
Berikan takrif bagi istilah tegasan terus dan Modulus Young.

[5 marks]
[5 *markah*]

CLO1
C2

(b) A rod has 3.5mm of diameter with 2.5m of length. The bar is pulled by the load 142kN and elongation occur is 0.5mm. Calculate ;
Satu rod mempunyai diameter 3.5mm dengan panjang 2.5m. Bar tersebut ditarik dengan daya 142kN dan mengalami pemanjangan 0.5mm. Kirakan;

i. Shear stress in rod, σ.
Tegasan tegangan di dalam rod, σ.

[4 marks]
[4 *markah*]

ii. Strain in the rod, ε.
Keterikan di dalam rod, ε.

[2 marks]
[2 *markah*]

iii. Modulus of elasticity in the rod, E.
Modulus keanjalan di dalam rod, E.

[2 marks]
[2 *markah*]

CLO1
C2

(c) During a tensile test on a sample, result as in **Table A2(c)** was obtained.
Semasa ujian tegangan dilakukan ke atas satu contoh sampel, keputusan pada ***Jadual A2(c)*** *dihasilkan.*

Table A2(c) / Jadual A2(c)

Load (kN) *Beban (kN)*	5	10	15	20	25	30
Elongation x 10^{-3} mm *Pemanjangan x* 10^{-3}*mm*	40	78	117	157	197	237

The followings are the data of the sample tested;
Berikut merupakan data contoh bahan yang diuji:

Initial diameter/ *Garispusat asal* = 15mm
Gauge length/ *Panjang tolok* = 100mm
Final diameter/ *Garispusat akhir* = 6.0mm
Final length / *Panjang akhir* = 250mm

i. Draw the graph of Load Vs Elongation.
Tunjukkan graf beban Vs pemanjangan.

[6 marks]
[6 *markah*]

ii. Identify modulus elasticity.
Kenalpasti modulus keanjalan bahan.

[4 marks]
[4 *markah*]

iii. Calculate the percentage of elongation.
Kirakan peratus pemanjangan.

[2 marks]
[2 *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

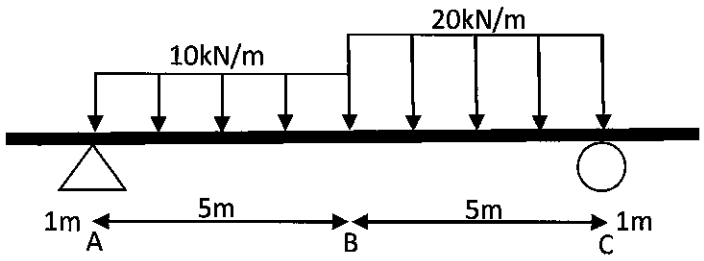


Figure B1a/ *Rajah B1a*

CLO2
C3

(a) Based on overhanging beam shown in **Figure B1a**,
*Berdasarkan kepada rasuk tergantung seperti ditunjukkan pada **Rajah B1a**,*

i. Sketch free body diagram.
Lakarkan gambarajah jasad bebas.

[3 marks]
[3 *markah*]

ii. Calculate all reactions in the beam.
Kesemua nilai tindakbalas pada rasuk.

[9 marks]
[9 *markah*]

CLO2
C4

(b) Based on **Figure B1a**, calculate the Shear Force and Bending Moment values at point A, B and C.
Berdasarkan kepada **Rajah B1a**, *kirakan nilai daya ricih dan momen lentur pada titik A, B dan C.*

[8 marks]
[8 *markah*]

CLO2
C6

(c) Based on shear force and bending moment values from **Question B1(b),** create the Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) by showing their values.
Berdasarkan kepada nilai daya ricih dan momen lentur dari ***Soalan B1(b),*** *hasilkan gambarajah daya ricih (GDR) dan Gambarajah Momen Lentur (GML) dengan menunjukkan nilai-nilai yang diperolehi.*

[5 marks]
[5 *markah*]

QUESTION 2
SOALAN 2

CLO2
C3

(a) A cross section of simply supported beam is shown in **Figure B2(a)**. Calculate bending stress for this beam. Given the neutral axis from bottom section, $\bar{y}$ is 115mm and maximum moment is 660 x 10^6 Nmm.

*Satu keratan rentas rasuk disokong mudah ditunjukkan dalam **Rajah B2(a)**. Kira tegasan lentur untuk rasuk tersebut. Diberi kedudukan paksi neutral daripada aras bawah keratan, $\bar{y}$ adalah 115mm dan momen maksima ialah 660 x 10^6 Nmm.*

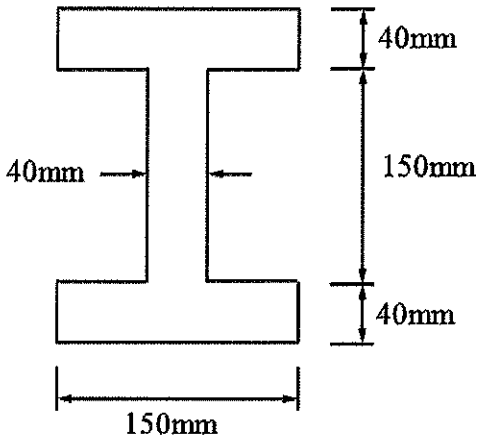


Figure B2(a) / *Rajah B2(a)*

[12 marks]
[12 *markah*]

CLO2
C4

(b) A simply supported beam with cross section as shown in **Figure B2(b)** carries point load of 200kN. Calculate the maximum bending stress of the beam.
*Sebuah rasuk disokong mudah mempunyai keratan rentas seperti ditunjukkan dalam **Rajah B2(b)** membawa beban sebanyak 200kN. Kirakan tegasan lentur maksimum rasuk tersebut.*

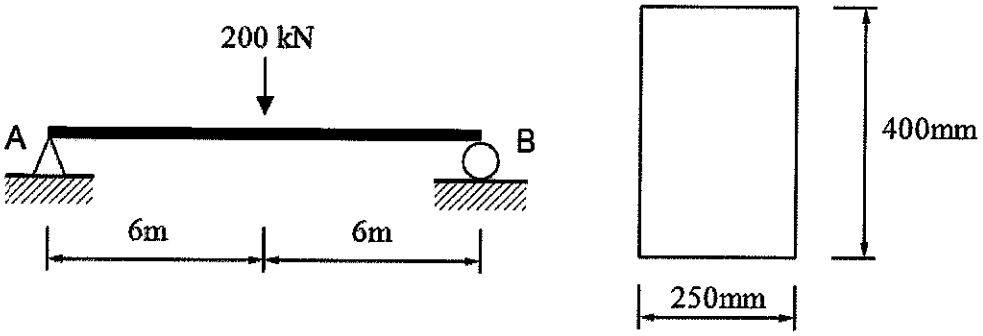


Figure B2(b) / *Rajah B2(b)*

[8 marks]
[8 *markah*]

CLO2
C6

(c) Based on bending stress value calculated from **Question B2(b)**, construct the bending stress distribution diagram for the rectangular beam section.
*Berdasarkan kepada nilai tegasan lentur dari **Soalan B2(b)**, bina rajah taburan tegasan lentur bagi keratan rasuk tersebut.*

[5 marks]
[5 *markah*]

QUESTION 3
SOALAN 3

CLO2
C3

(a) A simply supported beam as shown in **Figure B3(a)** is subjected to a shear force of 70kN. If the second moment of area of the section is 23.87 x 10^6 mm^4, calculate the shear stress distribution for the beam section.

*Rasuk disokong mudah seperti **Rajah B3(a)** dikenakan daya ricih sebanyak 70kN. Jika momen luas kedua keratan ialah 23.87 x 10^6 mm^4, kirakan agihan tegasan ricih pada keratan rasuk tersebut.*

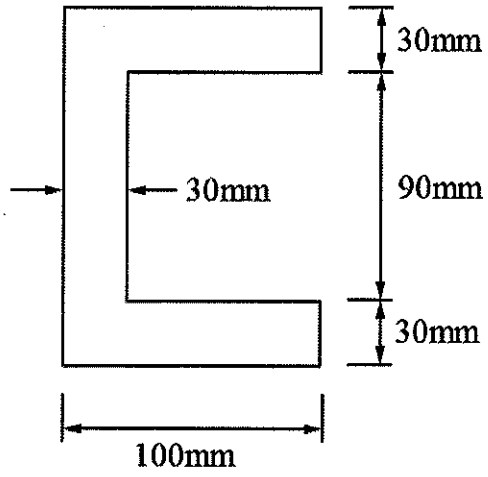


Figure B3(a) / *Rajah B3(a)*

[12 marks]
[*12 markah*]

CLO2
C4

(b) Three steel plates are connected together by using a bolt with 15mm of diameter. If shear stress in the bolt is 452.7 × 10^6 N/m^2, calculate shear force applied.
Tiga plat keluli disambungkan dengan menggunakan sebatang bolt berdiameter 15mm. Jika tegasan ricih di dalam bolt ialah 452.7 × 10^6 N/m^2, kira daya ricih yang dikenakan.

[8 marks]
[8 *markah*]

CLO2
C6

(c) **Figure B3(c)** shows a rectangular beam section carrying a shear force of 100kN. Given the second moment of area for the beam section is 3125 x 10^6 mm^4.

Rajah B3(c) *menunjukkan sebuah rasuk berkeratan rentas segiempat membawa beban ricih sebanyak 100kN. Diberi momen luas kedua keratan rasuk tersebut ialah 3125 x 10^6 mm^4.*

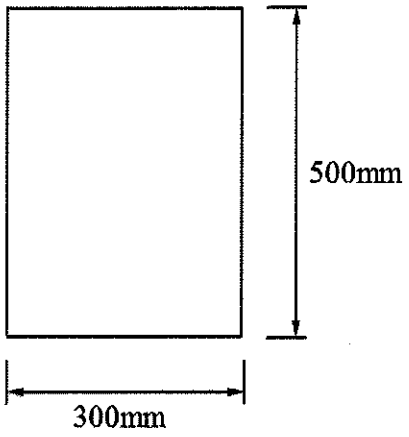


Figure B3(c) / *Rajah B3(c)*

i. Compute maximum shear stress in the beam section.
Kirakan tegasan ricih maksimum dalam keratan rasuk.

[3 marks]
[3 *markah*]

ii. Construct the shear stress distribution diagram for the beam by using the maximum shear stress value from **Question B3(c)i.**
Bina rajah taburan tegasan ricih rasuk tersebut dengan menggunakan nilai tegasan ricih maksimum dari ***Soalan B3(c)i.***

[2 marks]
[2 *markah*]

QUESTION 4
SOALAN 4

A simply supported beam is loaded as shown in **Figure B4.**
*Sebuah rasuk disokong mudah dikenakan beban seperti dalam **Rajah B4.***

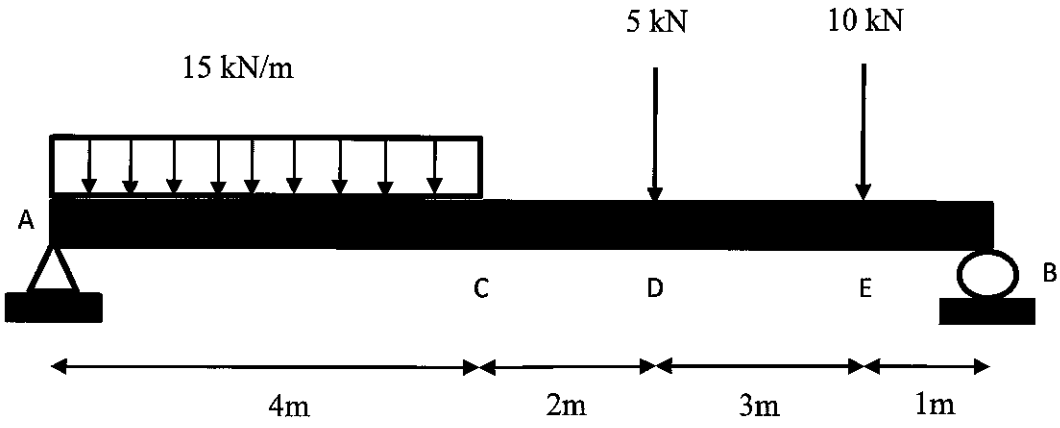


Figure B4 / *Rajah B4*

CLO2
C3

(a) Based on **Figure B4;**
*Merujuk kepada **Rajah B4;***

i. Calculate the reaction forces at support A and B.
Kirakan daya tindakbalas pada penyokong A dan B.

[3 marks]
[3 *markah*]

ii. Calculate the moment equations, slope equation and deflection equation by using Macaulay Method.
Tentukan persamaan momen, persamaan kecerunan dan persamaan pesongan bagi rasuk ini dengan menggunakan Kaedah Macaulay.

[9 marks]
[9 *markah*]

CLO2
C4

(b) Calculate the slope and deflection at point E by using Macaulay Method in term of EI.

Kirakan nilai kecerunan dan pesongan pada titik E dengan menggunakan Kaedah Macaulay dalam sebutan EI.

[8 marks]
[8 *markah*]

CLO2
C6

(c) Construct the free body diagram of the beam.

Bina gambarajah jasad bebas bagi rasuk.

[5 marks]
[5 markah]

SOALAN TAMAT

LIST OF FORMULA FOR DCC2063 MECHANICS OF CIVIL ENGINEERING STRUCTURES

1. $\sigma = \frac{P}{A}$
2. $\varepsilon = \frac{\delta L}{L}$
3. $E = \frac{\sigma}{\varepsilon}$
4. $E = \frac{PL}{A\delta L}$
5. $I_{xx} = \frac{bd^3}{12} + Ah^2$
6. $Z = \frac{I}{\bar{y}}$
7. $\frac{M}{I} = \frac{\sigma}{\bar{y}}$
8. $\tau = \frac{F}{nA}$
9. $\tau = \frac{VAy}{Ib}$

TABLE 1 MAXIMUM MOMENT FORMULA FOR SPECIFIC BEAM AND LOAD

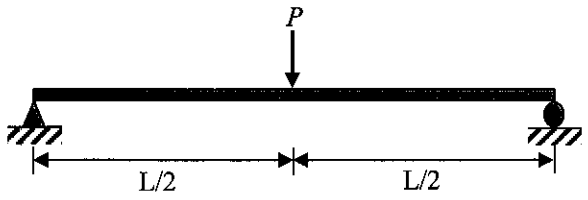
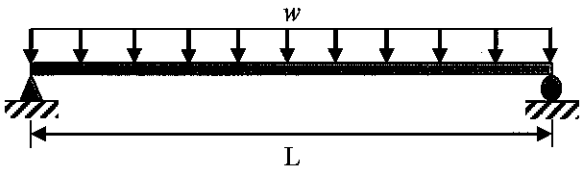
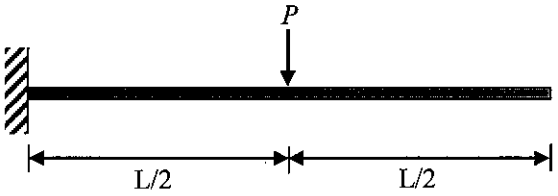
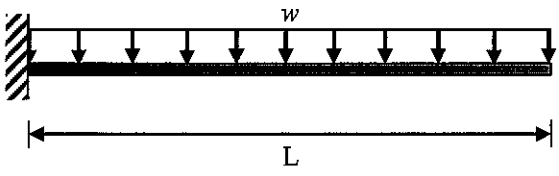
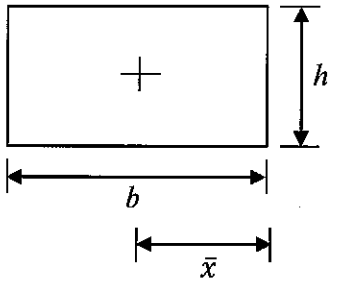
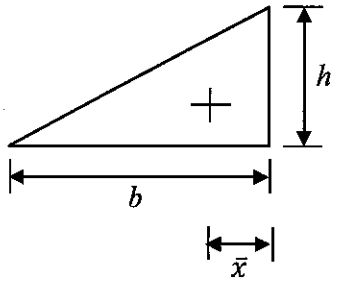
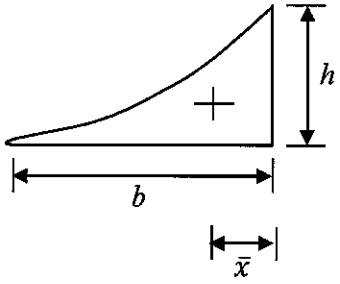
Beam with specific load	Maximum moment
	$\frac{PL}{4}$
	$\frac{wL^2}{8}$
	$\frac{-PL}{2}$
	$\frac{-wL^2}{2}$

TABLE 2 GEOMETRIC PROPERTIES OF AREA

Shape	Area, A	Centroid, $\bar{x}$
	bh	$\frac{1}{2}b$
	$\frac{1}{2}bh$	$\frac{1}{3}b$
	$\frac{1}{3}bh$	$\frac{1}{4}b$