

SULIT



**KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI**

**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI**

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI II : 2022/2023

DCC20053 : MECHANICS OF CIVIL ENGINEERING STRUCTURES

TARIKH : 13 JUN 2023

MASA : 8.30 PG – 10.30 PG (2 JAM)

Kertas ini mengandungi **TIGA BELAS (13)** halaman bercetak.

Bahagian A: Subjektif (2 soalan)

Bahagian B: Subjektif (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A: 50 MARKS**BAHAGIAN A: 50 MARKAH****INSTRUCTION:**

This section consists of **TWO (2)** subjective questions. Answer **ALL** questions

ARAHAN:

Bahagian ini mengandungi DUA (2) soalan subjektif. Jawab SEMUA soalan.

QUESTION 1**SOALAN 1**

CLO1

- (a) With the aid of a diagram, explain pinned support.

Dengan bantuan lakaran gambarajah, terangkan sokongan pin.

[5 marks]

[5 markah]

CLO1

- (b) A simply supported beam AB 9 m long carries a point load, uniformly distributed load and moment as shown in Figure A1(b). With the aid of free body diagram, find out the reaction force at each support.

Rasuk disokong mudah AB mempunyai 9 m panjang membawa beban tumpu, beban teragih seragam dan momen seperti Rajah A1(b). Dengan bantuan gambarajah jasad bebas, dapatkan nilai daya tindakbalas pada setiap penyokong.

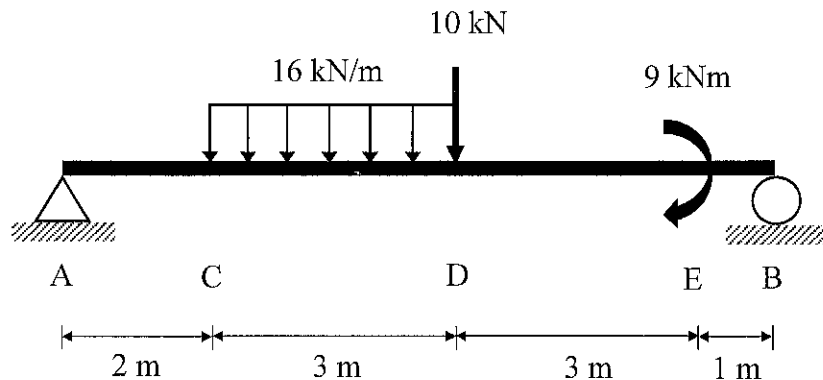


Figure A1(b) / Rajah A1(b)

[10 marks]

[10 markah]

CLO1

- (c) An automobile component shown in Figure A1(c) is subjected to a tensile load of 180 kN. Determine the total elongation of the component if the Modulus of Elasticity is 200 GPa.

Komponen kereta seperti yang ditunjukkan dalam Rajah A1(c) dikenakan daya tegangan sebanyak 180 kN. Tentukan jumlah pemanjangan komponen jika Modulus Keanjalan 200 GPa.

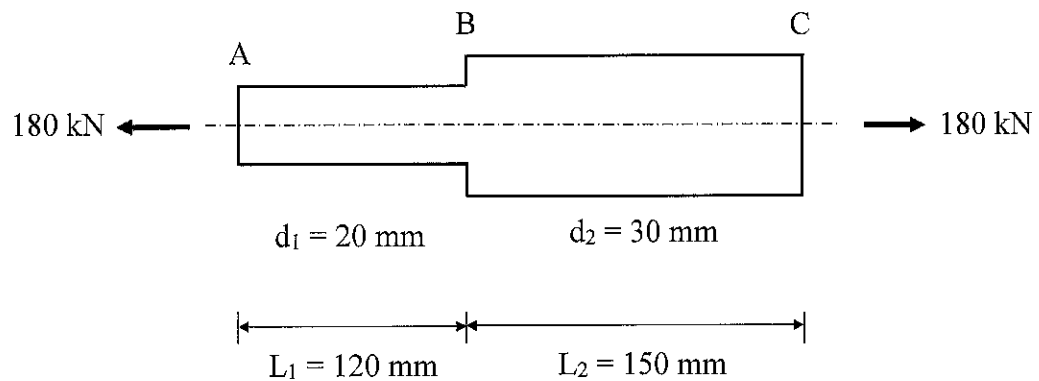


Figure A1(c) / Rajah A1(c)

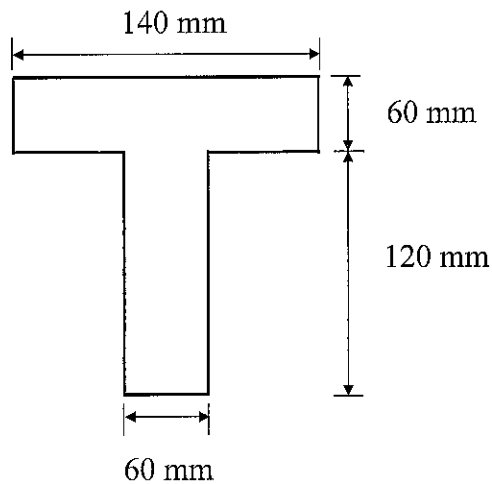
[10 marks]

[10 markah]

QUESTION 2**SOALAN 2**

CLO1

- (a) Figure A2(a) shows a T-section beam.

Rajah A2(a) menunjukkan rasuk berkeratan T.Figure A2(a) / *Rajah A2(a)*

From Figure A2(a);

Daripada Rajah A2(a),

- i. Identify the centre of gravity of a T-section beam.

Kenalpasti pusat graviti bagi rasuk berkeratan T.

[5 marks]

[5 markah]

- ii. Calculate the moment of inertia of T-section beam.

Kirakan momen luas kedua bagi rasuk berkeratan T.

[8 marks]

[8 markah]

CLO1

- (b) Two steel plates are connected with two rivets. If the force that imposed for plate is 52.5 kN and shear stress in rivet is 120 MN/m^2 , calculate the diameter of rivets.

Dua plat keluli bersambung dengan dua rivet. Jika daya yang dikenakan ke atas plat ialah 52.5 kN dan tegasan ricih di dalam rivet ialah 120 MN/m^2 , kirakan nilai bagi garis pusat rivet.

[6 marks]

[6 markah]

CLO1

- (c) Figure A2(c) shows a simply supported beam is subjected to point load, uniformly distributed load and moment. Given $R_{Ay} = 32.5 \text{ kN}$ and $R_{By} = 35.5 \text{ kN}$. By using a Macaulay Method, construct the equations for bending moment, slope and deflection.

Rajah A2(c) menunjukkan rasuk disokong mudah dikenakan beban tumpu, beban teragih seragam dan momen. Diberi $R_{Ay} = 32.5 \text{ kN}$ dan $R_{By} = 35.5 \text{ kN}$. Dengan menggunakan Kaedah Macaulay, bina persamaan momen lentur, persamaan kecerunan dan persamaan pesongan.

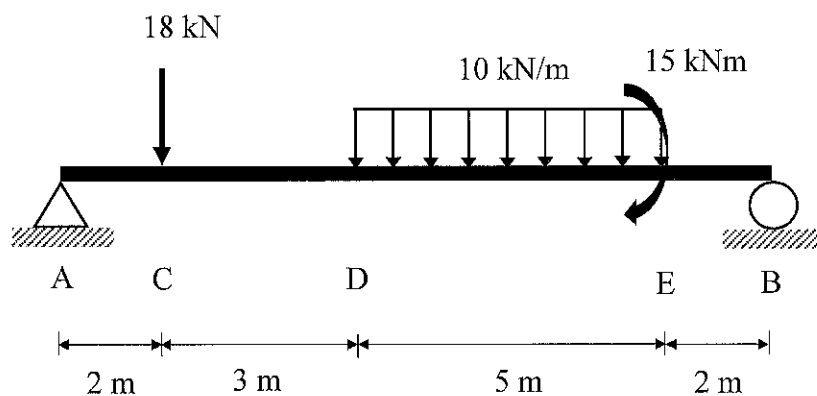


Figure A2(c) / Rajah A2(c)

[6 marks]

[6 markah]

SECTION B : 50 MARKS**BAHAGIAN B: 50 MARKAH****INSTRUCTION:**

This section consists of **FOUR (4)** subjective questions. Answer **TWO (2)** questions only.

ARAHAN:

Bahagian ini mengandungi EMPAT (4) soalan subjektif. Jawab DUA (2) soalan sahaja.

QUESTION 1**SOALAN 1**

- CLO2 (a) Describe the difference between statically determinate beam and statically indeterminate beam with the aid of a diagram.
- Huraikan perbezaan antara rasuk boleh tentu statik dan rasuk tidak boleh tentu statik dengan bantuan gambarajah.*
- [5 marks]
[5 markah]
- CLO2 (b) A simply supported beam is loaded to uniformly distributed load and point load as shown in Figure B1(b). Given the reaction $R_{Ay} = 31.25$ kN and $R_{Ey} = 16.75$ kN, calculate shear force value and bending moment value at each point.
- Satu rasuk disokong mudah dikenakan beban teragih seragam dan beban tumpu seperti yang ditunjukkan pada Rajah B1(b). Diberikan $R_{Ay} = 31.25$ kN and $R_{Ey} = 16.75$ kN, kirakan nilai daya ricih dan nilai momen lentur pada setiap titik.*

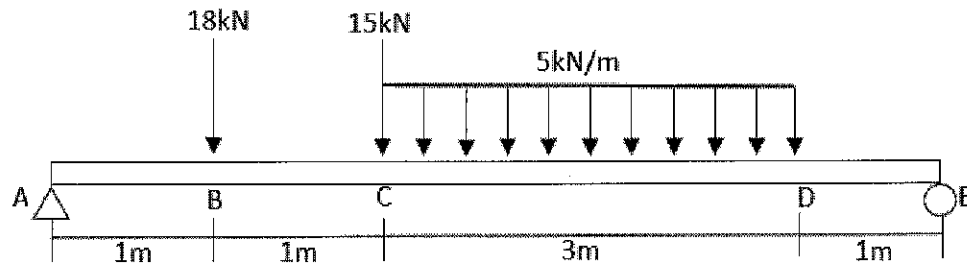


Figure B1(b) / Rajah B1(b)

[10 marks]

[10 markah]

CLO2

- (c) Based on the answer from Question 1(b), illustrate shear force and bending moment diagram of the beam.

Berdasarkan jawapan dari Soalan 1(b), lakarkan gambarajah daya ricih dan momen lentur bagi rasuk.

[10 marks]

[10 markah]

QUESTION 2

SOALAN 2

CLO2

- (a) The Figure B2(a) below shows a fixed end beam is loaded to point load in the middle of span. When a beam is being loaded as shown in figure below, bending stress will be resulted. Using the suitable sketching, identify the position of compressive and tensile bending stress.

Rajah B2(a) di bawah menunjukkan rasuk hujung terikat yang dikenakan beban tumpu di tengah rasuk. Apabila rasuk dikenakan beban seperti dalam rajah di bawah, tegasan lentur akan terhasil. Dengan menggunakan lakaran yang sesuai, kenal pasti kedudukan tegasan lentur mampatan dan tegangan.

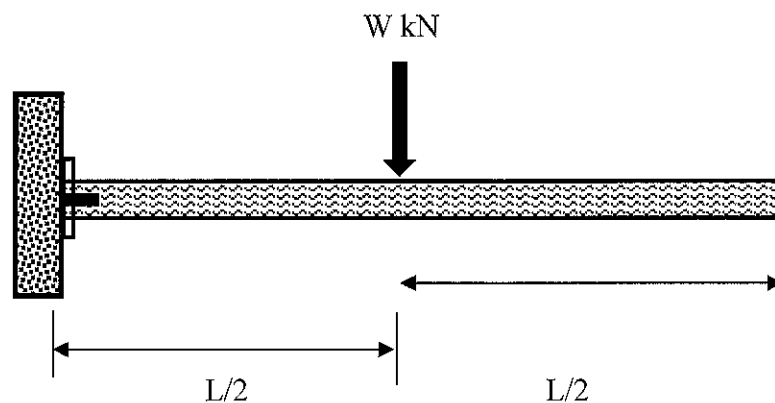


Figure B2(a) / Rajah B2(a)

[5 marks]

[5 markah]

CLO2

- (b) A symmetrical I-section beam as shown in Figure B2(b) is carried a uniformly distributed load 15 kN/m along the span and 60 kN point load in the middle of the span. Calculate the maximum bending moment and second moment area at y-axis, I_{xx} for the beam.

Satu rasuk simetri berkeratan I seperti Rajah B2(b) dikenakan beban teragih seragam 15 kN/m sepanjang rentang dan beban tumpu 60 kN di tengah rentang rasuk. Kirakan momen lentur maksimum dan momen luas kedua pada paksi y, I_{xx} bagi rasuk.

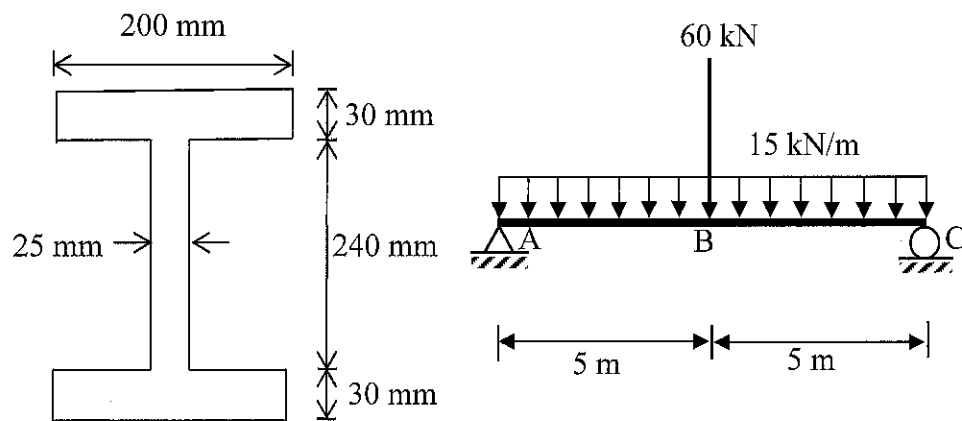


Figure B2(b) / Rajah B2(b)

[10 marks]

[10 markah]

CLO2

- (c) Using the answer from Question 2(b), illustrate the maximum bending stress distribution diagram for the symmetrical I-section beam.

Berdasarkan jawapan soalan 2(b), lakarkan gambarajah taburan tegasan lentur maksimum bagi rasuk simetri berkeratan I.

[10 marks]

[10 markah]

QUESTION 3**SOALAN 3**

- CLO2 (a) Figure B3(a) shows a rectangular beam section carries a shear force of 70 kN. Using formula given, estimate the maximum shear stress in the beam section.
Rajah B3(a) menunjukkan sebuah rasuk berkeratan rentas segiempat tepat membawa beban ricih sebanyak 70 kN. Menggunakan formula yang diberi, anggarkan tegasan ricih maksimum dalam keratan rasuk.

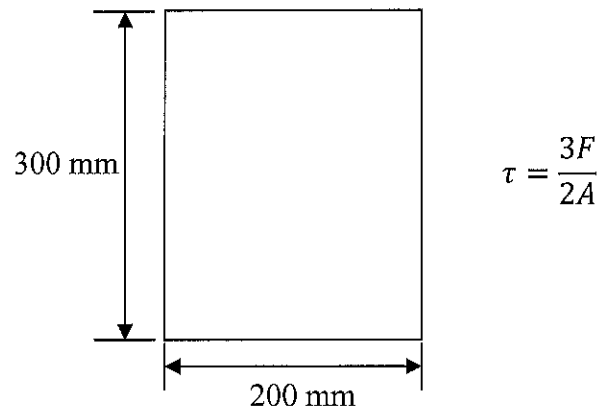


Figure B3(a) / Rajah B3(a)

[5 marks]

[5 markah]

- CLO2 (b) A T-section as shown in Figure B3(b) is subjected to a shear force of 50 kN. If the second moment of area of the section is $22.3 \times 10^6 \text{ mm}^4$, calculate the shear stress at upper flange, lower flange and junction of the web.
Satu rasuk berkeratan T seperti yang di tunjukkan dalam Rajah B3(b) telah dikenakan daya ricih sebanyak 50 kN. Jika momen luas kedua keratan ialah $22.3 \times 10^6 \text{ mm}^4$, kirakan tegasan ricih pada bebibir atas, bebibir bawah dan persimpangan web.

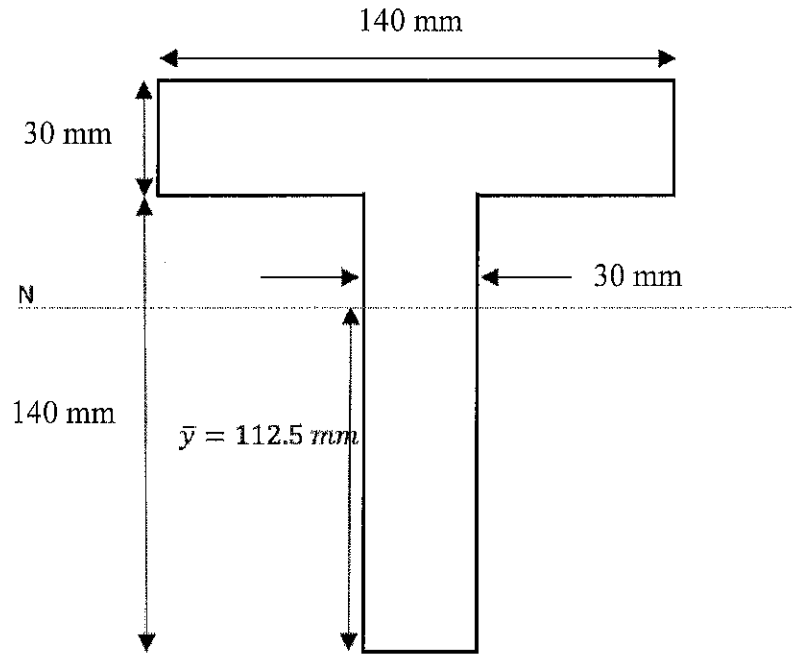


Figure B3(b) / Rajah B3(b)

[10 marks]

[10 markah]

CLO2

- (c) Based on answer from Question 3(b), illustrate the shear stress distribution across the section with maximum shear stress value.

Berdasarkan Soalan 3(b), lakarkan taburan tegasan ricih bagi keratan dengan nilai maksimum tegasan ricih.

[10 marks]

[10 markah]

QUESTION 4**SOALAN 4**

CLO2

- (a) A simply supported beam is subjected to a uniformly distributed load W N/m in the middle of the span as shown in Figure B4(a). Using Macaulay Method procedure, show the moment equation, $EI \frac{d^2y}{dx^2}$ when the beam cut at $x-x$.

Rasuk disokong mudah dikenakan beban teragih seragam W N/m di tengah-tengah rentang seperti yang ditunjukkan pada Rajah B4(a). Menggunakan prosedur Kaedah Macaulay, tunjukkan persamaan momen, $EI \frac{d^2y}{dx^2}$ apabila rasuk dikerat pada $x-x$.

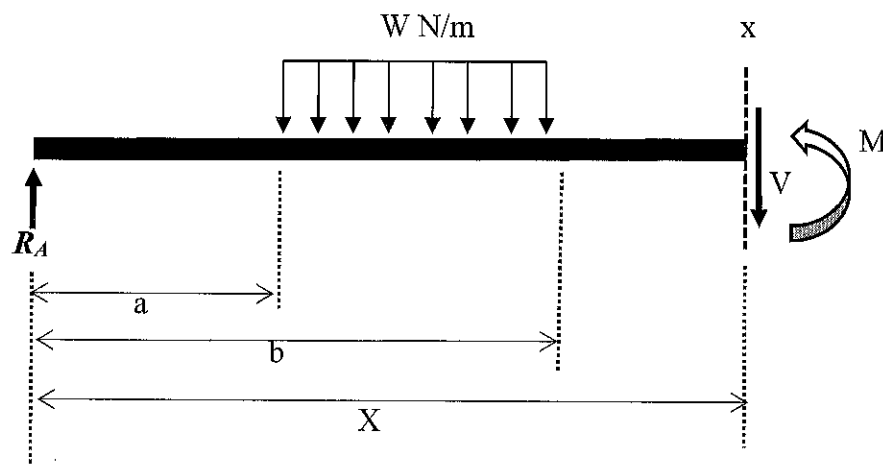


Figure B4(a) / Rajah B4(a)

[5 marks]

[5 markah]

CLO2

- (b) A cantilever beam is subjected to a point load and uniformly distributed load as shown in Figure B4(b). Given the reaction at point A is $R_{Ax} = 0$ kN, $R_{Ay} = 60$ kN and $M_A = -247.5$ kNm. Using a **moment area method**, identify the moment value for each loaded applied to the beam using moment area diagram.
- Satu rasuk hujung terikat dikenakan beban tumpu dan beban teragih seperti dalam Rajah B4(b). Diberi daya tindak balas pada titik A ialah $R_{Ax}=0$ kN, $R_{Ay}=60$ kN dan $M_A = -247.5$ kNm. Menggunakan **kaedah momen luas**, kenal pasti nilai momen bagi setiap beban yang dikenakan pada rasuk menggunakan gambar rajah momen luas.*

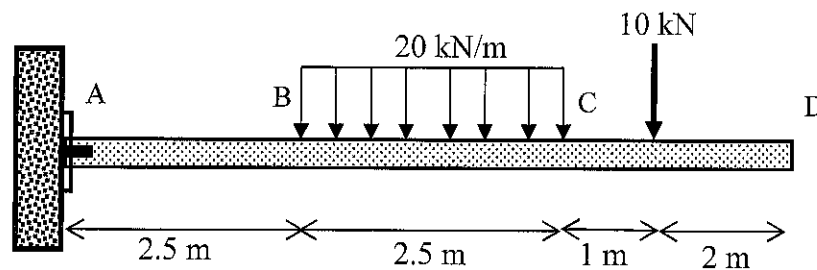


Figure B4(b) / Rajah B4(b)

[10 marks]

[10 markah]

CLO2

- (c) Using the answer from Question 4(b), analyze slope and deflection at free end. Given EI is constant.
- Berdasarkan jawapan dari Soalan B4(b), analisis cerun dan pesongan pada hujung bebas. Diberi EI adalah tetap.*

[10 marks]

[10 markah]

SOALAN TAMAT

LIST OF FORMULA FOR

1. $\sigma = \frac{P}{A}$	5. $Z = \frac{I}{\bar{y}}$
2. $\varepsilon = \frac{\delta L}{L}$	6. $\sigma = \frac{M}{I} \times \bar{y}$
3. $E = \frac{\sigma}{\varepsilon} @ E = \frac{PL}{A\delta L}$	7. $\tau = \frac{F}{nA} \ \& \ \tau = \frac{F}{2 \times n \times A}$
4. $I_{xx} = \frac{bd^3}{12} + Ad^2$	8. $\tau = \frac{VAy}{I_x b}$

TABLE 1 MAXIMUM MOMENT FORMULA FOR SPECIFIC BEAM AND LOAD

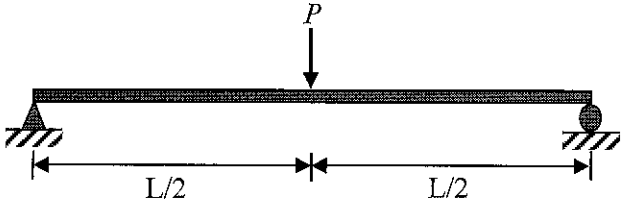
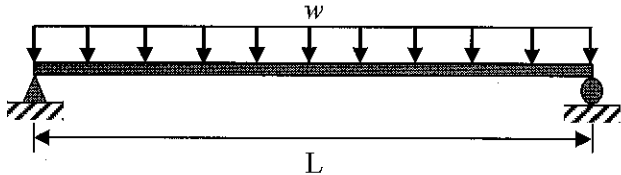
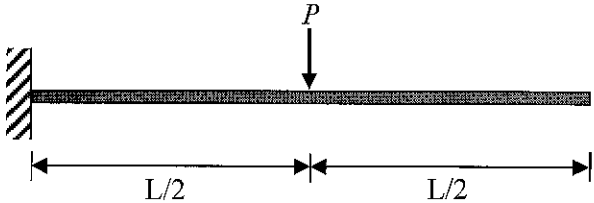
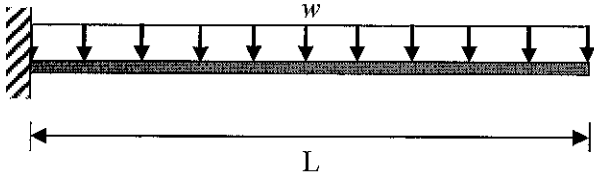
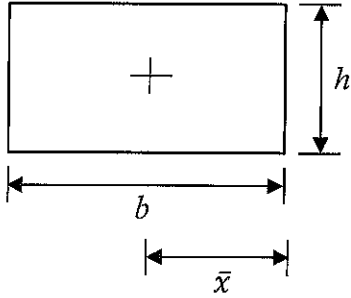
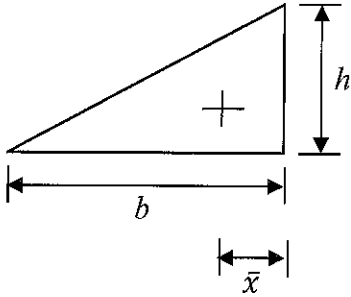
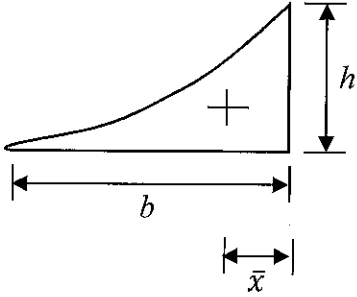
Beam with specific load	Maximum moment
	$\frac{PL}{4}$
	$\frac{wL^2}{8}$
	$\frac{-PL}{2}$
	$\frac{-wL^2}{2}$

TABLE 2 GEOMETRIC PROPERTIES OF AREA

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