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 I : 2023/2024

DCW30132 : WOOD MECHANIC STRUCTURE 2

TARIKH : 19 DISEMBER 2023
MASA : 2.30 PM – 4.30 PM (2 JAM)

Kertas ini mengandungi **TIGA BELAS (13)** halaman bercetak.
Bahagian A : Struktur (2 soalan)
Bahagian B : Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

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

(a) Based on Figure 1A(a), by using the moment area method, identify the value of T_{CA} in terms of EI.

Berdasarkan Rajah 1A(a), dengan menggunakan kaedah momen luas, kenalpasti nilai T_{CA} dalam sebutan EI.

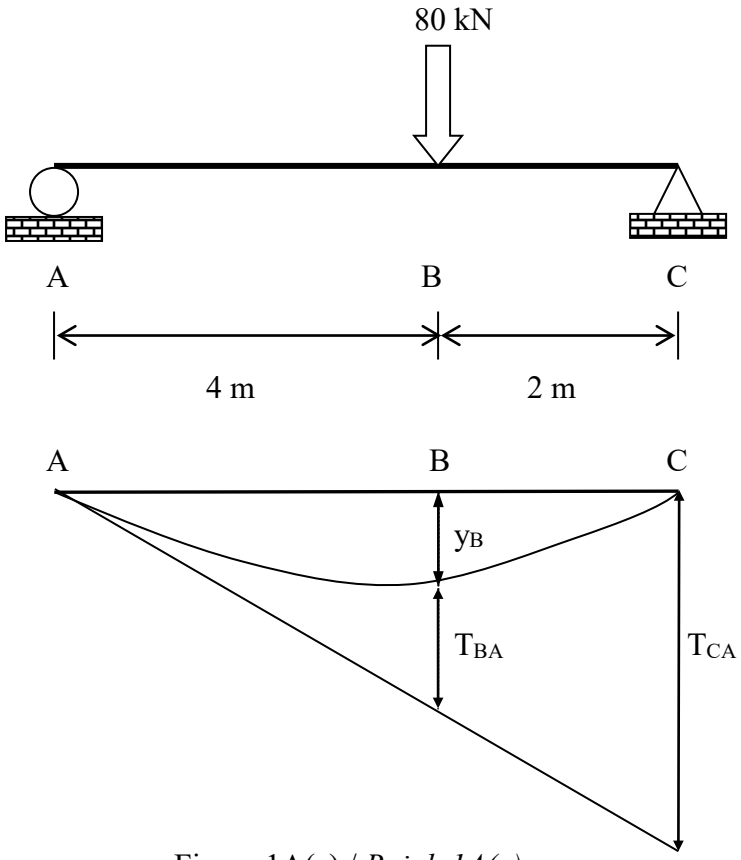


Figure 1A(a) / *Rajah 1A(a)*

[10 Marks]
[*10 Markah*]

CLO1

(b) A circular column of 4 m length is shown in Figure A1(b). The column is subjected to a compressive load of 300 kN. As a result of these forces, the column has shortened by 5 mm. The column is pinned both ends. Determine:

Satu tiang berkeratan bulat dengan panjangnya 4 m ditunjukkan seperti dalam Rajah A1(b). Tiang itu menanggung beban mampatan sebanyak 300 kN. Akibat daripada daya tersebut, tiang mengalami pemendekan sebanyak 5 mm. Tiang tersebut dipinkan kedua-dua hujungnya. Tentukan:

i. the minimum radius of gyration. [7 Marks]
jejari legaran minimum. [*7 Markah*]

ii. Euler critical load. [8 Marks]
beban kritikal Euler. [*8 Markah*]

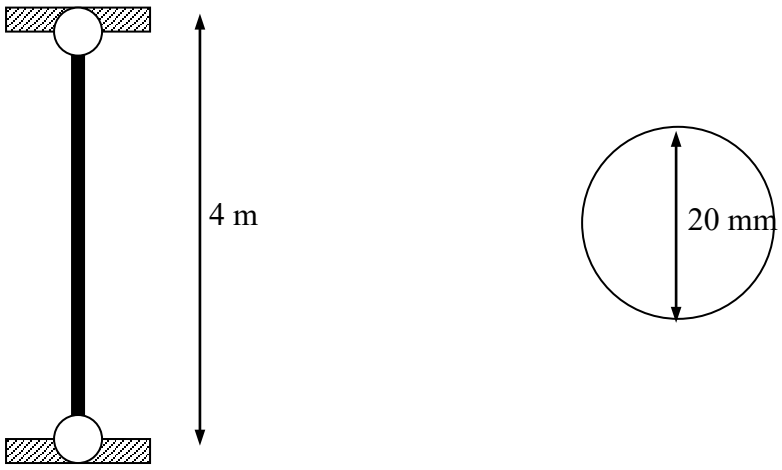


Figure A1(b) \ *Rajah A1(b)*

QUESTION 2
SOALAN 2

CLO1 (a) Identify **TWO (2)** types of column and its failure. [4 Marks]

*Kenalpasti **DUA (2)** jenis tiang dan kegagalannya* [*4 Markah*]

(b) Describe **SIX (6)** assumptions that are made by Leoard Euler to analyze the critical load for column. [6 Marks]

*Terangkan **ENAM (6)** andaian yang dibuat oleh Leoard Euler untuk menganalisa beban kritikal bagi tiang.*

[6 *Markah*]

CLO1 (c) Calculate the internal forces in members of the structure frame shown in Figure A2(b) using the method of joint.

Dapatkan nilai daya dalaman bagi anggota seperti Rajah A2(b) dengan menggunakan kaedah sendi.

i. member AB [7 Marks]
anggota AB [7 *Markah*]

ii. member EB [8 Marks]
anggota EB [*8 Markah*]

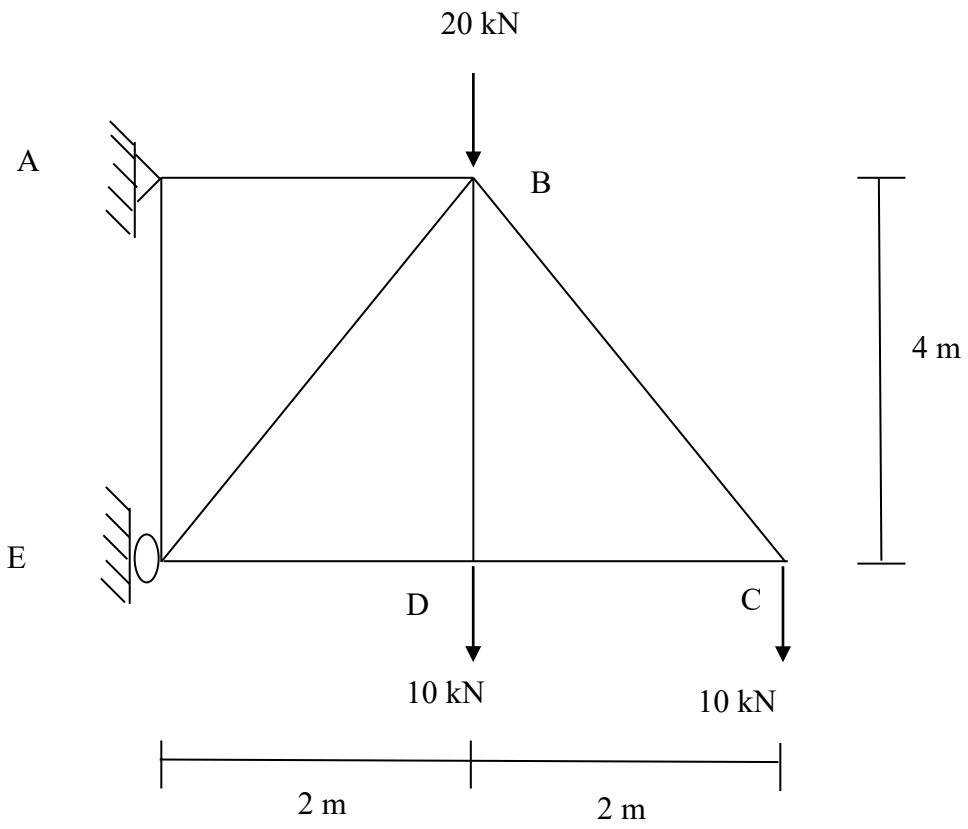


Figure A2(b) / *Rajah A2(b)*

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

(a) Based on Figure B1(a), determine the centroid of the section by referring to the axis OY and OX.

Berdasarkan Rajah B1(a), tentukan kedudukan pusat sentroid dengan merujuk kepada paksi OY dan OX.

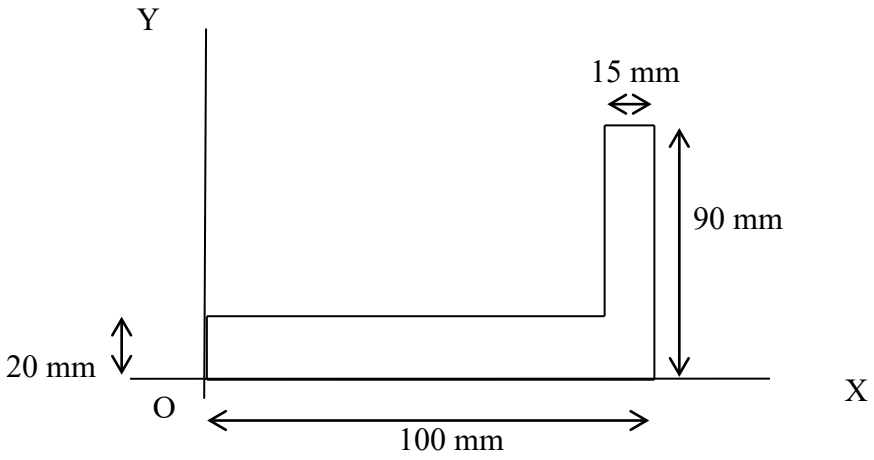


Figure B1(a) / *Rajah B1(a)*

[10 Marks]
[*10 Markah*]

CLO2

(b) Based on Figure B1(b), calculate the position of the center of centroid when the half circle is removed by reffering to:

Berdasarkan Rajah B1(b), kira kedudukan pusat sentroid apabila bahagian separuh bulatan dibuang merujuk kepada:

i. axis OY. [7 Marks]
paksi OY. [*7 Markah*]

ii. axis OX. [8 Marks]
paksi OX. [*8 Markah*]

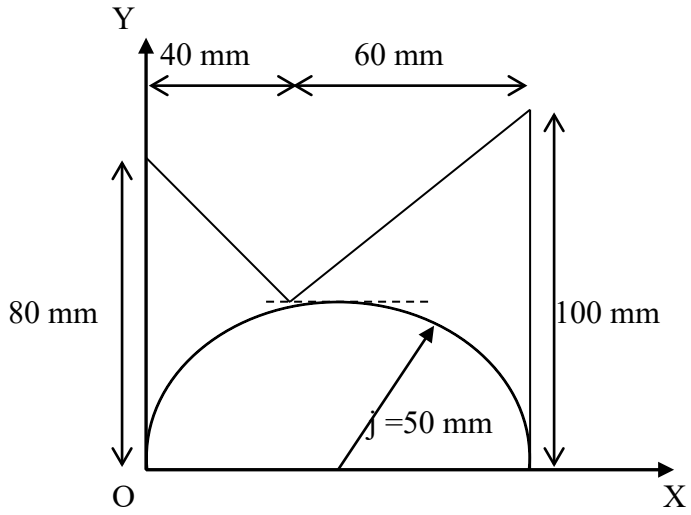


Figure B1(b) / *Rajah B1(b)*

QUESTION 2
SOALAN 2

CLO2 (a) A simply supported beam has loaded by point load as shown in Figure B2(a). Determine the b value if stress distribution is limited 60 kN/m^2.

Sebatang rasuk yang disokong mudah dikenakan beban tumpu seperti Rajah B2(a). Tentukan nilai b jika tegasan lentur maksima dihadkan kepada 60 kN/m^2.

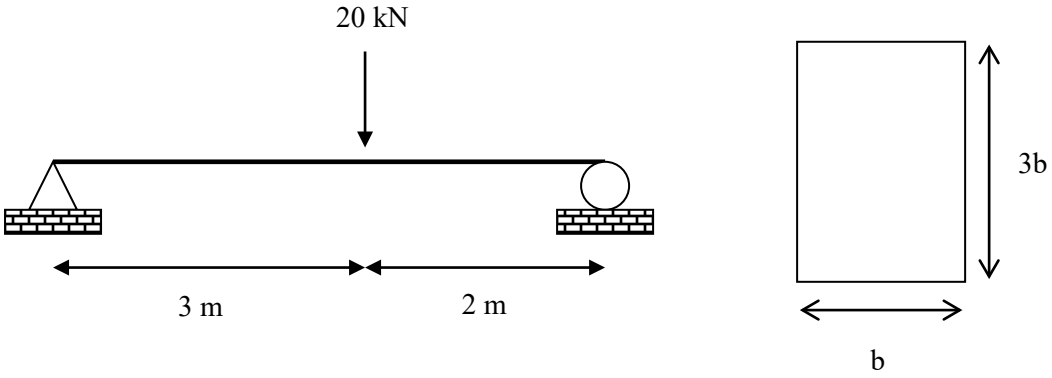


Figure B2(a) /*Rajah B2(a)*

[10 marks]
[*10 markah*]

CLO2 (b) An overhang beam has loaded by uniform distribution load as shown in Figure B2(b). If the maximum stress distribution is limited at 30 MN/m^2, determine:

Sebatang rasuk julur dikenakan beban teragih seragam seperti Rajah B2(b). Jika tegasan lentur maksima dihadakan kepada 30 MN/m^2, tentukan:

i. the value of the moment of inertia about the neutral axis. [8 Marks]
nilai momen inersia sekitar paksi neutral. [*8 Markah*]

ii. the value of uniformly distributed load W kN/m allowed. [7 Marks]
nilai beban teragih seragam W kN/m yang dibenarkan. [*7 Markah*]

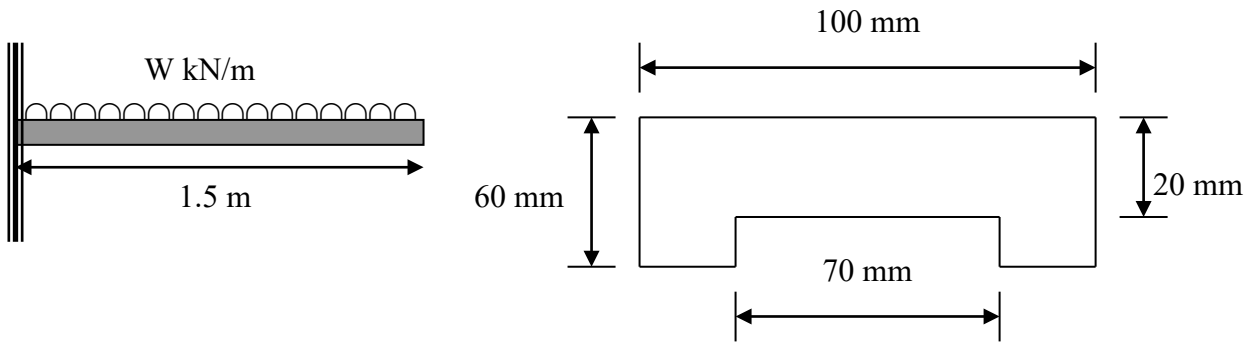


Figure B2(b) / *Rajah B2(b)*

CLO2

QUESTION 3
SOALAN 3

(a) Based on Figure B3(a) below, by using moment area method, calculate the deflection at point D in terms of EI if the reaction force on support A is 25 kN.

Berdasarkan Rajah B3(a) di bawah, dengan menggunakan kaedah momen luas, kirakan pesongan di titik D dalam sebutan EI sekiranya daya tindakbalas pada sokong A ialah 25 kN.

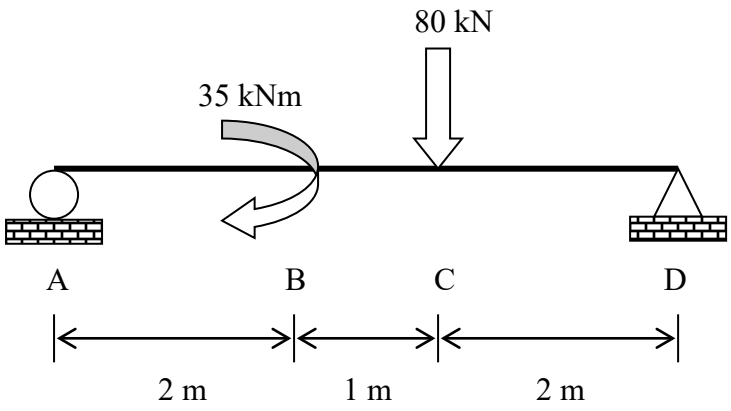


Figure B3(a) \ *Rajah B3(a)*

[10 Marks]
[*10 Markah*]

CLO2

(a) By referring to Figure B3(b), if the reaction force at support A is 8.75 kN, using the moment area method. Determine:

Berdasarkan Rajah B3(b), jika daya tindakbalas pada sokong A adalah 8.75 kN, dengan menggunakan kaedah momen luas. Tentukan:

i. slope at point B in EI value. [8 Marks]
kecerunan pada titik B dalam sebutan EI. [8 *Markah*]

ii. deflection at point B in EI value. [7 Marks]
pesongan pada titik B dalam sebutan EI. [7 *Markah*]

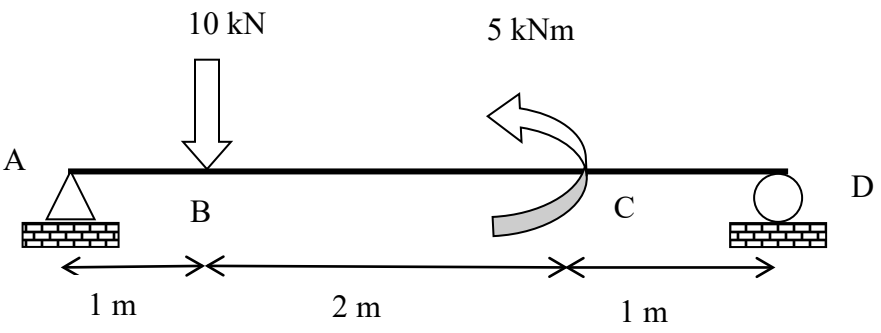


Figure B3(b) / *Rajah B3(b)*

QUESTION 4
SOALAN 4

CLO2

(a) A column 6 meter long has cross section of 60 mm x 60 mm. The column is both ends pinned. Given E = 2.0 x 10^5 N/mm^2 and P_{cr} = 5.92 x 10^4 N.
Determine:

Sebatang tiang yang panjangnya 6 meter mempunyai keratan rentas 60 mm x 60 mm. Tiang tersebut dipinkan di kedua-dua hujungnya. Diberi E = 2.0 x 10^5 N/mm^2 dan P_{cr} = 5.92 x 10^4 N. Tentukan:

i. Slenderness ratio [6 Marks]
Nisbah kelangsingan [*6 Markah*]

ii. Maximum load that can be carried by the column if the safety factor is 2.5 [4 Marks]
Beban maksima yang boleh ditanggung oleh tiang sekiranya faktor keselamatan ialah 2.5. [*4 Markah*]

CLO2

(b) The trusses ABCDE are supported at points A and D as in Figure B4(b). Point loads of 50 N and 100 N are applied at point B and C, respectively. By using section method, determine:

Kerangka ABCDE disangga pada titik A dan D seperti dalam Rajah B4(b). Beban tumpu 50 N dan 100 N masing-masing dikenakan pada titik B dan C. Dengan menggunakan kaedah keratan, tentukan:

i. the internal forces for AB member [8 Marks]
daya dalaman bagi anggota AB [*8 Markah*]

ii. the internal forces for AE member [7 Marks]
daya dalaman bagi anggota AE [*7 Markah*]

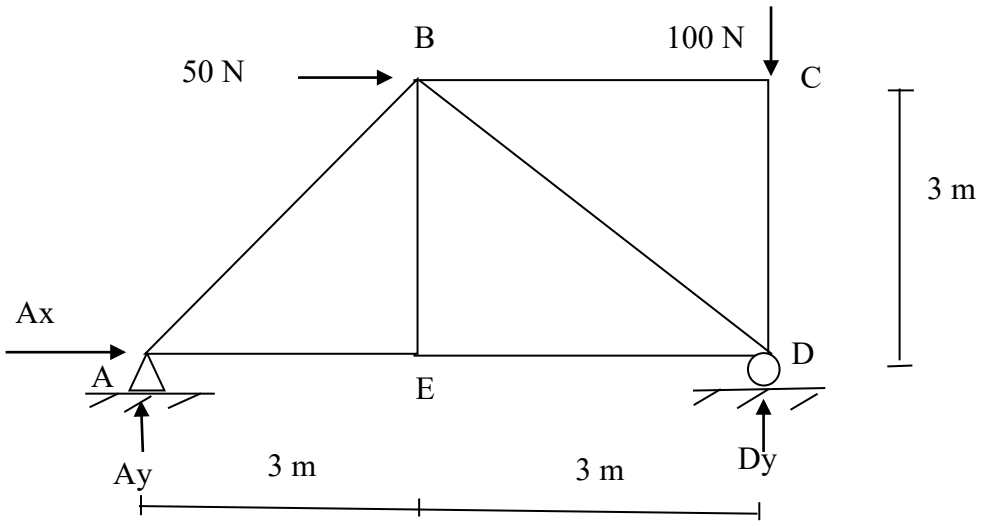


Figure B4(b) / *Rajah B4(b)*

SOALAN TAMAT

CENTROID AND SECOND MOMENT OF AREA

$$\bar{x} = \frac{\sum A\bar{x}}{\sum A} \qquad \bar{y} = \frac{\sum A\bar{y}}{\sum A} \qquad I_x = I_{pg} + Ad^2$$

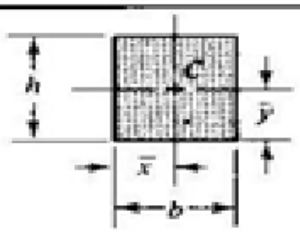
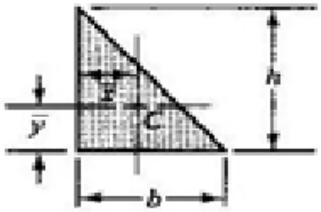
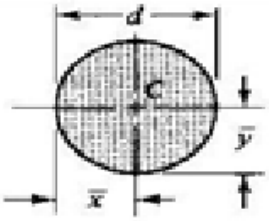
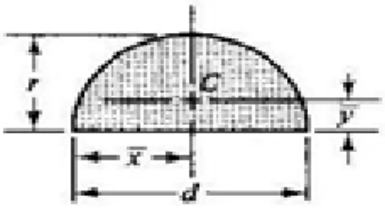
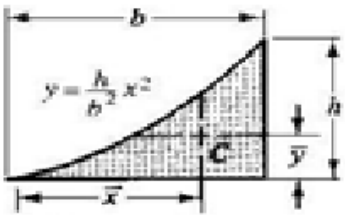
Shapes		Area	$\bar{x}$	$\bar{y}$
Rectangle		bh	$\frac{b}{2}$	$\frac{h}{2}$
Triangle		$\frac{bh}{2}$	$\frac{b}{3}$	$\frac{h}{3}$
Circle		$\frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{d}{2}$
Semi- circle		$\frac{\pi d^2}{8}$	$\frac{d}{2}$	$\frac{4r}{3\pi}$
Parabolic spandrel		$\frac{bh}{3}$	$\frac{3b}{4}$	$\frac{3h}{10}$

TABLE 1 : Centroid of Simple Geometric Shape

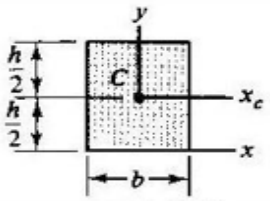
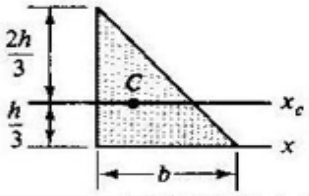
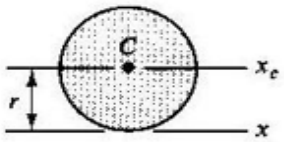
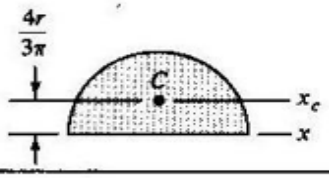
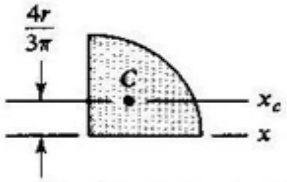
Shapes		I_x	I_{x_c}
Rectangle		$\frac{bh^3}{3}$	$\frac{bh^3}{12}$
Triangle		$\frac{bh^3}{12}$	$\frac{bh^3}{36}$
Circle		$\frac{5\pi r^4}{4}$	$\frac{\pi r^4}{4}$
Semicircle		$\frac{\pi r^4}{8}$	$0.0349\pi r^4$
Quarter-circle		$\frac{\pi r^4}{16}$	$0.01747\pi r^4$

TABLE 2: Moments Of Inertia Of Simple Shapes

BENDING STRESS

$$\frac{M}{I} = \frac{E}{R} = \frac{\sigma}{y}$$

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

$$M_{mak} = \frac{wL^2}{8}$$

$$M_{mak} = -\frac{wl^2}{2}$$

$$M_{mak} = \frac{wab}{L}$$

SLOPE AND DEFLECTION OF BEAM

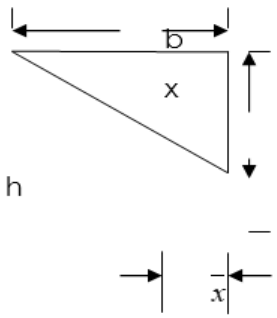
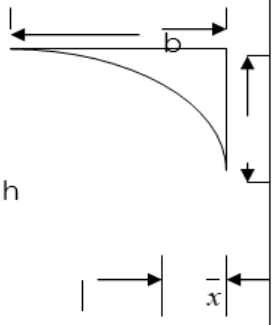
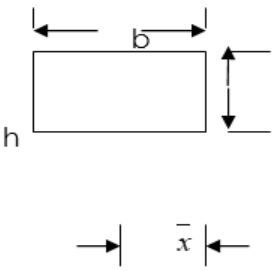
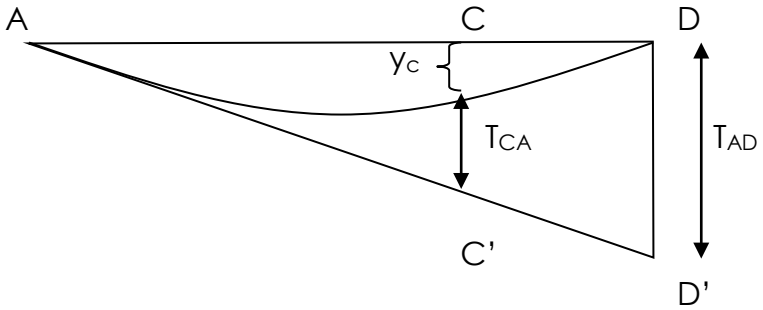
Shape	Triangle	Parabolic	Square
			
Area A	$\frac{1}{2}bh$	$\frac{1}{3}bh$	$\frac{1}{4}bh$
Centroid $\bar{x}$	$\frac{1}{3}b$	$\frac{1}{4}b$	$\frac{1}{2}b$

Table : Area and centroid for basic shape



$$T_{DA} = \Sigma\frac{A\bar{x}}{EI} = \frac{1}{EI}\Sigma A\bar{x}$$

$$\theta_{AC} = \frac{\Sigma luas G.M.L._{AC}}{EI}$$

$$\theta_C = \theta_{AC} - \theta_A$$

$$y_c = CC' - T_{CA}$$

COLUMN STABILITY AND SUPPORT

$$E = \frac{PL}{Ae}$$

$$r = \sqrt{\frac{I}{A}}$$

$$\lambda = \frac{L}{r}$$

$$\text{Beban Selamat} = \frac{Bebankritikal(Euler)}{Faktorkeselamat\,\text{an}}$$

$$P_{cr} = \frac{\Pi^2 EI}{L^2}$$

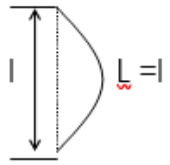
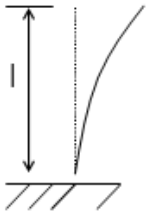
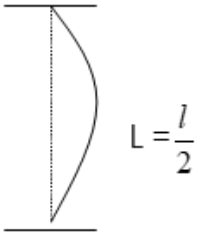
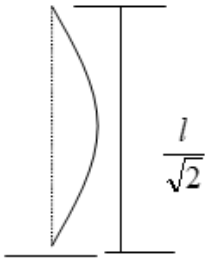
Case	Shape	Effective Length	Critical Load
Both end pinned		L =l	$P_E = \frac{\pi^2 EI}{L^2}$
One fixed and one free		L = 2l $l = \frac{L}{2}$	$P_E = \frac{\pi^2 EI}{L^2}$
Both end fixed		$L = \frac{l}{2}$	$P_E = \frac{\pi^2 EI}{L^2}$
One pinned and one fixed		$L = \frac{l}{\sqrt{2}}$ $l = \sqrt{2}\,L$	$P_E = \frac{\pi^2 EI}{L^2}$

FIGURE 3: Effective Length and Critical

TWO DIMENSION STRUCTURE FRAMES

$r+b = 2n$ $r + b > 2n$ $D = r + b - 2n$ $r + b < 2n$

$\circlearrowright +\sum M = 0$ $\uparrow +\sum Fy = 0$ $\rightarrow +\sum F_x = 0$