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POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

CIVIL ENGINEERING DEPARTMENT

FINAL EXAMINATION

CC205: MECHANICS OF STRUCTURES

DATE : 21 NOVEMBER 2012
DURATION : 2 HOURS (11.15 AM – 1.15 PM)

This paper consists of **SIX (6)** pages including the front page.
Section A: STRUCTURED (10 questions – answer ALL)
Section B: ESSAY (1 question – answer one)
Section C: ESSAY (2 question – answer one)

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(The CLO stated is for reference only)

SECTION A

STRUCTURED (40 marks)

Instruction: This section consists of **TEN (10)** subjective questions. Answer **ALL** the questions.

QUESTION 1

a. Describe the axial force using appropriate diagrams

(2 marks)

b. Sketch and label the direction of reaction for the following support:

i. Roller

ii. Fixed end

(2 marks)

[CLO 1: C1]

QUESTION 2

Calculate the reaction at support B for a beam subjected to the loads as shown in Figure1.

[CLO 1:C3]

(4 marks)

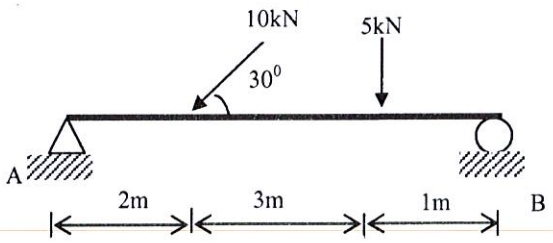


Figure 1

QUESTION 3

Calculate the reaction for a simply supported beam subjected to the loads as shown in Figure 2.

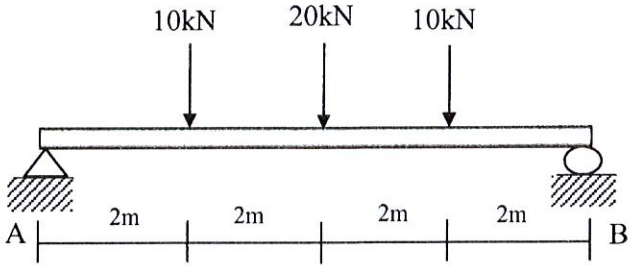


Figure 2

[CLO 1:C3]

(4 marks)

QUESTION 4

A steel rod 300mm in length is subjected to a tensile force of 25N has a diameter of 20mm as shown in Figure 3. Calculate the elongation in the rod. Given Young's Modulus = 205GPa.

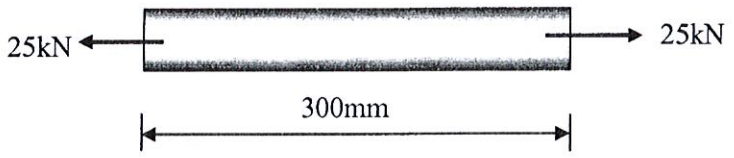


Figure 3

[CLO1:C3]
(4 marks)

QUESTION 5

A load of 40kN is to be raised with the help of a steel wire. Calculate the maximum diameter of the steel wire, if the stress is not to exceed 100N/mm^2.

[CLO1:C3]
(4 marks)

QUESTION 6

A simply supported beam has 150mm breadth and 230mm height is having stress in compression and tension of 100MPa. Calculate bending stress at 40mm from neutral axis.

[CLO 3: C3]
(4 marks)

QUESTION 7

A simply supported beam carries a maximum moment of 50kNm has a rectangular cross section of 300mm x 500mm. Calculate maximum bending stress in the section.

[CLO 3: C3]
(4 marks)

QUESTION 8

A rectangular column as shown in Figure 4, is loaded eccentrically with P kN. Calculate the stresses that occur at the corner of E, F, G and H if P/A= 2.0 N/mm^2, M_{xx}/Z_{xx} = 1.5 N/mm^2 and M_{yy}/Z_{yy} = 1.3 N/mm^2.

[CLO3: C3]

(4 Marks)

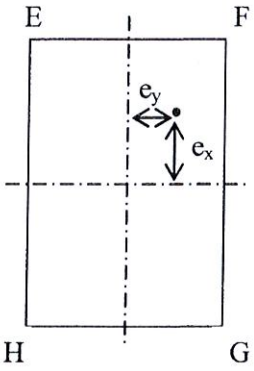


Figure 4

QUESTION 9

Calculate the force required to shear a bolt with 8mm diameter. Given the ultimate shear stress is 60MN/m^2.

(CLO3:C3)

(4 marks)

QUESTION 10

A rectangular beam as shown in Figure 5 carries a shear force of 30kN. Calculate the shear stress for the shaded area.

(CLO3:C3)

(4 marks)

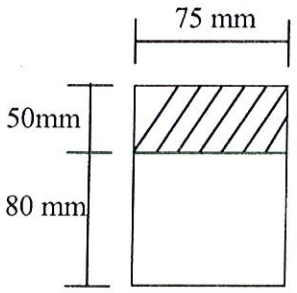


Figure 5

SECTION B

ESSAY (30 MARKS)

INSTRUCTION: This section consists of **ONE (1)** structured question. Answer all question.

QUESTION 1

A cantilever beam is subjected to point load and moment as shown in Figure 6. Calculate slope and deflection at free end of the cantilever beam by using Moment area Method.

[CLO 5 : C4]

(30 marks)

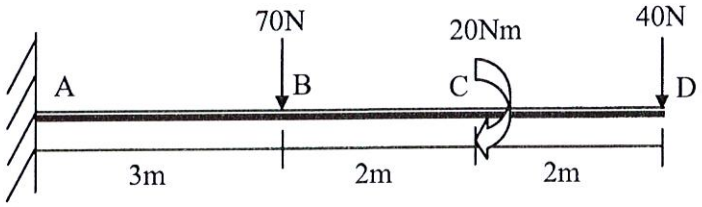


Figure 6

SECTION C

ESSAY (30 MARKS)

INSTRUCTION: This section consists of **TWO (2)** structured questions. Answer **ONE (1)** question only.

QUESTION 1

Sketch the Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) for the cantilever beam as shown in Figure 7. [CLO 2:C3]

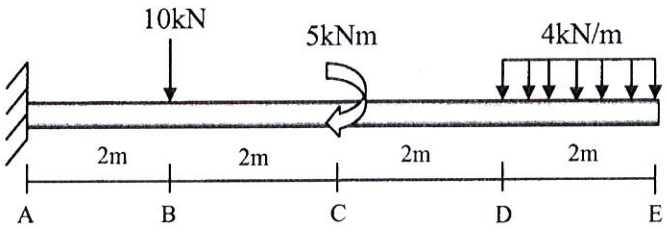


Figure 7

(30 marks)

QUESTION 2

a) Two plates of 8 mm thickness are connected by **TWO (2)** 20 mm diameter bolts as shown in Figure 8. Calculate the shear stress in the bolts.

[CLO3: C2]

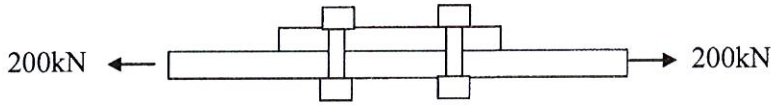


Figure 8

(5 Marks)

b) A T-section beam as shown in Figure 9 is subjected to a shear force of 250kN. Calculate the maximum shear stress at the junction of the web and the flange. Sketch the shear stress distribution diagram for the section.

[CLO 3:C3]

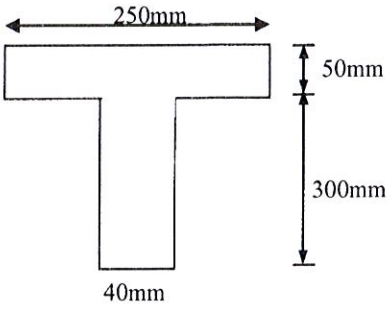


Figure 9

(25 Marks)

LIST OF FORMULA FOR CC205 – MECHANICS OF STRUCTURES

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

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

3. $$\mathrm{E} = \frac{pl}{A\delta l}$$

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

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. $$\tau = \frac{VA\bar{y}}{I_x b}$$

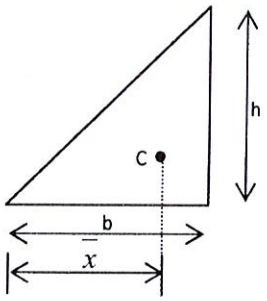
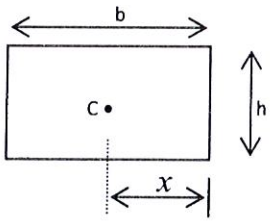
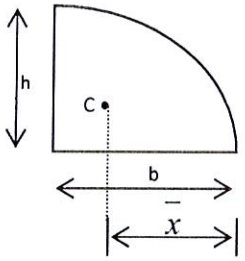
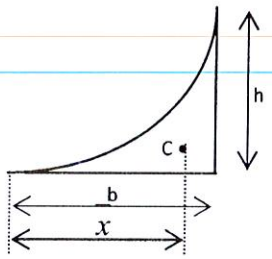
10.

$$\sigma_{\max/\min} = \sigma_d \pm \sigma b_x \pm \sigma b_y$$

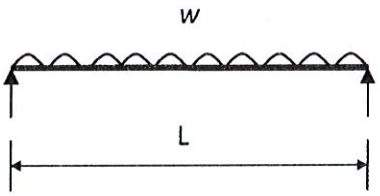
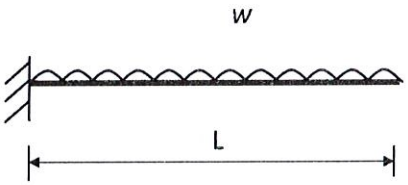
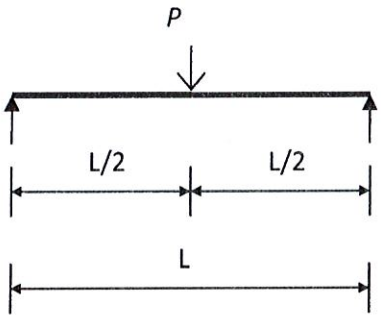
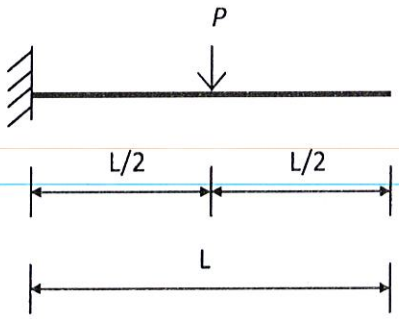
$$\sigma_{\max/\min} = \frac{P}{A} \pm \frac{Pe_x y}{I_{xx}} \pm \frac{Pe_y x}{I_{yy}}$$

$$\sigma_{\max/\min} = \frac{P}{A} \pm \frac{M_{xx}}{Z_{xx}} \pm \frac{M_{yy}}{Z_{yy}}$$

Table 1 : Geometric Properties of Areas

Shape		Area, A	$centroid, \bar{x}$
Triangle		$\frac{1}{2}bh$	$\frac{2}{3}b$
Rectangle		bh	$\frac{b}{2}$
Semi parabola		$\frac{2}{3}bh$	$\frac{5}{8}b$
Parabolic spandrel		$\frac{1}{3}bh$	$\frac{3}{4}b$

Maximum Moment

Beam	*Maximum moment*
	$\frac{wL^2}{8}$
	$-\frac{wL^2}{2}$
	$\frac{PL}{4}$
	$-\frac{PL}{2}$