Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	MECHANICS OF MATERIAL
COURSE CODE	:	DAC 20703
PROGRAMME	:	2 DAA
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS OUT OF **SIX (6)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) List types of stress in the material strength.

(5 marks)

(b) Explain briefly about stress-strain diagram.

(5 marks)

(c) A steel bar of length 130 cm tied between two walls at a temperature of 80 °C. Steel bar area is $4cm^2$, α value is 13.3 X 10^{-6}/°C and E value is 22 x 10^6 N/cm2. If the temperature drops to 0 °C, calculate the stress that occurs as follows:

(i) Distance between two walls is 130 cm
(ii) Distance between two walls is increased into 130.33 cm
(iii) Distance between two walls is decreased into 129.95 cm

(10 marks)

Q2 (a) List **five (5)** types of beam.

(5 marks)

(b) Explain the procedures for obtaining the shear and bending moment diagrams.

(5 marks)

(c) Determine the shear force and bending moment by using area method for cantilever beam in Figure **Q2(c)**.

(10 marks)

Q3 (a) List the assumptions before bending position for a wooden plank that placed across a drain.

(5 marks)

(b) Explain about economic sections in structural installations.

(5 marks)

(c) The beam cross-section 120 mm X 180 mm and a length of 8 m is located at the support pin at A and a roller support at B. The beam carries a uniformly distributed load of 7 kN/m as shown in Figure Q3(c). Calculate the following:

(i) The shear stress at section 1.0 m from the support pin at A

(ii) The shear stress at 60 mm intervals from the top to the bottom of the section
(iii) The maximum shearing stress in the beam

(10 marks)

Q4 (a) Sketch an example of deflection application in real world.

(3 marks)

(c) Explain elastic curve.

(3 marks)

(c) Evaluate $\langle x-5\rangle^2$ for the following cases:

(i) x = 0
(ii) x = 5

(2 marks)

(d) Determine slope and deflection of the beam at X m from roller A using the given simply supported beam AC diagram in Figure **Q4(d)**.

General equation for slope: $EI\frac{dy}{dx}=150x^2-200\langle x-0.5\rangle^2-87.5$

(i) X = 1.5
(ii) X = 0.25

(12 marks)

Q5 (a) List **four (4)** assumptions made in the derivation of torsion equation.

(4 marks)

(b) Given data:
T1 = 4000 kNm
T2 = 5000 kNm
T3 = 3000 kNm

Referring to Figure **Q5(b)** and given data, solve:

(i) T_4 value if system is in equilibrium
(ii) Torques in sections AB, BC, and CD

(7 marks)

(c) The vertical shaft AD is attached to a fixed base at D and is subjected to torques at sections A and B as shown in Figure **Q5(c)**. A hole of unknown diameter has been drilled into the centre of portion CD of the shaft. Knowing that the entire shaft is made of steel for which G = 80 GPa, and $\tau_{allowable}$ = 50 MPa, solve:

(i) Torques in shaft AB, BC, and CD
(ii) The maximum possible value of the hole diameter
(iii) The angle of twist at section A when the hole diameter size is of that in (ii)

(9 marks)

Q6 (a) Define critical load.

(4 marks)

(b) Write the Euler's equation for columns with the following end condition.

(i) Both end fixed
(ii) One end fixed, one end free
(iii) One end pinned, one end fixed

(3 marks)

(c) Referring to Figure **Q6(c)**, determine the maximum value of the load F using Euler's formula. Use factor of safety of 4 and E = 13 GPa.

(13 marks)

- END OF QUESTION -

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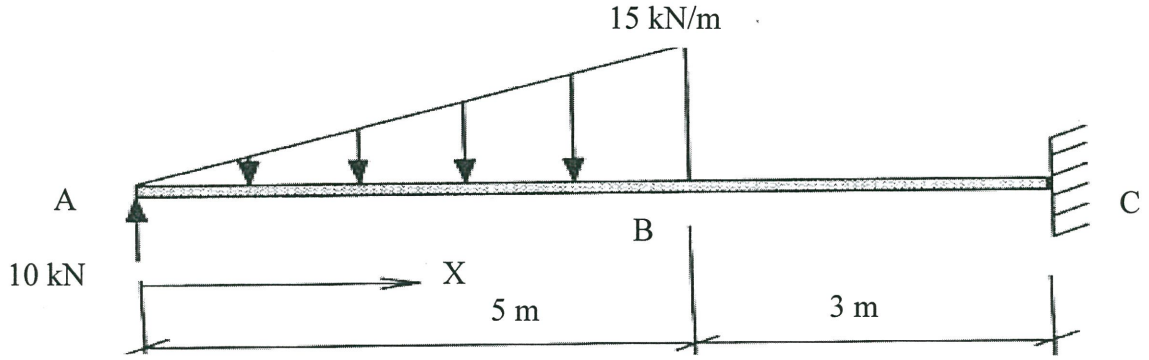

Figure Q2(b)

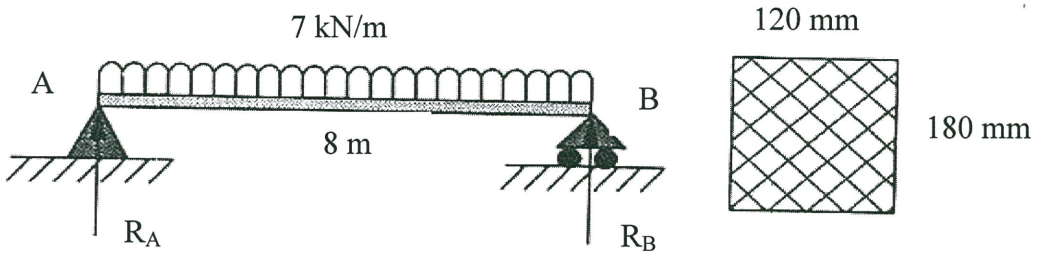

Figure Q3(c)

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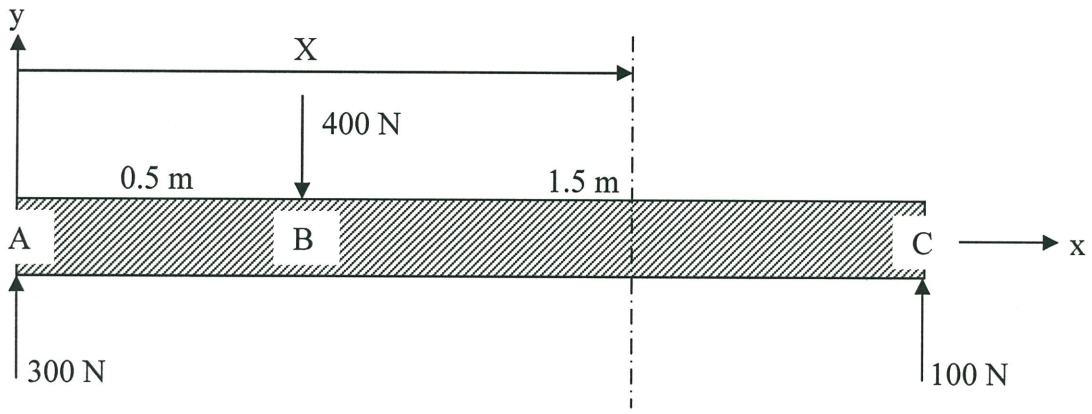

Figure Q4(d)

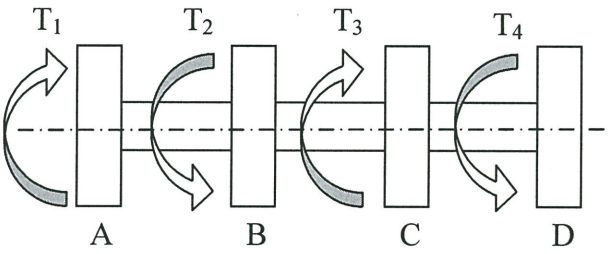

Figure Q5b

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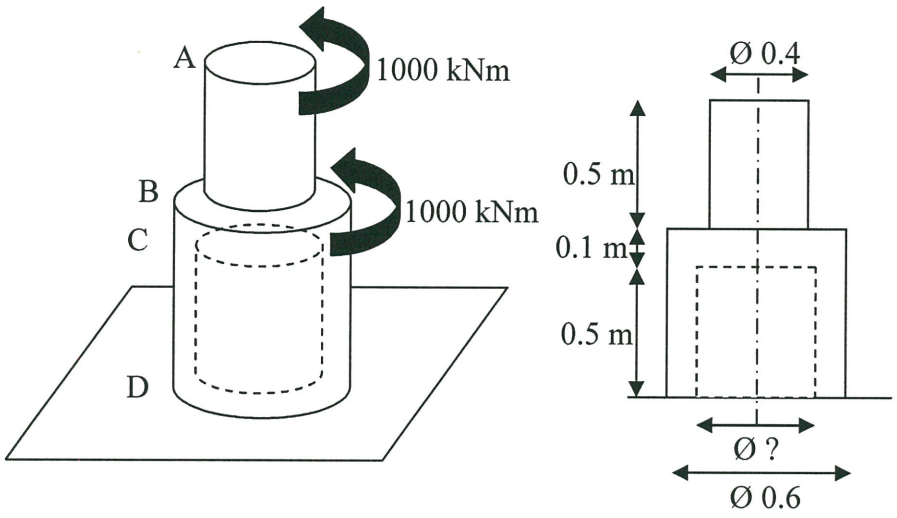

Figure Q5(c)

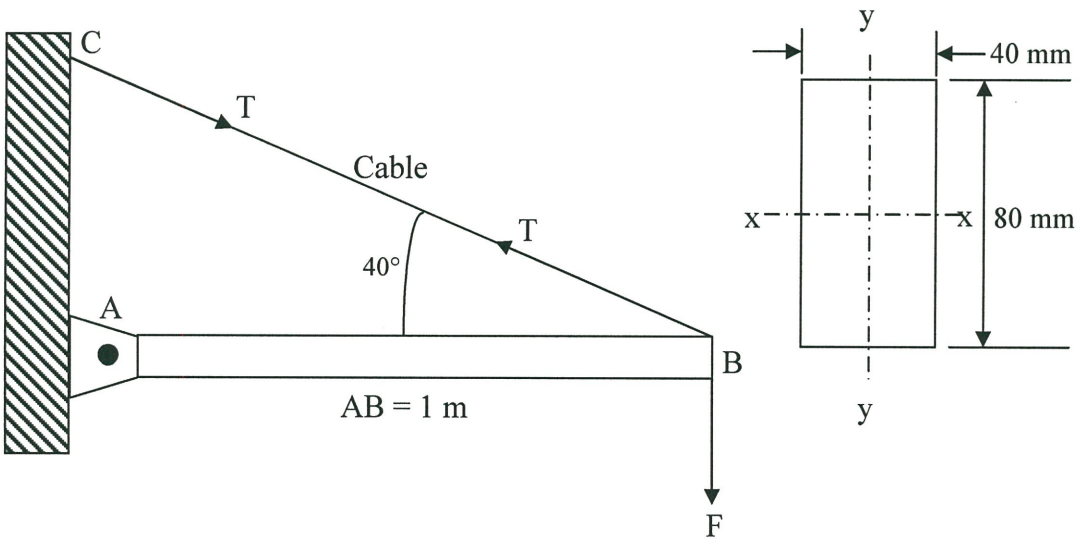

Figure Q6(c)