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CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2011 SESSION

SUBJECT CODE	:	FMB 20102
SUBJECT TITLE	:	STRENGTH OF MATERIALS
LEVEL	:	BACHELOR
TIME / DURATION	:	12.30pm – 2.30pm (2 HOURS)
DATE	:	10 MAY 2011

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, Answer THREE (3) questions only.
6. Answer all questions in English.
7. *Formulae are appended.*

THERE ARE 3 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

A 100-mm long rod has a diameter of 15 mm. If an axial tensile load of 100 kN is applied determine its change in length. Take E= 200 GN/m^2.

(10 marks)

Question 2

A bar has a length of 200 mm and cross sectional area of 7000 mm^2. Determine the modulus of elasticity of the material if it is subjected to an axial load of 50 kN and stretches 0.075 mm.

(10 marks)

Question 3

A 200-mm long rod has a diameter of 20 mm. If an axial load of 15 kN is applied to it, determine its change in diameter. Take Young's modulus, E= 70 GPa and Poisson's ratio, ν= 0.35.

(10 marks)

Question 4

A solid cylinder bar is made up of two lengths. The first is 200 mm long with diameter of 40 mm; the second is 150 mm long with diameter of 30 mm. Calculate the total compression of this bar under a load of 100 kN. E= 180 GN/m^2.

(10 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 4

A steel bar 600 mm long, 30 mm diameter is turned down to 20 mm diameter for one-third of its length is clamped at both ends. It is heated 30 °C above room temperature. Find the maximum stress in the bar. E = 200 GN/m^2, α = 12 x 10^{-6}/ °C.

(20 marks)

Question 5

Draw the shear force and bending moment diagram for the cantilever beam shown in Figure 1. State the greatest value of shear force and bending moment and where it occurs.

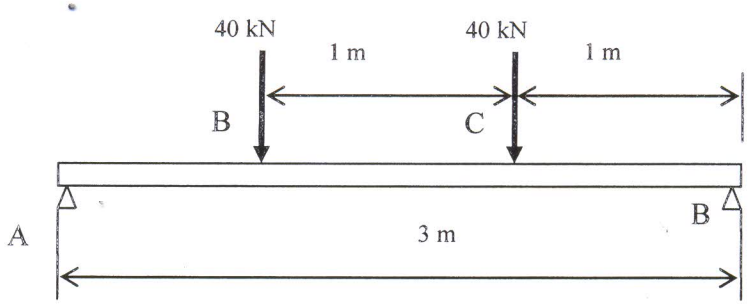

Figure 1

(20 marks)

Question 6

A concrete column with diameter of 200 mm is reinforced by two steel bars of diameter 20 mm. Calculate the stress on the concrete and steel when the column carries an axial load of 400 kN. E for concrete is 20 GN/m^2 and E foor steel is 200 GN/m^2.

(20 marks)

Question 7

A solid shaft of 500 mm long is to transmit 100 kW at 1250 rev/min. If the ultimate shear strength of the shaft is 180 MN/m^2, calculate the minimum diameter of the shaft. The factor of safety is to be 4.

(20 marks)

END OF QUESTION

Formulae

Stress, $\sigma = \frac{F}{A}$

Strain, $\varepsilon = \frac{x}{l}$

$\frac{\sigma}{\varepsilon} = E$ (Young's modulus)

Shear stress, $\tau = \frac{F}{A}$

Modulus of rigidity, $G = \frac{\tau}{\phi} = \frac{\tau}{r\theta / l}$

$\frac{T}{J} = \frac{G\theta}{l} = \frac{\tau}{r}$

J for solid shaft = $\frac{\pi(d^4)}{32}$, J for hollow shaft = $\frac{\pi(d_1^4 - d_2^4)}{32}$, J for thin tube = $2\pi r^3 t$

Poisson's ratio, $\nu = \frac{lateral\_strain}{longitudinal\_strain}$

Volumetric strain (Change in volume), $\Delta V = \varepsilon(1 - 2\nu)$

Stiffness = $\frac{T}{\theta} = \frac{GJ}{l}$

Power = $\frac{torque(Nm) x speed(rad/s)}{1000} kW$

Strain Energy, $U = \frac{\sigma^2}{2E}$ x volume

Thermal strain, $\varepsilon = \alpha t$