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CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2010 SESSION

SUBJECT CODE	:	FMB 20102
SUBJECT TITLE	:	STRENGTH OF MATERIALS
LEVEL	:	BACHELOR
TIME / DURATION	:	08.00 pm – 10.00 pm (2 HOURS)
DATE	:	30 APRIL 2010

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, 1 PAGE OF FORMULAE EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

A bar with diameter 10 mm is subjected to a tensile load of 5 kN. Calculate the stress on the bar. If the modulus of elasticity of the bar is 180 GN/m^2, find the extension on the 250 mm length.

(10 marks)

Question 2

A solid shaft 60 mm diameter and 1.2 m long, is rigidly clamped at both ends so that all axial extension is prevented. A concentric hole of diameter 30 mm is drilled along the shaft for one-third of it's length. If the bar is raised in temperature by 40 °C, calculate the maximum stress in the bar. Take E for the bar 200 kN/mm^2; $\alpha = 12 \times 10^{-6}$ /°C.

(20 marks)

Question 3

Calculate the maximum thickness of plate which can be punch if the punching force is limited to 70 kN and the ultimate shear strength of the plate is 180 MN/m^2. The diameter of the hole to be punched is 50 mm.

(10 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) questions only.
Please use the answer booklet provided.

Question 4

A bar of 25 mm diameter and 600 mm long is subjected to an axial load of 80 kN. The contraction in diameter is 0.006 mm and the extension is 0.55 mm. Find Poisson's ratio, Young's modulus and the change in volume of the bar.

(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.

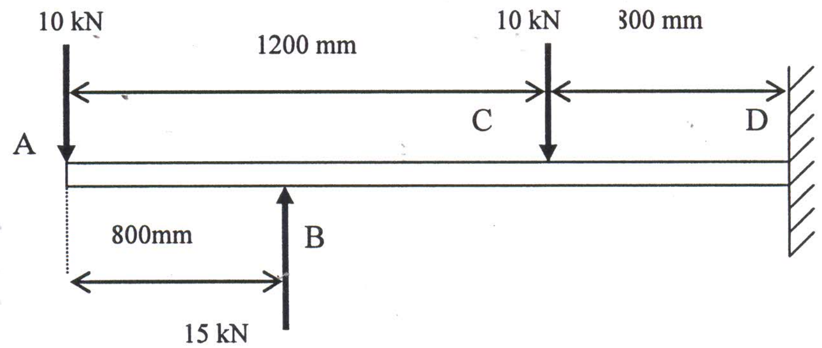

Figure 1

(20 marks)

Question 6

A column is made up of a steel tube, 80 mm inside diameter, filled with concrete. The maximum stress in the concrete is not to exceed 20 N/mm^2. If the outside diameter of the tube is 100 mm, calculate the maximum load carried by the column. What is the compression under this load if the height of the column is 2 m. For concrete E = 20 kN/mm^2. For steel E = 200 kN/mm^2.

(20 marks)

Question 7

A solid shaft of 300 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, $\varepsilon = \alpha t$