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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JULY 2010 SESSION

SUBJECT CODE	:	FMB 20102
SUBJECT TITLE	:	STRENGTH OF MATERIALS
LEVEL	:	BACHELOR
TIME / DURATION	:	4.00 pm – 6.00 pm (2 HOURS)
DATE	:	21 NOVEMBER 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 AND 1 PAGE OF FORMULA, EXCLUDING THIS PAGE.

SECTION B (Total: 60 marks)

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

Question 4

A solid shaft 40 mm diameter and 1.2 m long, is turned down to 20 diameter for one-third of its length. The bar is rigidly clamped at both ends so that all axial extension is prevented. If the bar is raised in temperature by 40 $^{\circ}$ C, calculate the maximum stress in the bar. Take E for the bar 200 kN/mm^2; α = 12 x 10^{-6} /$^{\circ}$C.

(20 marks)

Question 5

A shaft is to transmit 200 kW at 500 rpm through solid coupling flanges. The coupling is fastened with six bolts on a pitch circle of 200 mm. If the ultimate shear stress is 300 MN/m^2, calculate the bolt diameter required. The factor of safety is to be 4.

(20 marks)

Question 6

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 7

A column as shown in Figure 1 is constructed from concrete and six steel reinforcing rods. If it is subjected to an axial force of 100 kN, determine the force supported by the concrete. Each rod has a diameter of 20 mm. Take E for concrete 30 GN/m^2 and E for steel 210 GN/m^2.

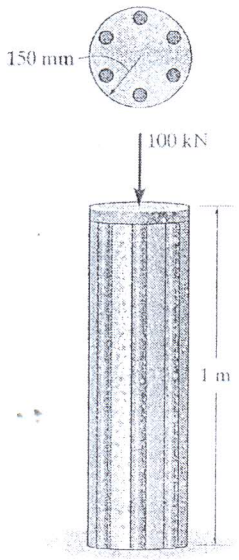

Fig 1

(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 = $\frac{\pi(d_1^4 - d_2^4)}{32}$

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

Volumetric strain, $= \varepsilon(1-2v)$

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

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

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

Thermal strain, $\varepsilon = \alpha t$