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CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR

MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION

JULY 2010 SEMESTER

SUBJECT CODE	: FMD 20102
SUBJECT TITLE	: STRENGTH OF MATERIAL
LEVEL	: DIPLOMA
TIME/DURATION	: 12.30 pm – 2.30 pm (2 HOURS)
DATE	: 13 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 two (2) questions only.
6. Answer all questions in English.
7. Formula is appended.

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

SECTION A (Total: 60 marks)

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

Question 1

A 100mm long rod has a diameter of 15mm. If an axial tensile load of 150kN is applied, determine its change in length. E = 200GPa.

(20 marks)

Question 2

A bar has a length of 200mm and cross-sectional area of 7500mm^2. Determine the modulus of elasticity of the material if it is subjected to an axial tensile load of 50kN and stretches 0.075mm.

(20 marks)

Question 3

A 200mm long rod has a diameter of 20mm. If an axial load of 10kN is applied to it, determine its change in diameter. E= 70GPa, ν= 0.35.

(20 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only
Please use the answer booklet provided.

Question 4

A solid shaft 60mm diameter and 1.2m long, is rigidly clamped at both ends so that all axial extension is prevented. A concentric hole of diameter 30mm 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 200kN/mm^2; α.= 12 x 10^{-6} /°C.

(20 marks)

Question 5

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

(20 marks)

Question 6

A rectangular aluminum slab, 200mm by 100mm is reinforced by 2 bars of steel of diameter 30mm. Calculate the stresses in the aluminum and the reinforcement when this compound carries an axial load of 300kN. E for aluminum = 90 GN/m^2; E for steel = 180 GN/m^2.

(20 marks)

Question 7

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

(20 marks)

END OF QUESTION

Appendices

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, $\nu = \frac{lateral\_strain}{longitudinal\_strain}$

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

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, $\varepsilon = \alpha t$