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SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FMD20103 / FMD20102**
SUBJECT TITLE	:	**STRENGTH OF MATERIAL**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**8.00 PM – 10.30 PM (2.5 HOURS)**
DATE	:	**31 DECEMBER 2014**

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.**

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING APPENDIX AND THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided

Question 1

The inclined member in figure 1 below is subjected to a compressive force of 3000 N.

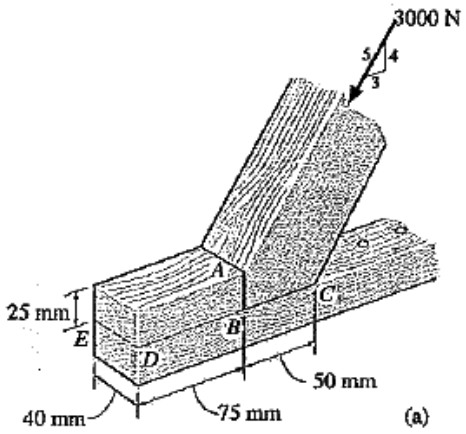

Figure 1: Structure under load

a) What is the value of the force downward (F_y) acting on surface BC?

(2 marks)

b) What is the value of the force horizontal (F_x) acting on the surface AB?

(2 marks)

c) Calculate the area of vertical surface of AB in meter square

(2 marks)

d) Calculate the area of horizontal surface BDE in meter square

(2 marks)

e) Calculate the area of horizontal surface of BC in meter square

(2 marks)

f) Find the stress developed on vertical surface AB

(2 marks)

g) Find the shear stress developed on the horizontal surface of BDE

(2 marks)

h) Find the stress developed on the horizontal surface of BC

(2 marks)

Question 2

There are several terms used in the study of material strength or mechanic of solid. Define all the terms listed below;

a) Elastic behavior

(4 marks)

b) Yielding

(4 marks)

c) Ultimate Stress

(4 marks)

d) Ductile materials

(4 marks)

e) Brittle materials

(4 marks)

f) Hooke Law

(4 marks)

g) Poisson's Ratio

(4 marks)

Question 3

A reinforce circular concrete column of 400 mm diameter has 4 steel bars of 20 mm embedded in it (figure 2). The stress in steel must not to exceed 120 Mpa and on the concrete must not to exceed 5 Mpa while the Modulus of elasticity of steel (E_s) is 18 times more of concrete.

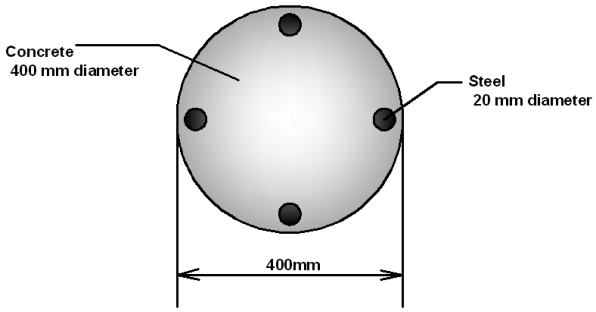

Figure 2: Illustration of concrete and steel beam combined

a) Calculate the total area on the circular column

(2 marks)

b) Calculate the area of steel

(2 marks)

c) Calculate the area of concrete

(2 marks)

d) Calculate the maximum stress developed on the concrete

(3 marks)

e) Calculate the stress developed in steel

(3 marks)

f) Calculate the maximum load of the column

(4 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions ONLY.

Please use the answer booklet provided

Question 4

Figure 3 shows a cantilever beam of span 1.5m carrying point loads.

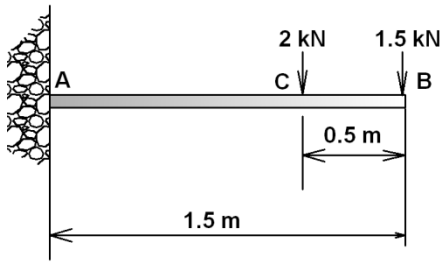

Figure 3**:** Illustration of beam carrying points load

a) Calculate F_B

(2 marks)

b) Calculate F_C

(2 marks)

c) Calculate F_A

(2 marks)

d) Draw the Shear Force diagram

(4 marks)

e) Calculate M_B

(2 marks)

f) Calculate M_C

(2 marks)

g) Calculate M_A

(2 marks)

h) Draw Moment Diagram

(4 marks)

Question 5

A shaft of 80 mm diameter is allowed to have a permissible angle of twist at 1.5 degree in a length of 5 meter and the shear stress must not to exceed 42 Mpa while the modulus of rigidity is at 84 Gpa.

a) Find the shaft diameter

(2 marks)

b) Find the permissible angle of twist in radian

(2 marks)

c) Find the length in mm

(2 marks)

d) Find the minimum shear stress in millimeter square

(2 marks)

e) Find the modulus of rigidity in millimeter square

(2 marks)

f) Find the torque based on the shear stress

(2 marks)

g) Find the based on the angle of twist

(2 marks)

h) Find the relation of both torques

(2 marks)

i) Which minimum torque should we applied

(4 marks)

Question 6

Member AC shown in figure 4 below is subjected to a vertical force of 3 kN. The average of compressive stress at the smooth support of C must be equal to the average tensile stress in the tie rod AB. The tie rod has a cross sectional area of 400 mm^2 and the contact area of C is 650 mm^2.

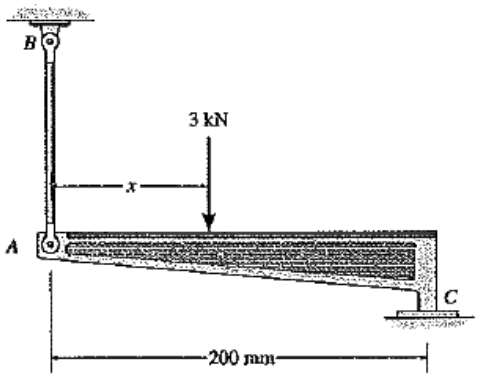

Figure 4: The load distance is defined by x

a) Derive the stress equation for tie rod AB

(2 marks)

b) Derive the stress equation for support at C

(2 marks)

c) Calculate the F_C in the statement of F_{AB}

(4 marks)

d) Calculate F_{AB}

(4 marks)

e) Calculate F_C

(4 marks)

f) Calculate the distance of X (Load from AB in mm)

(4 marks)

END OF QUESTION

APPENDIX

FOMULAE

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

$$\varepsilon = \frac{\delta L}{L}$$

$$E = \frac{F \cdot L}{A \cdot \delta l}$$

$$v = \frac{\varepsilon_{lateral}}{\varepsilon_{longitudinal}}$$

$$\tau = \frac{F}{A}$$

$$\varepsilon_{thermal} = \alpha \cdot t$$

$$\sigma_{thermal} = \varepsilon \cdot E = \alpha \cdot t - \frac{\Delta}{l} E$$

Torsional Stress and Strain

$$\frac{\tau}{G} = \frac{r \cdot \theta}{L}$$

$T = \frac{\pi}{16} \cdot \tau \cdot D^3$ (solid shaft)

$T = \frac{\pi}{16} \cdot \tau \cdot \frac{D^4 - d^4}{D}$ (Hollow Shaft)

$$P = \frac{2\pi NT}{60}$$