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CONFIDENTIAL

SET A

UNIVERSITI KALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE	: **FMB 20102**
SUBJECT TITLE	: **STRENGTH OF MATERIALS**
LEVEL	: **BACHELOR**
TIME / DURATION	: **2.5 HOURS** 2.00 pm - 4.30 pm
DATE	: 01 JUN 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 5 questions. Choose and answer 4 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.

INSTRUCTION: Answer FOUR (4) questions only.
Answer on the answer booklet provided

Question 1

Referring to the Figure 1 below,

(a) Briefly describe P, E, Y, R, U and Actual rupture strength

(18 marks)

(b) Explain the important of stress – strain curve.

(7 marks)

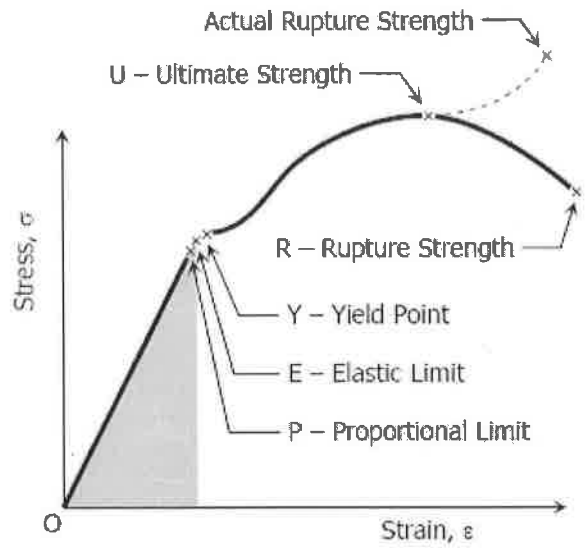

Figure 1 Stress-strain diagram of a medium-carbon structural steel

Question 2

(a) Determine the minimum diameter of a solid steel shaft that will not twist through more than 3° in a 6-m length when subjected to a torque of 12 kN·m. Calculate maximum shearing stress is developed. Given the modulus of elasticity is G = 80 GPa.

(10 marks)

(b) Calculate the maximum stress in a propeller shaft with 200 mm external and 100 mm internal diameter, when subjected to a twisting moment of 2350 Nm. If the modulus of rigidity is C = 82 GN/m², determine the angle of twist in a length 10 times of the diameter.

(15 marks)

Question 3

(a) Compute the shear and moment equations for the beams problems as shown in Figure 2.

(10 marks)

(b) Develop the shear and moment diagrams, specifying values at all changes of loading positions and at points of zero shears. Neglect the mass of the beam in each problem.

(15 marks)

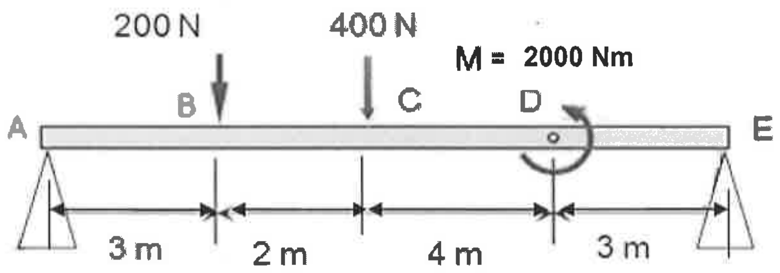

Figure 2

Question 4

A hollow shaft has a 50 mm outside diameter and a 30 mm internal diameter. An applied torque of 1.6 kNm is found to produce an angular twist of 0.4^0, measured on a length of 0.2 m of the shaft.

(a) Evaluate the value of the modulus of rigidity,

(15 marks)

(b) Determine the maximum power which can be transmitted by the shaft at 200 revolutions per minute if the maximum allowable shearing stress is 65 MN/m^2.

(10 marks)

Question 5

The state of plane stress at a point is represented by the stress element as shown in Figure 3. The stress are defines in terms of the established sign convention:

$$\sigma_x = -80\ MPa$$

$$\sigma_y = 50\ MPa$$

$$\tau_{xy} = -25\ MPa$$

(a) Differentiate the maximum shear stress

(12 marks)

(b) Develop the corresponding stress element.

(13 marks)

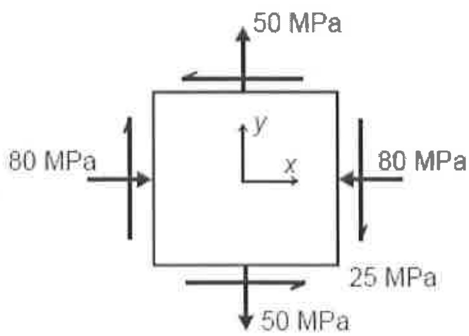

Figure 3

END OF QUESTION

FORMULAE

$\frac{dV}{V} = \varepsilon_x + \varepsilon_y + \varepsilon_{zx}$	$\varepsilon_x = \frac{\sigma_x}{E} + \frac{1}{m}\left[\frac{1}{E}(\sigma_y + \sigma_z)\right]$	$\sigma = \frac{M}{I}y$
$T = \frac{\sigma_s . J}{c}$	$Js = \frac{\pi . d^4}{32}$	$J_H = \frac{\pi.(d^4 - d^4)}{32}$
$\theta = \frac{TL}{JG}$	$P = \frac{2\pi T n_r}{60}$	$\bar{x} = \frac{\sum wx}{W}$
$\bar{y} = \frac{\sum wy}{W}$	$Poisson's\ ratio = \frac{1}{m}$	$Poisson's\ ratio = \frac{\varepsilon_x}{\varepsilon_y}$
$\tau_{x1y1} = -\frac{(\sigma_x - \sigma_y)}{2} sin\ 2\theta + \tau_{xy} Cos\ 2\theta$	$\frac{d\tau\_x1y1}{d\theta} = -(\sigma_x - \sigma_y) Cos\ 2\theta - 2\tau_{xy} Sin\ 2\theta = 0$	$Tan 2\theta = -\frac{(\sigma_x - \sigma_y)}{2\tau_{xy}}$