UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2017 SEMESTER

COURSE CODE	: LGB21103
COURSE NAME	: STRENGTH OF MATERIALS
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: BACHELOR OF ENGINEERING TECHNOLOGY (HONS) IN NAVAL ARCHITECTURE & SHIPBUILDING BACHELOR OF ENGINEERING TECHNOLOGY (HONS) IN NAVAL ARCHITECTURE & SHIPBUILDING
DATE	: 05/07/2017 WED
TIME	: 9.00 AM - 12.00 PM
DURATION	: 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read CAREFULLY the instructions given in the question paper.
2. This question paper has information printed on both sides.
3. This question paper consists of FIVE (5) questions. Answer FOUR (4) questions only.
4. Please write yours answers on the answer booklet provided.
5. Write your answers only in BLACK or BLUE ink.
6. Answer all questions in English.

THERE ARE 5 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer FOUR (4) questions ONLY.
Please use the answer booklet provided.

Question 1

Two (2) steel wires AB and AC are used to support load P as shown in Figure 1. Both wires have an allowable tensile stress of σ_{allow} = 180MPa. Wire AB has a diameter of 6mm and wire AC has a diameter of 4mm.

(a) Draw the free body diagram and derive the force equilibrium equations of the system.
(9 marks)

(b) Determine the greatest force P that can be applied to the chain before one of the wires fails.
(16 marks)

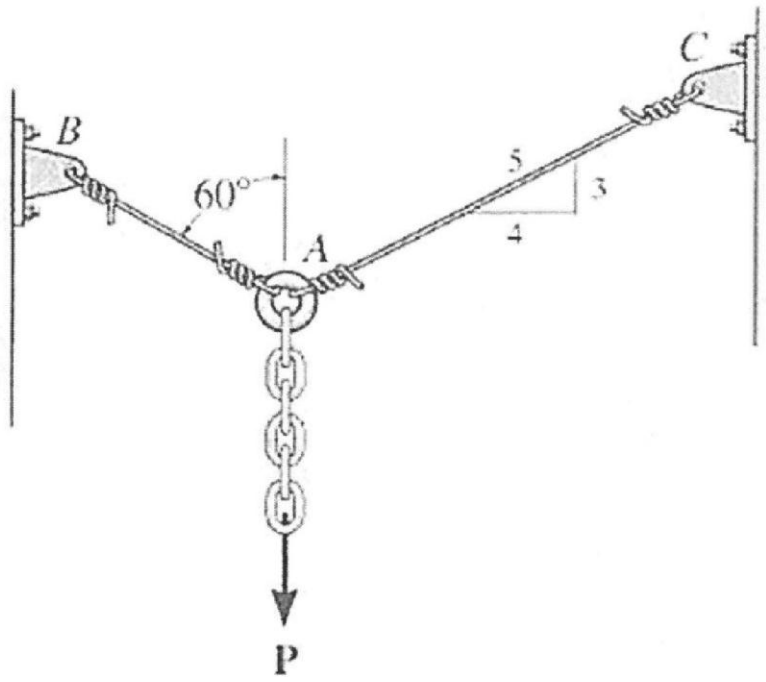

Figure 1: Two (2) wires supporting a load

Question 2

A tension test was performed on a steel specimen having an original diameter of 12.5mm and gauge length of 50mm. the data is listed in the Table 1. Use a scale of 20mm=50MPa and 20mm = 0.05mm/mm.

(a) Plot the stress-strain diagram. Redraw the linear elastic region, using the same stress scale but a strain scale of 20mm=0.001mm/mm.

(16 marks)

(b) Determine approximately the modulus of elasticity, the ultimate stress and the rupture stress.

(6 marks)

(c) Determine approximately the modulus of toughness.

(3 marks)

Table 1: Steel specimen tension test data.

Load (kN)	Elongation (mm)
0	0
11.1	0.0175
31.9	0.0600
37.8	0.1020
40.9	0.1650
43.6	0.2490
53.4	1.0160
62.3	3.0480
64.5	6.3500
62.3	8.8900
58.8	11.9380

Question 3

(a) An engineer in charge of the design of a structural member or mechanical element must restrict the stress in the material to a level that is safe. In your own words, deliberate five (5) reasons why Factor of Safety (F.S.) is introduced.

(10 marks)

(b) Poisson's Ratio is a ratio of lateral strain against longitudinal strain. Explain how this ratio is used to determine the modulus of elasticity of a material should the stress and strain in any one of the axis experienced by the material are known.

(5 marks)

(c) The rubber block is subjected to an elongation of 0.75mm along the x-axis, and its vertical faces are given a tilt so that $\theta = 89.3^0$ as shown in Figure 2 below. Determine the strains ε_x, ε_y and γ_{xy}. Take $\nu_r = 0.5$.

(10 marks)

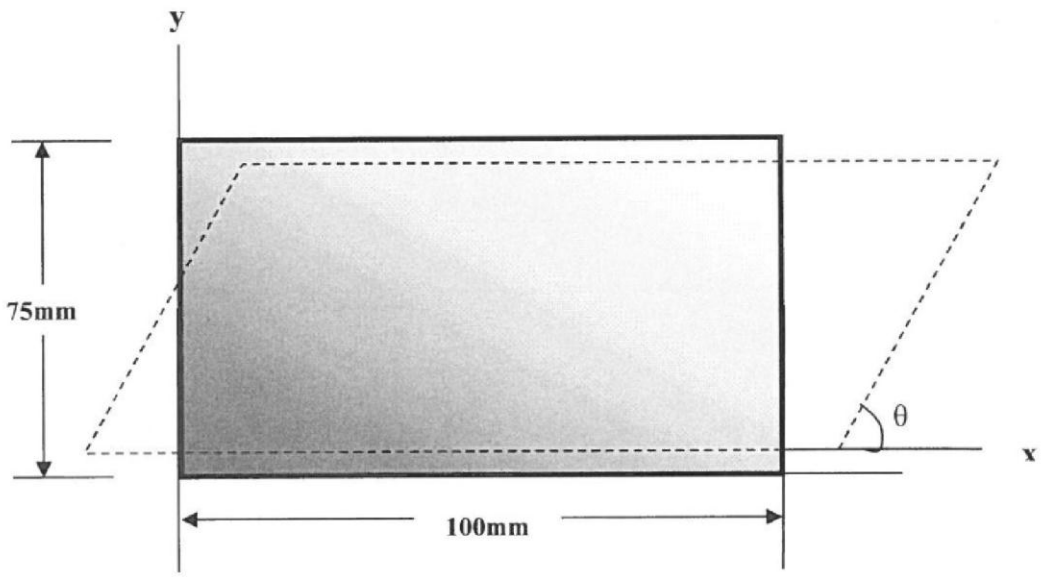

Figure 2: Deformed rubber block

Question 4

From the beam shown in Figure 3:

(a) Replace the distributed load by an equivalent resultant force and reactions

(3 marks)

(b) Draw the free body diagram of the beam segment of length x.

(3 marks)

(c) Determine the shear and moment equations.

(9 marks)

(d) Draw the shear force and bending moment diagram.

(10 marks)

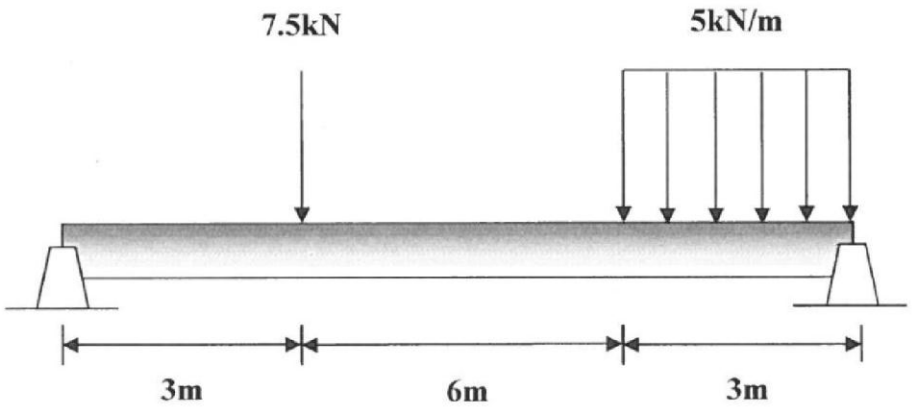

Figure 3: Simply supported beam under loads

Question 5

The bronze C86100 pipe has an outer diameter of 30mm and a thickness of 2mm as shown in Figure 4. The coupling on it at C is being tightened using a wrench. The applied force is F= 100N and shear modulus is G = 38GPa.

(a) Determine the polar moment of inertia of the pipe.

(5 marks)

(b) The angle of twist as the result of the applied force F for the pipe AC and BC is identical.

(10 marks)

(c) Determine the internal torque acting about the pipe AC and BC.

(5 marks)

(d) Determine the maximum shear stress in the pipe.

(5 marks)

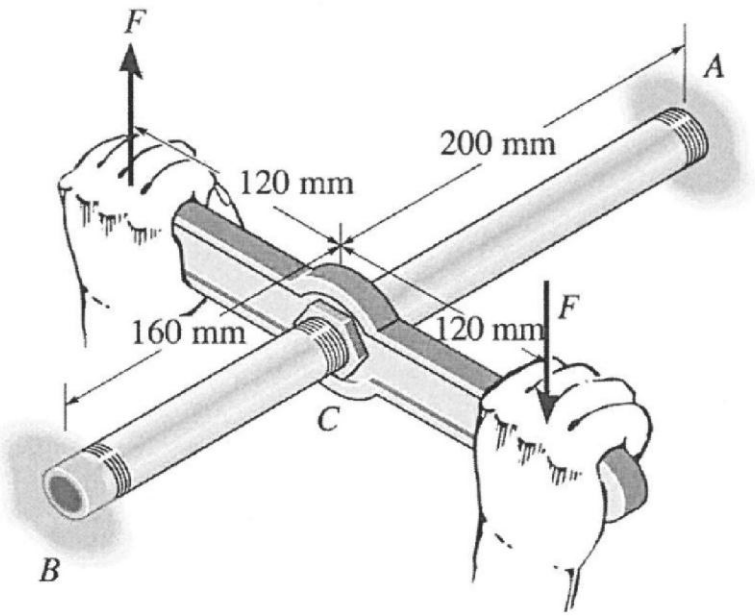

Figure 4: Bronze pipe under torsion

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