Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	AIRCRAFT STRUCTURE II
COURSE CODE	:	BDL 30203
PROGRAMME	:	3 BDC
EXAMINATION DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS **ONLY**

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Briefly explain about plain strain and plain stress.

(5 marks)

(b) The principal strains in a plane, measured experimentally at a point on the aluminum fuselage of a jet aircraft, are $\varepsilon_1 = 630 \times 10^{-6}$ and $\varepsilon_2 = 350 \times 10^{-6}$. If this is a case of plane stress, determine the associated principal stresses at the point in the same plane. Modulus of Elasticity and Poisson's ratio for the aluminum are 68.9 MPa and 0.33, respectively.

(6 marks)

(c) The state of plane strain at a point on the aircraft landing gear strut is represented by the components $\varepsilon_x = 250 \times 10^{-6}$, $\varepsilon_y = -150 \times 10^{-6}$ and $\gamma_{xy} = 120 \times 10^{-6}$.

(i) Draw a Mohr's circle.

(ii) Determine the maximum in-plane shear strains and the orientation of an element.

(iii) Sketch the deformed element.

(9 marks)

Q2 (a) Sketch the Shear Force Diagram (SFD) and the Bending Moment Diagram (BMD) for the problem shown in Figure **Q2(a)**.

(8 marks)

(b) An overhanging beam is pin-supported at point A and roller-supported at point B is loaded as shown in Figure **Q2(b)**. Using a Superposition Method and assume that EI is constant, determine;

(i) the reactions at points A and B;

(ii) the deflection at point C.

(12 marks)

Q3 (a) Explain the difference between short column and long column.

(5 marks)

(b) The aluminum column is fixed at its bottom and is braced at its top by cables so as to prevent movement at the top along the x axis, as shown in Figure **Q3(b)**. If it is assumed to be fixed at its base, determine the largest allowable load P that can be applied. Use a Factor of Safety for buckling, FS = 3.0, Modulus of Elasticity, $E_{al} = 70$ GPa, Yield Strength, $\sigma_Y = 215$ MPa, cross-sectional area, $A = 7.5 \times 10^{-3}$ m^2 and moment of inertia, $I_x = 61.3 \times 10^{-6}$ m^4 & $I_y = 23.2 \times 10^{-6}$ m^4.

(15 marks)

Q4 (a) Explain about Castigliano's Theorem.

(5 marks)

(b) Determine the vertical displacement of joint C of the steel truss shown in Figure **Q4(b)**. The cross-sectional area of each member is A = 400 mm^2 and Modulus of Elasticity, E_{st} = 200 GPa.

(15 marks)

Q5 (a) Define the main difference between thick and thin cylinders. Discuss the characteristics of thick cylinders.

(7 marks)

(b) A steel cylinder of 300 mm external diameter is to be shrunk to another steel cylinder of 150 mm internal diameter. After shrinking the diameter at the junction is 250 mm and radial pressure at the junction is 28 N/mm^2. Determine the original difference in radii at the junction. Take E=2x10^5 N/mm^2.

(13 marks)

Q6 (a) Explain about the following failure modes; yielding, low stiffness, fracture and buckling.

(8 marks)

(b) The A-36 steel pipe with outer and inner diameters of 30 mm and 20 mm, respectively is subjected to the vertical forces as shown in Figure **Q6(b)**. Determine the factor of safety against yielding of the material at point A according to the maximum-shear-stress theory.

(12 marks)

- END OF QUESTION –

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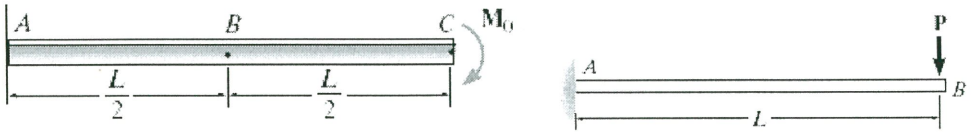

(a) (b)

Figure Q2(a)

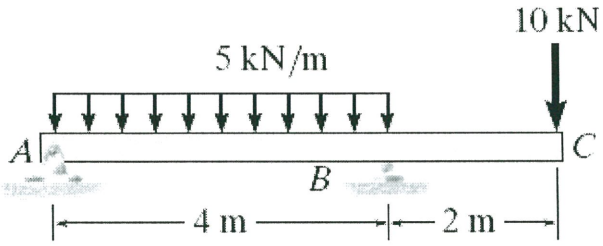

Figure Q2(b)

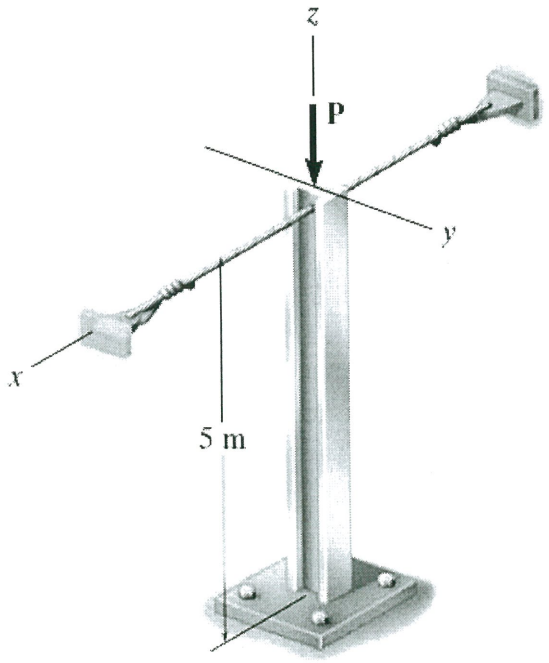

Figure Q3(b)

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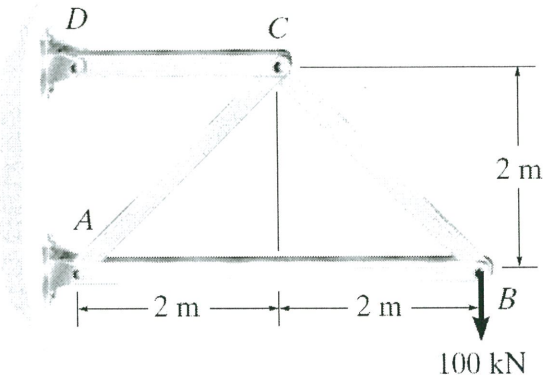

Figure Q4(b)

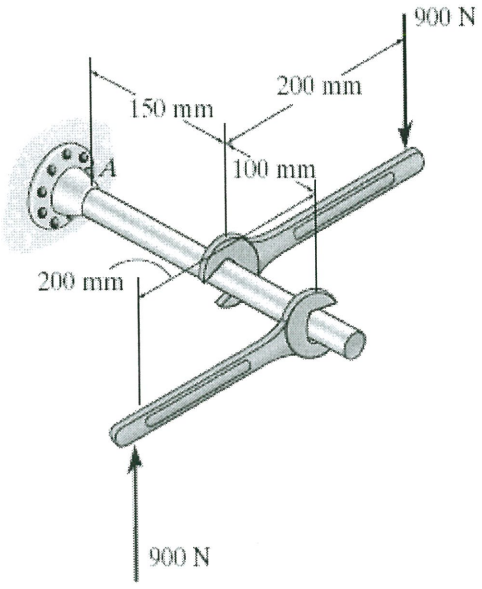

Figure Q6(b)