UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2011/2012

COURSE NAME	:	AIRCRAFT STRUCTURE
COURSE CODE	:	BDU 20103
PROGRAMME	:	2 BDC
EXAMINATION DATE	:	JANUARY 2012
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER FOUR (4) QUESTIONS ONLY

THIS PAPER CONTAINS FIVE (5) PRINTED PAGES

Q1 (a) Explain briefly the monocoque aircraft structure. Please provide necessary sketch.

(5 marks)

(b) The load on a structural member of aircraft wing produces a direct tensile stress of 90 N/mm^2 and a shear stress of 50 N/mm^2 on the same plane. Determine the values and directions of the principal and shear stresses.

(10 marks)

(c) A stress analysis test was performed on a composites material, where at a particular point the measured σ_x, σ_y and τ_{xy} are 54 N/mm^2, 30 N/mm^2 and 5 N/mm^2 respectively. By using Mohr's circle, determine the principal stresses at this point and its direction.

(10 marks)

Q2 (a) Describe the principle of stressed skin construction.

(10 marks)

(b) **FIGURE Q2** shows a section of the fuselage skin where two plates of 3 mm thick are connected by a double riveted joint. The rivets have a diameter of 3 mm. It is known that the failure strength of the rivet in shear and the ultimate tensile strength of the plate are 360 N/mm^2 and 450 N/mm^2 respectively. Calculate the rivet spacing if the joint is designed so that failure due to shear in rivet and failure due to tension in plate will occur simultaneously.

(15 marks)

Q3 (a) Sketch the stress distribution of a beam subjected to a pure bending moment.

(5 marks)

(b) The cross section of a wing's stringer shown in **FIGURE Q3** is subjected to a bending moment of 2000 Nm, acting in the vertical plane.

i) calculate the maximum direct stress due to bending moment
ii) state the location (point) where the maximum direct stress acts

(20 marks)

Q4 (a) Give brief explanation on the structural idealization of aircraft structure.

(5 marks)

(b) **FIGURE Q4** shows the front view of a wing spar for an aircraft which carries a uniformly distributed loads of 15 kN/m along its length. Each flange has a cross section of 500 mm^2 with top flange being horizontal. If the flanges are assumed to resist all direct loads while the spar web is effective only in shear, determine the flange loads and the shear flows in the web at sections 1 and 2 from the free end.

(20 marks)

Q5 (a) Sketch the structural idealization of a wing section. Please provide the appropriate labels on the sketch.

(5 marks)

(b) A four-cell wing section is shown in **FIGURE Q5**. The data for this wings section is given in **TABLE Q5**. Determine the torsional stiffness for this component.

(20 marks)

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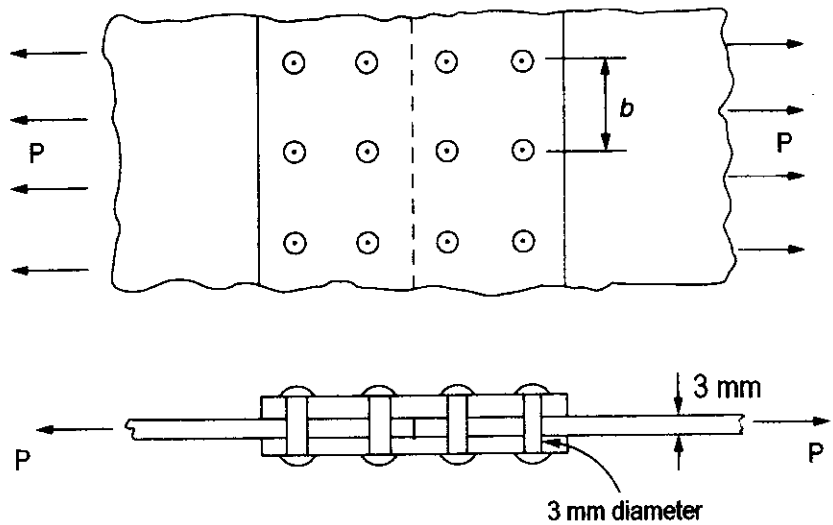

FIGURE Q2

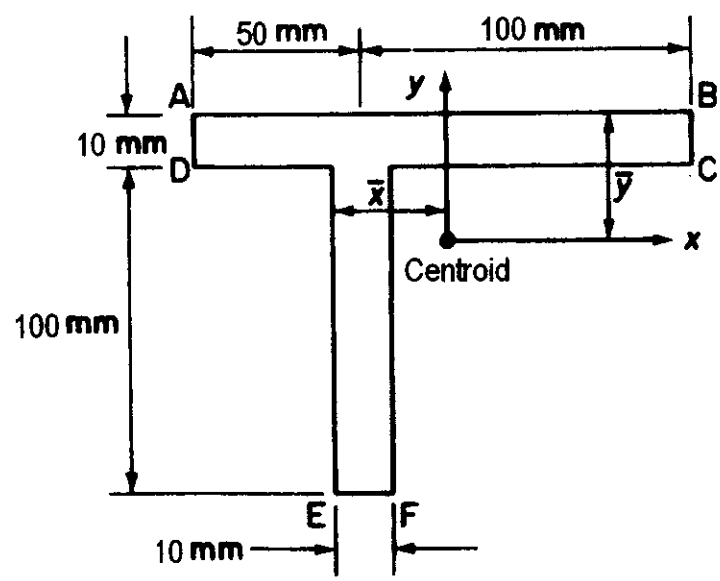

FIGURE Q3

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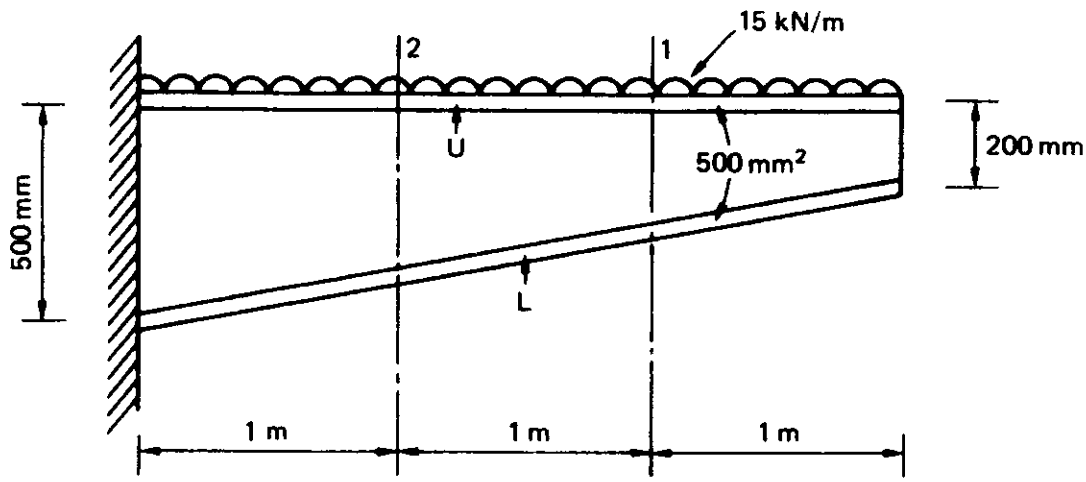

FIGURE Q4

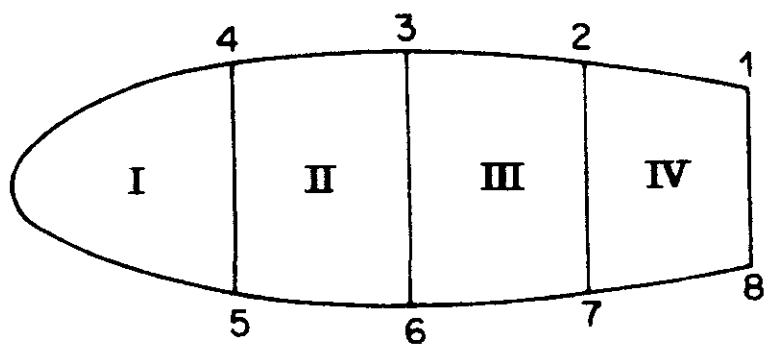

FIGURE Q4

TABLE Q5

Wall	12, 18	23, 67	34, 56	45°	45°	36	27	18
Peripheral length (mm)	762	812	812	1525	356	406	356	254
Thickness (mm)	0.915	0.915	0.915	0.711	1.220	1.625	1.220	0.915
	I		II		III		IV	
Cell area (mm^2)	161500		291000		291000		226000	