Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	AIRCRAFT STRUCTURE II
COURSE CODE	:	BDL 30203
PROGRAMME CODE	:	BDC
EXAMINATION DATE	:	JULY/AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **FOUR** QUESTIONS **ONLY**.
		2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.
		3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

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

Q1 (a) Describe the flutter and buffeting phenomena.

(5 marks)

(b) **Figure Q1(b)** shows the cross-section of Boeing 777 fuselage stringer. The stringer is subjected to a bending moment of -1000 Nm in a vertical plane. Calculate the coordinate of centroid $(\bar{x}, \bar{y})$ and maximum direct stress due to bending stating the point at which it acts.

(15 marks)

Q2 (a) Provide the sketch for actual thin wall and approximate representation of the section. State three assumptions made in thin wall sections approximation.

(5 marks)

(b) **Figure Q2(b)** shows an approximate thin-walled cross-section of A380 wing stringer. The beam is subjected to a bending moment M_x in the plane of the web 23. Prove that the I_{xx}, I_{yy} and I_{xy} of the cross-section are $(10h^3t)/3$, $(5h^3t)/12$ and $(-3h^3t)/4$, respectively. Analyze the beam to determine the direct stress at each point in the beam cross-section.

(15 marks)

Q3 (a) Explain about static dan dynamic aeroelasticity. Give 2 phenomena occur for each type of aeroelasticity.

(5 marks)

(b) The fuselage of a DA62 aircraft has the circular cross-section shown in **Figure Q3(b)**. The cross-sectional area of each stringer is 100 mm^2 and the vertical distances given in the figure are to the mid-line of the section wall at the corresponding stringer position. If the fuselage is subjected to a bending moment of 200 kNm applied in the horizontal plane of symmetry, calculate the direct stress distribution.

(15 marks)

Q4 (a) Sketch two cross-section of the symmetrical beams. Explain three criteria of symmetrical bending of the beams.

(5 marks)

(b) **Figure Q4(b)** shows a wing spar of Learjet 60 aircraft. The web of the beam has a thickness of 2 mm and is fully effective in resisting direct stress. The beam tapers symmetrically about its horizontal centroidal axis and the cross-sectional area of each flange is 400 mm^2. Determine the shear flow distribution in the web of the tapered beam at a section A-A. Sketch the shear flow distribution obtained.

(15 marks)

Q5 (a) Describe about divergence phenomenon. Explain how it could occur.

(5 marks)

(b) The fuselage in **Q3(b)** is subjected to a vertical shear load of 100 kN applied at a distance of 150 mm from the vertical axis of symmetry. As the shear center coincides with the center of symmetry, the loading system could be replaced as shown in **Figure Q5(b)**. From the shear load analysis, q_{b32}, q_{b43} and q_{b54} were obtained as 30.3 N/mm, 53.5 N/mm and 66.0 N/mm, respectively. By using the q_b values given, calculate the distribution of shear flow in the section.

(15 marks)

– END OF QUESTIONS –

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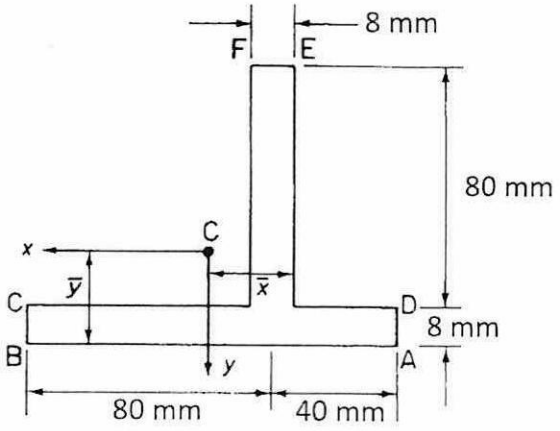

Figure Q1(b)

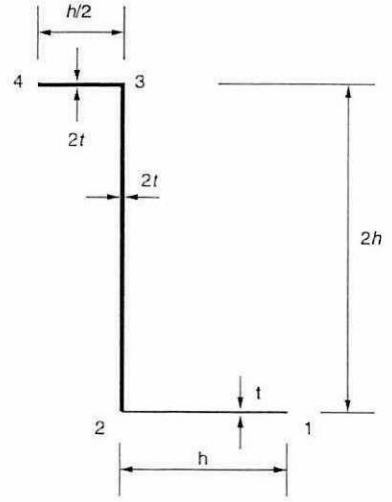

Figure Q2(b)

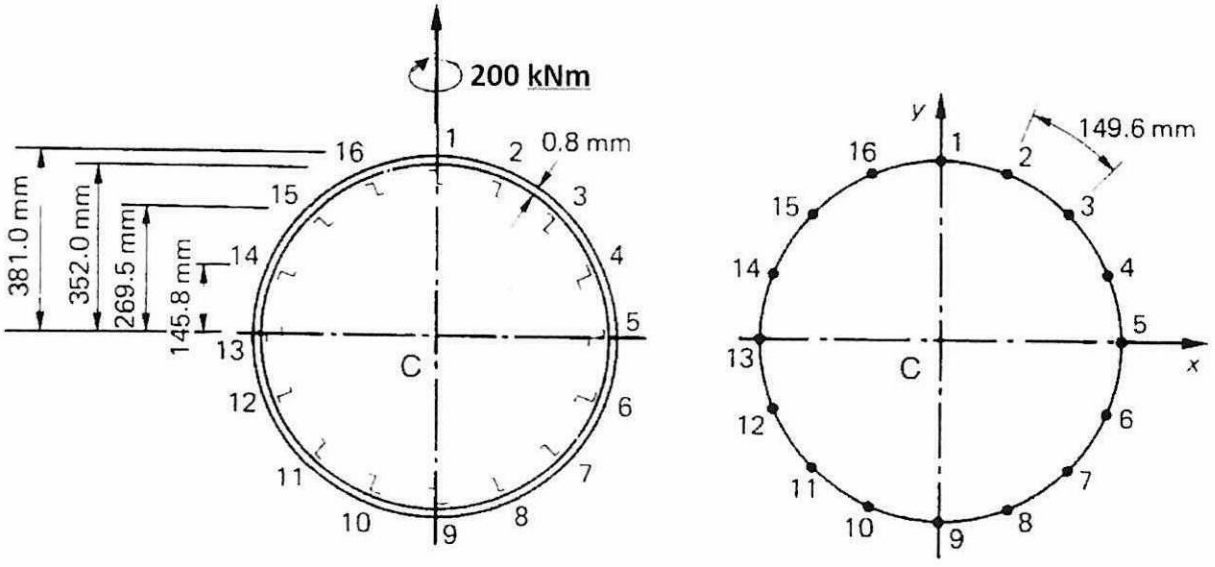

Figure Q3(b)

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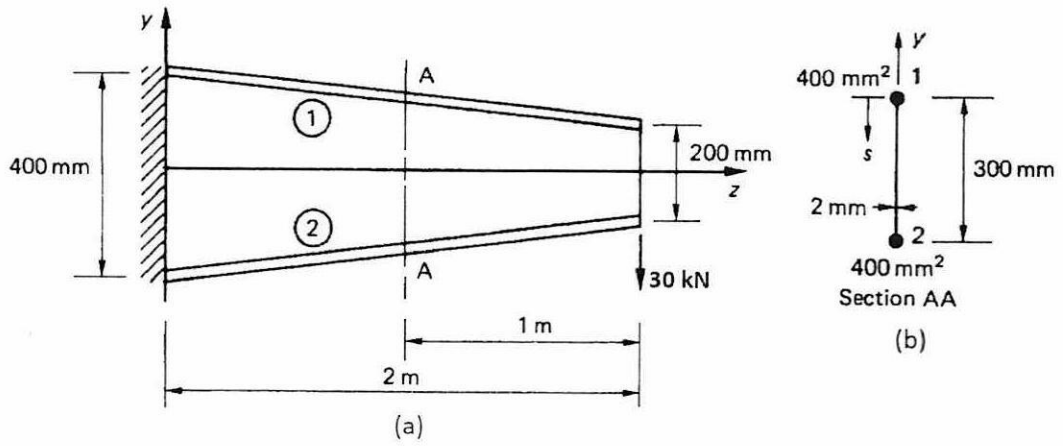

Figure Q4(b)

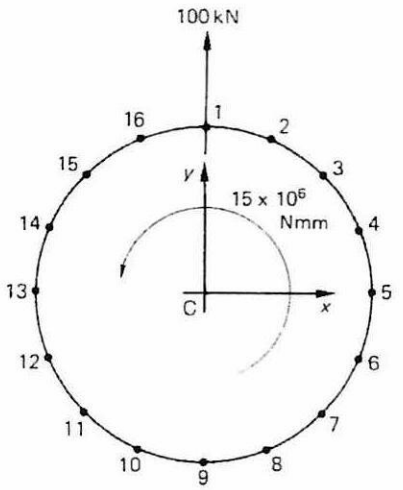

Figure Q5(b)