MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF AERONAUTICAL ENGINEERING

III B.TECH I SEMESTER

R15 SUPPLEMENTARY

PREVIOUS QUESTION PAPERS

LIST OF SUBJECTS

CODE	*NAME OF THE SUBJECT*
R15A2110	Aircraft Stability and Control
R15A2109	Aircraft Vehicle Structures - II
R15A2108	High Speed Aerodynamics

Code No: **R15A2110** **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

III B.Tech I Semester Supplementary Examinations, June 2022

Aircraft Stability and Control

(AE)

Roll No										

Time: 3 hours **Max. Marks: 75**

Answer Any **Five** Questions

All Questions carries equal marks.

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1	Estimate the Elevator angle required to Trim for an aircraft.	**[15M]**
2	Explain the forces and moments on aircraft for steady unaccelerated flight.	**[15M]**
3	Derive expression for equilibrium of forces and moments for lateral stability.	**[15M]**
4	What are control tabs? Explain each of them.	**[15M]**

5	What is the effect of trim tab? Derive the expression trim tab angle required.	**[15M]**
6	Derive an expression for the contribution of aircraft wing to the static longitudinal stability of the aircraft.	**[15M]**
7	Derive Eulers angles for an aircraft.	**[15M]**
8	Discuss briefly two degree of freedom approximations for constant speed (short period).	**[15M]**

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Code No: R15A2109

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

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III B.Tech I Semester Supplementary Examinations, June 2022

Aerospace Vehicle Structures - II

(AE)

Roll No										

Time: 3 hours **Max. Marks: 75**

Answer Any **Five** Questions

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1 Derive the equation $(1/\rho) = M / [D (1+ \upsilon)]$ of thin plate subjected to pure bending **[15M]**

2 The beam shown in Figure.1. is assumed to have a complete tension field web. If the cross-sectional areas of the flanges and stiffeners are, respectively, 350 mm^2 and 300mm^2 and the elastic section modulus of each flange is 750 mm^3, determine the maximum stress in a flange and also whether or not the stiffeners will buckle. The thickness of the web is 2 mm and the second moment of area of a stiffener about an axis in the plane of the web is 2000 mm^4; E =70 000 N/mm^2. **[15M]**

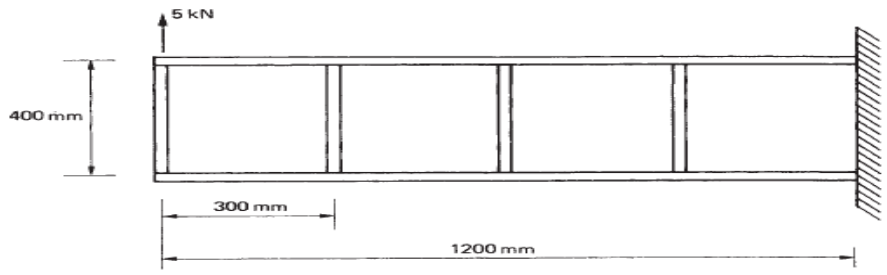

Figure.1

3 The cross-section of a beam has the dimensions shown in figure.2 If the beam is subjected to a negative bending moment of 100 kNm applied in a vertical plane, determine the distribution of direct stress through the depth of the section **[15M]**

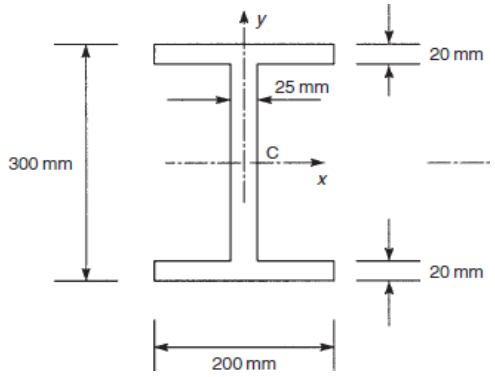

Figure.2

4 Derive general stress, strain and displacement relation for open and single cell closed section thin-walled beams **[15M]**

5 The thin-walled single cell beam shown in Figure.3 has been idealized into a combination of direct stress-carrying booms and shear-stress-only-carrying walls. If the section supports a vertical shear load of 10 kN acting in a vertical plane through booms 3 and 6, calculate the distribution of shear flow around the section. Boom areas: B1=B8=200 mm^2, B2=B7=250 mm^2 B3=B6=400 mm^2, B4=B5=100 mm^2 **[15M]**

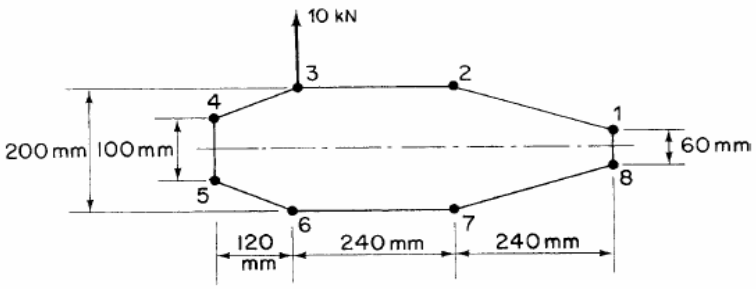

Figure.3

6 Calculate the shear flow distribution in the channel section shown in Figure.4. produced by a vertical shear load of 4.8 kN acting through its shear centre. Assume that the walls of the section are only effective in resisting shear stresses while the booms, each of area 300mm^2, carry all the direct stresses. **[15M]**

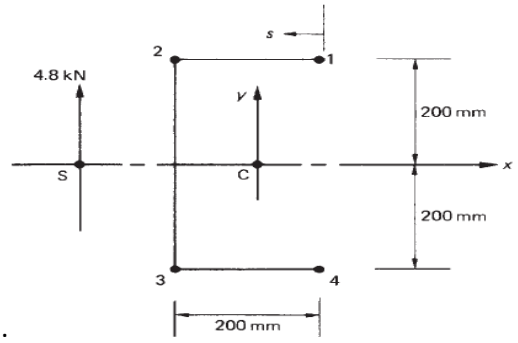

Figure.4

7 Explain shear stress distribution of a closed section beam built-in at one end and subjected to bending **[15M]**

8 Calculate the shear flows in the web panels and the axial loads in the flanges of the wing rib shown in Figure.6. Assume that the web of the rib is effective only in shear while the resistance of the wing to bending moments is provided entirely by the three flanges 1, 2 and 3. **[15M]**

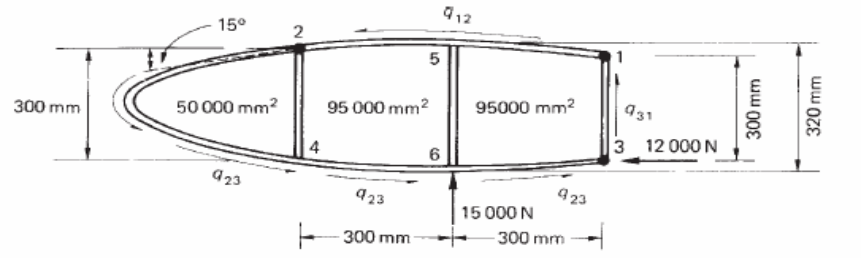

Figure.6

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Code No: **R15A2108**

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

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III B.Tech I Semester Supplementary Examinations, June 2022

High Speed Aerodynamics

(AE)

Roll No										

Time: 3 hours **Max. Marks: 75**

Answer Any **Five** Questions

All Questions carries equal marks.

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1 Derive momentum equation for compressible flow through a control volume. **[15M]**

2 Explain why normal shock wave causes supersonic flow to jump to subsonic flow. Substantiate your answer with governing equations, relevant reasons and using T-s diagram. **[15M]**

3 Consider an oblique shock wave with a wave angle equal to 35º. Air (gamma=1.4 and R=287 J/kg-K) with upstream pressure of 95.76 kPa and 289K temperature moves with a velocity of 1022.6 m/s encounters the shock wave. Determine the (a)static pressure (kPa) at the downstream of the flow **[15M]**

(b) The downstream temperature (K)

(c) The flow deflection angle (in 'degree')

(d) The velocity (m/s) at the downstream of the flow.

Use the following table of normal shock wave to solve the questions

M	P_2/P_1	T_2/T_1	M_2
3	10.33	2.679	0.4752
1.72	3.285	1.473	0.6355

4 a)Illustrate the supersonic flow over a blunt-nosed body and summarise the detached shockwave in front of the a blunt body. **[15M]**

b) Explain the concept of Pressure Deflection Diagrams.

5 Derive Expression for linearized Pressure Coefficient. **[15M]**

6 What is Prandtl-Glauert Rule and derive expression for Pressure coefficient for compressibility effects. **[15M]**

7 Explain the Phenomena of Choking in Nozzles and plot the effect of Exit Pressure on Mass Flow Rate and Pressure inside Nozzle. **[15M]**

8 Discuss the advantages and disadvantages of an open type and closed type wind tunnel. **[15M]**

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