

# SECOND SEMESTER 2023-2024

Course Handout Part II

Date: 09-01-2024

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* : **AN F315 (L-P-T-U:3-0-0-3)**

*Course Title* : **Aircraft Structures**

*Instructor-in-Charge* : **Prof. Srinivasa Prakash Regalla**

**Scope and Objective of the Course:** Basic elasticity and 2D problems, Virtual work and energy method, Bending of thin plates, Structural components of aircraft, Airworthiness and airframe loads, Bending, Shear and Torsion of Thin-Walled Beams, Stress analysis of aircraft components including Wing spars and box beams, Fuselage, Wings, Fuselage frame and wing ribs, Laminated composite structures, Aeroelasticity, Computational Modelling of various Aircraft Components under Service Loads.

# Textbooks:

1. Megson T.H.G., “Aircraft Structures for Engineering Students" Butterworth-Heinemann (Elsevier), 7th Edition, UK, 2022.

# Reference books

1. Sun C. T., Adnan A., “Mechanics of Aircraft Structures”, 3rd Edition, Wiley, NJ, USA, 2021.

# Course Plan:

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| Lecture No. | Learning objectives | Topics to be covered | Chapter in the Text Book |
| 1-2 | Basic elasticity and 2D problems | Elasticity of materialsstress-strain relations, stress function, membrane’s analogy | CH1 to CH3 (TB) |
| 3-6 | Virtual work and energy method | Principle of virtual work, strain energy and complementary energy methods | CH4 &5 (TB) |
| 7-10 | Bending of thin plates | Pure bending and combined loading of thin plates, application of strain energy method | CH7 (TB) |
| 11 -13 | Structural components of aircraft | Loads on aircraft structural components, functions of structural components, fabrication of structural  components, riveted joints and their design | CH12 (TB) |
| 14 -17 | Airworthiness and airframe loads | Factors of safety, load factor determination, airframe loads, symmetric maneuver loads, gust  loads, design against fatigue | CH13 (TB) |
| 18 - 21 | Bending, Shear and Torsion of Thin-Walled Beams | Symmetric and unsymmetric bending, deflection | CH16 (TB) |

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| 22 - 27 | Stress analysis of aircraft components: Wing spars and box  beams | Open and closed section beams in aircraft, beams with variable stringer areas | CH10 (TB) |
| 28 - 31 | Stress analysis of aircraft components: Fuselage, Wings, Fuselage frame and wing ribs | Fuselage bending, shear and torsion, pressurized fuselages | CH17 (TB) |
| 32 - 35 | Laminated composite structures | Laminated composites and thin-walled composite beams | CH16 (TB) |
| 36-39 | Aeroelasticity | Wing flutter, control effectiveness, aileron effectiveness | CH29 (TB) |
| 40-43 | Computational Modelling of various Aircraft Components  under Service Loads | Matlab-based stress analysis and design of aircraft structures | CH6 (TB) |

**Evaluation Scheme:**

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| **Component** | **Duration**  **(min)** | **Weightag**  **e(%)** | **Date & Time** | **Nature of**  **Component** |
| Mid-semester Examination | 90 | 25%=50M | 15/03 - 4.00 - 5.30PM | Closed Book |
| Design Project + Seminar | - | 20%=40M |  | Open Book |
| Classroom Interaction Tests  (Quizzes) | 10-30 min each | 15%=30M | In the lecture class | Closed Book |
| Comprehensive Examination | 180 | 40%=80M | 17/05 AN | Closed Book |

**Chamber Consultation Hour:** To be announced in the first lecture class.

**Notices:** CMS

# Make-up Policy: Only for Mid-semester and Comprehensive examinations and only in genuine cases of illness with prior intimation with medical documents enclosed.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**INSTRUCTOR-IN-CHARGE**