**BITS PILANI, HYDERABAD CAMPUS**

**SECOND SEMESTER 2023 – 2024**

Course Handout

**Date**: 09/01/2024

**Course No. : AN F312**

**Course Title : Aircraft Propulsion Instructor-in-charge : Dr. Sayan Das**

**Course Description:**

This course is an introductory course on aircraft propulsion and deals with the different types of aircraft engines currently in use. The purpose of the course is to discuss the various components used in those engines, do simplified thermodynamic analysis based on their components and discuss the relative scope of applications. The course also imparts a system level approach for aircraft propulsion by discussing the intake, combustion and exhaust systems describing the role of those systems and their roles.

**Scope and Objective of the Course:**

1. Introduce propulsion techniques used in aircraft.
2. Describe various components of aircraft engines including system level
3. Thermodynamic analysis using simplified assumptions
4. Analyze performance parameters of various aircraft engines
5. Physical understanding of system level components of various systems such as intake, combustor,and exhaust.

**Course Pre/Co- requisite** (if any)**:** BITS F111 Thermodynamics and ME F212 Fluid Mechanics

**Text books:**

**[TB1] Ahmed F. El-Sayed, Aircraft Propulsion and Gas Turbine engines, CRC Press, 2008.**

**Reference books:**

**[RB1] H.I.H. Saravanamuttoo, GFC Rogers and H. Cohen, Gas Turbine Theory, 5th Ed., PearsonEducation, 2001.**

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**Course Plan:**

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| **Lecture Nos.** | **Learning Objectives** | **Topics to be covered** | **Book** |
| 1-2 | Introduction & history of Aerospace engines | Introduction, Airbreathing engines, Jet engines and their classifications  , | 1 |
| 3-6 | Performance of Jet engines | Introduction, Thrust, Factors affecting thrust, Engine performance parameters | 2 |
| 7-10 | Pulsejet and Ramjet  engines | Introduction, Valved & Valveless Pulsejet, Ideal ramjet cycle | 3 |
| 11-12 | Shock Waves | Normal and Oblique Shock waves and their relations | 3 |
| 13-18 | Turbojet engines | Introduction, Single spool engine, Components, Thermodynamic  analysis, Ideal and actual cycles, Operative and inoperative afterburners, Thrust augmentation methods | 4 |
| 19-23 | Turbofan engines | Introduction, Thermodynamic analysis, Various components, Variation of thrust and drag with bypassratio | 5 |
| 24-28 | Turboprop engines | Introduction, classification of turboprop engines, components, thermodynamic analysis of single spoolturboprop engine | 6 |
| 29-32 | Intakes | Subsonic & supersonic intakes, Inlet performance and performance parameters, Matching intake and engine | 9 |
| 33-38 | Combustion systems | Subsonic combustors, combustion process, Combustion chemistry, Combustion chamber performance, Combustor cooling, Aircraft fuels & emissions | 10 |
| 39-41 | Exhaust systems | Nozzles, converging diverging nozzles | 11 |

The lectures may slightly diverge from above mentioned plan, which include special lectures and discussions based on student’sinterests that would be scheduled and notified accordingly.

**Evaluation scheme:**

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| **Evaluation**  **Components** | **Nature of**  **Component** | **Duration** | **Weightage**  **%** | **Date & Time** |
| Test-I | Open Book | 50 mins | 10% | TBA |
| Test-2 | Open Book | 50 mins | 10% | TBA |
| Seminar | Open Book | 15 mins | 10% | TBA |
| Mid Sem Exam | Closed book | 90 mins | 30% | 11/03 - 4.00 - 5.30PM |
| Comprehensive Exam | Closed Book | 3 hours | 40% | 07/05 AN |

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**Chamber consultation hours**: Wednesday 5-6 PM. Other days with prior appointment.

**Make-up policy**: Total of 3 tests will be conducted and the best two will be considered for evaluation. So, no make-up will be taken for tests. For mid-sem and comprehensive exams, the institute norms will be followed for make-up.

**Notices**: All notices concerning this course shall be displayed on the CMS (the Institute’s web-based course management system). Students are advised to regularly visit CMS for the latest updates.

**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**

**AN F312**