

**FIRST SEMESTER 2023-2024**

# Course Handout Part II

Date: 11-08-2023

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.* : ME F418

## Course Title : Rocket and Spacecraft Propulsion

## Instructor-in-Charge : Dr. Supradeepan K

**Scope and Objective of the Course:** This is an introductory multi-disciplinary course aimed at providing a comprehensiveoverview of the propulsive systems in rocket and space craft. It also aims at understanding the principles and practices in rockets and spacecraft propulsion

**Textbooks:**

1. **George P. Sutton, Oscar Biblarz**, Rocket Propulsion Elements, John Wiley & Sons 2010.

**Reference books**

1. Martin J. L Turner, Rockets and spacecraft propulsion, Springer Science & Business Media, 3rdEdition.
2. C. J. Bora, Introduction to Rockets and spacecraft propulsion, Online Gatha; First Edition (2017).

**Course Plan:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1-4 | Introduction | History and principles of rocket propulsion | TB1:1 |
| 5-8 | The thermal rocket engine | thermodynamics of the rocket engine, thrust equation, engine performance | TB1:3 |
| 9-14 | Liquid propellant rocket engines | configuration of the liquid propellant engine,  combustion chamber and nozzle  Liquid propellant distribution systems  Cooling of liquid-fuelled rocket engines  Combustion and the choice of propellants | TB1:7 |
| 15-21 | Solid propellant rocket motors | Basic configuration  Properties and the design of solid motors  Propellant composition  Integrity of the combustion chamber  Ignition  Hybrid Rocket motors | TB1:11,12 |
| 22-27 | Launch vehicle dynamics | rocket equation  Vertical motion in the Earth’s gravitational field  Inclined motion in a gravitational field  Motion in the atmosphere  The gravity turn  Basic launch dynamics | RB1:5 |
| 28-33 | Electric propulsion | Principles of electric propulsion  Electric thrusters  Electromagnetic thrusters  Plasma thrusters  Low-power electric thrusters | TB1:19 |
| 34-39 | Nuclear propulsion | Nuclear fission basics  The principle of nuclear thermal propulsion  The fuel elements  Exhaust velocity of a nuclear thermal rocket  Increasing the operating temperature  The nuclear thermal rocket engine | RB1:7 |
| 40-42 | Advanced thermal rockets | Fundamental physical limitations  Improving efficiency  Practical approaches to SSTO  Practical approaches and developments | RB1:8 |

**Evaluation Scheme:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Midsem | 90 Min. | 20% | 11/10 - 11.30 - 1.00PM | CB |
| Compre | 180 Min. | 40% | 12/12 AN | CB |
| Project type assignment | - | 20% |  | OB |
| Surprise Quiz | 15 Mts | 10% |  | CB |
| Assignment/Report | - | 10% |  | OB |

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

**Notices:** All notices concerning this course shall be communicated only through **CMS** (theinstitute’s web based course managementsystem) students are advised to visit CMS regularly for latest updates.

**Make-up Policy:** Make-up shall be given only to the genuine cases with prior confirmation.

**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.

**Dr. Supradeepan K**

**INSTRUCTOR-IN-CHARGE**

**ME F418**