

AE40009: ROCKET PROPULSION

Topics:

- **Theory Rocket Propulsion** (Definition, Principle, Rocket Equation, Performance parameters of a Rocket)
- **Nozzle Theory** (Ideal Rocket; Isentropic Flow through Nozzles; Exhaust Velocity; Choking; Nozzle Types; Nozzle Shape; Nozzle Area Expansion Ratio; Underexpansion and Overexpansion; Nozzle Configurations; Real Nozzles; Performance Correction Factors)
- **Solid Propellant Rocket Motors** (Application and Classification of Solid Propellant Rocket Motors; Propellants and Characteristics; Composite, Double Base and Composite Modified Double Base Propellants; Metallized Propellants; Ingredients and Processing; Propellant Burning Rate; Erosive Burning; Propellant Grains and Grain Configurations)
- **Liquid Propellant Rocket Engines** (Propellant and their Properties; Monopropellants and Bipropellants; Fuels and Oxidizers ; Storable and Gelled Propellants; Metals; Propellant Tanks; Liquid Propellant Feed Systems; Injectors; Thrust Chamber Shapes and Characteristic Length)
- **Monopropellant Rockets and Hybrid Rockets** (Hydrazine monopropellant rockets, Hybrid rockets, Choice of fuel and oxidizers)
- **Thrust Vector Control** (TVC mechanisms with single nozzle, TVC with multiple thrust chambers or nozzles)

Special Topic:

- **Combustion Instability** (Types of Instability – Bulk Mode, Transverse Mode and Axial Mode Instabilities; Causes of Instability in Solid Rocket Motors, Remedial Methods)

Books:

1. Rocket Propulsion Elements – Sutton, George P. and Biblarz, Oscar, 7th Edition (or latest), John Willey and Sons
2. Rocket Propulsion by K Ramamurthi, MacMillan, 2010
3. Understanding Aerospace Chemical Propulsion by H.S. Mukunda, Interline, 2004
4. Mechanics and Thermodynamics of Propulsion (2nd Edition) by Hill and Peterson, Addison-Wesely, 1992

Grading Policy: Your final grade will be determined according to the following format

TA(Homework + Term paper + Attendance) → **20%**; Mid Semester Exam → **30%**

End Semester Exam → **50%**