GUJARAT TECHNOLOGICAL UNIVERSITY
AERONAUTICAL ENGINEERING
B. E. SEMESTER: VII

Subject Name: **Rocket & Missile Configurations Design**
Subject Code: **170104**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
4	0	0	4	70	-	30	50

Sr. No	Course Content	Total Hrs.
1.	**General Aerodynamics Design Considerations** Introduction, Missile Classifications, Types of Design and Control	2
2.	**Aerodynamics Characteristics of Airframe Components** Introduction, Bodies of Revolution, Forebody: Conical, Ogival, Hemispherical and other shapes, Mid-Section and Boattail, General Aerodynamics of Airfoil, Aspect ratio, wing planform, Airfoil sections, Wing area, Subsonic characteristics of Airfoil, Aerodynamics Controls & Jet Controls	6
3.	**Missile Performance** Introduction, Friction drag, Pressure drag, induced drag, Interference drag, Boost- Glide Trajectory, Boost - Sustain Trajectory, Long range Cruise Trajectory, Long range Ballistic Trajectory, Maneuvering Flight: Flat turns, Pull- ups & Relation between Maneuverability & Static stability margin	8
4.	**Aerodynamics Launching Problems** Introduction, Safety of parent aircraft – Air launch, Launch boundaries – Air launch, Consideration to parent aircraft performance, Ground launch, Range Safety, Shipboard and underwater launches	5
5.	**Free Flight Dispersions** Introduction, Boost phase, Power off flight, Dispersion sensitivity factors in vacuum, Reentry body design considerations	7
6.	**Power Plant design considerations** Introduction, Fundamentals of Rocket engines, Rocket motor design considerations	4

7.	**Rocket Propellants** Liquid Propellants & Pressurization systems Propellant loading tolerances, inventory & concept of ullage, Volume versus mass loading & Loading measurement and control, Outage control, liquid rocket combustion chamber, Injectors, propellant feed lines, propellant tank outlet design, elimination of geysering effect in missiles, Gas feed and pump feed system	13
	Solid Propellants Igniter & Ignition system, Single base propellants - Double base propellants - Composite propellants – CMBD propellants - and their ingredients, Introduction to different fuels and oxidizers of composite propellants, Manufacturing techniques of solid propellant, Properties of solid propellant and solid propellant Grain design Fundamentals of combustion of solid propellants	

Text Books:

1. Missile Configuration Design by S. S. Chin, McGraw-Hill Book Company, Inc
2. Rocket Propulsion Elements", George P. Sutton and Oscar Biblarz, Wiley-Interscience
3. Propellants and Pressurization system by Elliot Ring