



Course Title: ROCKETS & MISSILES

Credit Units: 03

Course Code: AERO403

Course Level : UG

L	T	P/S	SW/ FW	TOTAL CREDIT UNITS
3	-	-	-	3

Course Objectives

This course is aimed to provide knowledge of rockets / missiles, their performance, stability & control, Launch Operation & Re-entry. The course also covers methods of stabilization and mathematical treatment of stability and maneuverability.

Pre-requisites: Aerodynamics-I, Aircraft Stability & Control

Course Contents/Syllabus:

	Weightage (%)
Module I : General Information	10
Descriptors/Topics: Difference between Rocket and missile, Type of Rockets and missiles, satellite launch vehicles.	
Module II : Aerodynamic Characteristics of Airframe Components	15
Descriptors/Topics : Introduction, Bodies of revolution, Different fore-body shapes, Summary of characteristics of bodies of revolution, Base pressure, Aerodynamic control, Jet control.	
Module III : Performance of Missiles and Rockets	25
Descriptors/Topics : Introduction, various types of drags, Boost glide trajectory, Graphical solution, Boost sustainer trajectory, long range cruise trajectory, long range ballistic trajectory, Powered and un-powered flight, Brief description of Fin Stabilized, spin stabilized Rockets and their force systems, Thrust misalignment.	
Module IV : Stability and Control	20
Descriptors/Topics : <i>Longitudinal:</i> Two degrees of freedom Analysis, Complete Missile Aerodynamics with forward and rear control, Static stability margin. <i>Directional:</i> Introduction, cruciform configuration, Body wing and Tail contribution on directional control.	

<i>Lateral:</i> Induced roll, internal control and design consideration for cruciform and Monowing, Damping in roll.	
Module V : Maneuvering Flight	10
Descriptors/Topics : Introduction, Flat turn for cruciform and mono-wing, Pull-ups, Relationship of maneuverability and static stability margin.	
Module VI : Dynamic Stability	10
Descriptors/Topics : Equation of motion, longitudinal dynamic degree of freedom, classical solution, lateral dynamics.	
Module VII : Miscellaneous	10
Descriptors/Topics : Launching problems, Re-entry and recovery of space vehicles, Modern Concepts, Manned Missions, Current topics.	

Student Learning Outcomes:

- Describe different types of rockets and missiles.
- Differentiate between rockets and missiles.
- Calculate various stability aspects of various control configuration of space vehicles.
- Analyze problems related to launch and recovery of space vehicles.
- Predict various types of trajectories and space vehicles.

Pedagogy for Course Delivery: Session Plan / course-material uploading, Class-room teaching associated with assignments, presentations, quiz, viva-voce and evaluation.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
100	NA	100

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment - 30					End Term Examination
Components (Drop down)	A	CT	S/V/Q	HA	70
Weightage (%)	5	10	8	7	70

Text & References:

- S.S Chin, “Missile Configuration Design” McGraw Hill
- Davis Follin and Blitzler, “Exterior Ballistics of Rockets”, Van Nostrand.
- Seifert and Brown, “Ballistic Missiles and Space Vehicle Systems”, John Wiley
- Seifert (Edited by), “Space Technology”, John Wiley.

Any other Study Material:

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