

7th Semester	RAE7D002	Launch Vehicle Aerodynamics	L-T-P 3-0-0	3 Credits
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Module I:**BASICS OF HIGH-SPEED AERODYNAMICS**

Compressible flows-Isentropic relations-mathematical relations of flow properties across shock and expansion waves-fundamentals of Hypersonic Aerodynamics

Module II:**BOUNDARY LAYER THEORY**

Basics of boundary layer theory-compressible boundary layer-shock shear layer interaction-Aerodynamic heating-heat transfer effects

Module III:**LAUNCH VEHICLE CONFIGURATIONS AND DRAG ESTIMATION**

Types of Rockets and missiles-various configurations-components-forces on the vehicle during atmospheric flight-nose cone design and drag estimation

Module III:**AERODYNAMICS OF SLENDER AND BLUNT BODIES**

Aerodynamics of slender and blunt bodies, wing-body interference effects-Asymmetric flow separation and vortex shedding-unsteady flow characteristics of launch vehicles- determination of aero elastic effects.

Module IV:**AERODYNAMIC ASPECTS OF LAUNCHING PHASE**

Booster separation - cross wind effects - specific considerations in missile launching – missile integration and separation-methods of evaluation and determination - Stability and Control Characteristics of aunch Vehicle Configuration- Wind tunnel tests - Comparison with CFD Analysis.

Books:

- [1] Anderson, J.D., “Fundamentals of Aerodynamics”, McGraw-Hill Book Co., New York.
- [2] Chin SS, Missile Configuration Design, Mc Graw Hill, New York.
- [3] Nielson, Jack N, Stever, Gutford, “Missile Aerodynamics”, Mc Graw Hill, New York.
- [4] Anderson Jr., D., – “Modern compressible flows”, McGraw-Hill Book Co., New York 1999.
- [5] Charles D.Brown, “Spacecraft Mission Design”, AIAA Education Series, Published by AIAA, 1998.
- [6] Elements of Space Technology for Aerospace Engineers”, Meyer Rudolph X, AcademicPress,1999.