

<b>5<sup>th</sup> Semester</b>	<b>RAE5D003</b>	<b>Space Vehicle Design</b>	<b>L-T-P 3-0-0</b>	<b>3 CREDITS</b>
--------------------------------	-----------------	-----------------------------	------------------------	------------------

### **COURSE OUTCOMES**

1. Mission objectives, needs, requirements and constraints, logistics
2. Design requirements, process, analysis and verification with future space structure
3. Thermal design, balance and analysis of satellite
4. Basic launch vehicle consideration, selection process, spacecraft design envelope, Attitude requirements, Space control system, Navigation Telecommunication, Onboard systems, Science instruments
5. Vehicle design and mission concept, System engineering, Product assurance, Spacecraft integration and test, reliability and quality assurance, Small satellite engineering and application and its costing system.

#### **Module 1 SPACE MISSION ANALYSIS AND DESIGN PROCESS 8 Hours**

Space mission life cycle, Mission objectives, Mission needs, Mission requirements and constraints,  
Space environment and survivability, Space logistics and reliability, Orbital debris

#### **Module 2 SPACECRAFT CONFIGURATION AND STRUCTURAL DESIGN**

**8 Hours**

Thermal environment, Thermal balance, Thermal analysis, Thermal design, Thermal technology,  
Thermal design verification, Satellite thermal design.

#### **Module 3 THERMAL CONTROL OF SPACECRAFT 8 Hours**

Basic launch vehicle consideration, Launch system selection process, Determining the spacecraft design envelope, Attitude requirements, kinematics, measurements, estimation and dynamics, Space control system, Telecommunication, Onboard systems, Science instruments, Navigation.

#### **Module 4 SPACECRAFT ATTITUDE, CONTROL AND INSTRUMENTATION**

**8 Hours**

Basic launch vehicle consideration, Launch system selection process, Determining the spacecraft design envelope, Attitude requirements, kinematics, measurements, estimation and dynamics, Space control system, Telecommunication, Onboard systems, Science instruments, Navigation.

**Module V SPACECRAFT DESIGN MANAGEMENT**

**8 Hours**

Vehicle design and mission concept, System engineering, Product assurance, Spacecraft integration and test, Spacecraft reliability and quality assurance, Small satellite engineering and application, Cost.

**Books:**

1. V.L. Pisacane and R.C. Moore, "Fundamentals of Space Systems", AIAA Series, 2003
2. P. Fortescue, J. Stark, and G. Swinerd, "Spacecraft Systems Engineering" AIAA Series, 2005
3. W.J. Larson and J. R. Wertz., "Space Mission Analysis and design", AIAA Series, 1998
4. M.J.L. Turner, "Rocket and Spacecraft Propulsion" (Principles, Practice and New Developments).

**Digital Learning Resources**

Course Name: Design of fixed wing Unmanned Aerial Vehicles

Course Link: <https://nptel.ac.in/courses/101/104/101104073/>

Course Instructor: Prof. Saderla Subrahmanyam, IIT Kanpur