GUIDANCE AND CONTROL OF AEROSPACE VEHICLES

VIII Semester: OPEN ELECTIVE -IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE69	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

The purpose of this subject is to provide the students with the theoretical background and engineering applications.

1. To introduce the concepts of Navigation, guidance and control
2. To familiarize with various ways in which aerospace vehicles are guided and controlled
3. The dynamic objectives which students also learn to achieve by designing flight control systems.
4. Familiarize with the control principles of rockets and missiles
5. To give Insight into the manoeuvres of the space craft

COURSE OUTCOMES:

At the end of the course the students are able to:

1 Formulate the navigational equations of the space vehicle
2 Describe the guidance of the vehicle with state feed back
3 Explain the automatic control and guidance of the aircraft
4 Evaluate the control techniques of the rockets and missiles
5 Describe major manoeuvres of the space aircraft.

UNIT-I NAVIGATION

Introduction, Basic Principles and Definitions; Dead reckoning and Position Fixing, Celestial, Radio, Inertial Navigation; Principle and Construction of Accelerometers, Mechanical Gyros and Ring Laser Gyros, Inertial Measurement Units, Navigation Equations, Sensor Error Models, Kalman Filter, Attitude Heading Reference System, GPS, Terrain Reference Navigation.

UNIT-II GUIDANCE

Optimal Terminal Guidance of Interceptors, Optimal Terminal Guidance - planar and non-planar, Robust and Adaptive Guidance, Guidance with State Feedback , Guidance with Normal Acceleration Input , Minimum Energy Orbital Transfer.

UNIT-III GUIDANCE AND CONTROL OF AIRCRAFT

Powered Flying Controls, Helicopter Flight Controls, Fly-by-Wire Flight Control, Control laws, Redundancy and Failure Survival, Digital Implementation, Fly-by-Light Flight Control, Auto Pilot, Flight Management Systems, Unmanned Aerial Vehicle.

UNIT-IV CONTROL TECHNIQUES/ CONTROL OF ROCKETS AND MISSILES

Open-loop and Closed Loop Control Systems, Multi-variable Optimization, Optimal Control of Dynamic Systems, Hamiltonian and Minimum Principle and Jacobi-Bellman Equation, Linear Time-Varying System with Quadratic Performance Index..

UNIT-V CONTROL OF SPACECRAFT

Launch of Satellite/ Spacecraft, Terminal Control of Spacecraft Attitude, Optimal Single-Axis Rotation of Spacecraft, Multi-axis Rotational Manoeuvres of Spacecraft, Spacecraft Control Torques, Rocket Thrusters, Reaction Wheels, Momentum Wheels and Control Moment Gyros, Torque.

Text Books:

1. Tewari, A.—Advanced Control of Aircraft, Spacecraft and Rocketsǁ, John Wiley & Sons, Ltd, Chichester, UK, 2011
2. Nelson R. C - Flight Stability and Automatic Control, SIE edition, McGraw Hill, New York, 2007.

Reference Books:

1. Noton,M. —Spacecraft navigation and Guidanceǁ, Springer-Verlag, Germany, 1998
2. Mc. Cormic 2. B. W - Aerodynamics, Aeronautics and Flight Mechanics, Wiley India Pvt. Ltd, USA, 2010.