Diploma, Anna Univ UG & PG Courses

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AE8001 SPACE MECHANICS

DETAILED SYLLABUS

OBJECTIVE:

- To introduce concepts of satellite injection and satellite perturbations, trajectory computation for interplanetary travel and flight of ballistic missiles based on the fundamental concepts of orbital mechanics.

UNIT I SPACE ENVIRONMENT

Peculiarities of space environment and its description– effect of space environment on materials of spacecraft structure and astronauts- manned space missions – effect on satellite life time

UNIT II BASIC CONCEPTS AND THE GENERAL N- BODY PROBLEM

The solar system – reference frames and coordinate systems – terminology related to the celestial sphere and its associated concepts – Kepler's laws of planetary motion and proof of the laws – Newton's universal law of gravitation - the many body problem - Lagrange-Jacobi identity – the circular restricted three body problem – libration points – the general N-body problem – two body problem – relations between position and time.

UNIT III SATELLITE INJECTION AND SATELLITE PERTURBATIONS

General aspects of satellite injection – satellite orbit transfer – various cases – orbit deviations due to injection errors – special and general perturbations – Cowell's method and Encke's method – method of variations of orbital elements – general perturbations approach.

UNIT IV INTERPLANETARY TRAJECTORIES

Two-dimensional interplanetary trajectories – fast interplanetary trajectories – three dimensional interplanetary trajectories – launch of interplanetary spacecraft – trajectory estimation about the target planet – concept of sphere of influence – Lambert's theorem

UNIT V BALLISTIC MISSILE TRAJECTORIES

Introduction to ballistic missile trajectories – boost phase – the ballistic phase – trajectory geometry – optimal flights – time of flight – re-entry phase – the position of impact point – influence coefficients.

TEXT BOOKS:

1. Cornelisse, J.W., "Rocket Propulsion and Space Dynamics", J.W. Freeman & Co., Ltd, London, 1982

2. Parker, E.R., "Materials for Missiles and Spacecraft", Mc. Graw Hill Book Co. Inc., 1982.

REFERENCE:

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edition, 1993.