Indian Institute of Technology Kanpur

Course Proposal
Indian Technical and Economic Cooperation Programme

Title of the Course/Workshop: **Spacecraft Dynamics and Control**

Item	Details
Title of the Course	Spacecraft Dynamics and Control
Course Coordinators	• Dipak Kumar Giri
Duration	**TWO Weeks**
Eligibility Criteria (basic expected background)	Basic Science / Engineering Background
Target group	Teachers of Engineering, Researchscholars, Business analysts from corporate sector
Tentative dates for the proposed event	**April-June 2024: 17th June-30th June 2024**
No. of days of training	14 Days= 40 hrs (approximate)

Objectives	The module provides the theory and practical application of spacecraft dynamics and control. After successful completion of this module, attendees will be able to: - 1. explain and interpret the basic terms and concepts of classical control theory, 2. analyse the properties of linear systems, - design controllers for linear systems, 3. use standard software for the analysis of controlled systems and the design of controllers, 4. explain and interpret the basics and methods related to state space control, 5. derive the requirements for an attitude control subsystem from the mission objectives, 6. explain the basic terms and concepts related to spacecraft attitude control, 7. identify and calculate different methods for attitude parameterization and compare their advantages and limiting cases, 8. identify and calculate/use different methods for attitude determination and their limitations, 9. analyze the kinematics of attitude control and develop the kinematics model for a spacecraft, 10. analyze the dynamics of a rigid body and develop the dynamics model for a spacecraft, 11. model and demonstrate different spacecraft sensors and actuators, develop kinematics and dynamic models for a real system in threeaxis, 12. design and demonstrate singleaxis attitude control maneuvers on a real system using the methods of classical control theory.
Tentative list of topics to be covered	1. Properties and stability of linear systems 2. Laplace transformation 3. Classical control theory (Root locus, PID-controller) - State space representation 4. Basics and methods of state control (Pole Placement, Linear Quadratic Regulator, Observer) 5. Model-based state prediction - Mission analysis and requirements on attitude control systems 6. Attitude control system concept and types 7. Various types of spacecraft attitude parameterization - Rigid body dynamics and attitude kinematics 8. Attitude estimation algorithm