Indian Institute of Technology Kanpur

Course Proposal
Indian Technical and Economic Cooperation Programme

Title of the Course/Workshop: **Space Mission Design, Analysis and Operations**

Item	Details
Title of the Course	**Space Mission Design, Analysis and Operations**
Course Coordinators	• Dipak Kumar Giri
Duration	**TWO Weeks**
Eligibility Criteria (basic expected background)	Basic Science / Engineering Background
Target group	Teachers of Engineering, Research Scholars, Business analysts from corporate sector
Tentative dates for the proposed event	30th June - 12th July, 2025
No. of days of training	14 Days = 60 hrs (approximate)
Objectives	The attendees of this course will explore the critical spacecraft subsystems, including propulsion, power, communication, and thermal control. Also, the challenges associated with entry, descent, and landing (EDL) systems will be covered. From the system engineering perspective, the cost analysis and risk assessment techniques will be introduced to evaluate mission feasibility. Participants will gain knowledge on software and simulation tools development for mission planning and also gain experience in conceptual planning for various mission profiles, such as Earth observation, planetary exploration, and interplanetary missions. Additionally, the module includes hands-on experiments focusing on spacecraft instrumentation, telemetry, communication, attitude determination and control systems (ADCS), and orbit trajectory design in software. By the end of this module, attendees will have understanding of space mission design and practical skills for applying these principles to real-world scenarios.
Tentative list of topics to be covered	1. Introduction to Space Mission Design a) Objectives b) Motivation behind space exploration and utilization c) The history of human space exploration d) The main space agencies in the world 2. Introduction to Space Environment a) Reviews on mechanics of laws involved in the space dynamics b) Transition from atmosphere to space environments c) Orbital lifetime and space debris 3. Introduction to Orbital Mechanics a) Orbital motion equations, Kepler's law, circular and elliptical orbits b) Reference frames, orbital manoeuvres c) Perturbation of orbital motion 4. Relative Motion of Two Spacecrafts a) Rendezvous of spacecrafts b) Relative motion of chaser and target satellites

	c) Successful rendezvous and docking in LEO orbits 5. Interplanetary Trajectory Desing a) Gravity Assist manoeuvres b) Laws of propulsion, concept of specific impulse, different types of thrusters c) Entry, descent, and landing systems 6. Mission Operations and Ground Segment Design 7. Space Mission Cost Analysis and Risk Management 8. Case Studies and Current Trends in Space Missions 9. Hands-on Sessions and Practical Experiments.