

Indian Institute of Technology, Kanpur

1. Course No and Title: SPA 626: Course Title: Space Environments and Space Systems

2. Course Description:

A. Objectives: This course aims to provide the students the exposure to understand different aspects of the space environment, including space weather, space climate, space debris and how these impact on spacecraft design, terrestrial infrastructure systems and will enable students to explore the topics at a deeper level.

B. Contents:

1. Introduction to Space Environment and Weather
2. The vacuum environment, vacuum environment effects, modelling, simulation, and testing, design guidelines and mitigation techniques
3. Neutral gas flow around a spacecraft, earth's atmosphere, pressure variation with altitude, planetary atmospheres, aerodynamic force; contamination, erosion by atomic oxygen, glow, particle impacts on spacecraft, scattering of EM radiation from particles
4. Basics of plasma physics, space plasma, solar wind, Coronal mass ejections, coupling of solar wind with earth's magnetosphere, geomagnetic storm, substorm.
5. The physics of macroscopic particles, cometary meteoroids, asteroidal meteors, space debris.
6. Electromagnetic radiation, electromagnetic radiation at radio frequencies, visible and infrared, UV, EUV, and X-rays; energetic particle radiation; trapped radiation, cosmic rays, solar proton events, radiation interactions with matter, single-particle interactions, photon interactions, charged-particle interactions, neutron interactions.
7. Spacecraft outgassing; chemical thrusters; plasma thrusters; the space radiation environment; solar-array degradation.
8. Spacecraft charging; single event upsets; spacecraft drag; space radiation, radiation hazards to satellite electronic systems; radiation due to heavy ions, radiation charging of dielectric materials; particulate interactions: particle impacts on spacecraft scattering of EM radiation from particles, environmental effects of space systems.
9. Coupling, victim, spacecraft radiation hardening, test and evaluation, design guidelines, material selection, wiring and cable shields and their bonding