

Indian Institute of Technology, Kanpur

Proposal for a New Course for Undergraduate studies

1. Course No and title: SPA402: Course Title: Introduction to Manmade Satellite System and its Environment
2. Course Description:
 - A. Objectives: The objective of this course is to introduce the students from interdisciplinary Engineering and science streams to the fundamentals of Engineering topics related to manmade orbital satellites and its environment.
 - B. Contents
 1. Recapitulation of the basic concepts related to Earth's atmosphere, spacecraft orbits, solar activities, earth's magnetosphere
 2. Vertical electron density profile and Chapman Model of different layers of ionosphere (F, E and D layers), ionospheric disturbances, auroral magnetosphere-ionosphere coupling, radio wave propagation in ionosphere, attenuation and reflection of radio waves, propagation modes, effects of ionospheric phenomena on artificial satellite system radio signal propagation.
 3. Orbital Spacecraft and the ambient space environment, interactions between the environment and a spacecraft, solar wind, the magnetosphere, geomagnetic substorms, the auroral region, the radiation belts, relevance of the space plasma environment on spacecraft charging; spacecraft charging, spacecraft potential, electron and ion fluxes, current and potential equilibrium, spacecraft charging in Maxwellian plasma.
 4. Low Earth Orbit: ISS, Remote sensing polar orbit satellites, constellation of small satellites for communication, space telescopes like Hubble telescope; Medium Earth Orbit: Navigational satellites like GPS, GLONASS, Galileo.
 5. GEO and GSO orbits: Communication and navigation satellites like GSAT and NavIC series of satellites
 6. Space segments, power system, attitude and orbit control system, station keeping, thermal control, TT&C subsystem, payloads, propulsion system; earth segments; receive-only home TV systems, transmit-receive earth stations, large earth stations.
 7. Different anomalies in space missions, introduction of reliability, failure rate, the probability of survival or reliability, failure probability or unreliability, mean time to failure, mean satellite lifetime, reliability during the wear-out period, satellite system availability, subsystem reliability.
 8. Communication satellite, uplink, downlink and overall link performance, Intersatellite links, frequency allocations, different types of transponders; bent pipe payloads, regenerative payloads, navigation satellite; space segment, control segment, user segment; remote sensing satellite; different types of remote sensing satellites, microwave and optical payloads; Interplanetary satellites.