NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech. Electronics & Communication Engineering
Course Code:	3EC303ME24
Course Title:	Satellite Communication
Course Type:	Departmental Elective
Year of Introduction:	2024-25

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Course Learning Outcomes (CLOs):

At the end of the course, students will be able to

1. appreciate the role of satellite in a wide spectrum of applications such as navigation, remote sensing, and communication. BL-2
2. comprehend the principle, operation and working of various subsystems of satellite and the earth station. BL-3
3. apply communication techniques in satellite applications. BL-3
4. analyse and design a satellite link. BL-6

Unit No.	Contents	Teaching hours (Total 45)
I	**Orbital Mechanics and Launching:** Kepler's law, orbital mechanics, type of orbits, orbital perturbations, orbital effects, launching of satellite, launch vehicle technology, numerical problems	08
II	**Satellite Sub Systems:** Structure, attitude & orbit control, comparison of spin and 3-axis stabilization, thermal control, power supply, propulsion, telemetry, tracking & command, transponder types- bent pipe and regenerative, satellite antennas	07
III	**Satellite Link Design:** Free space path loss, G/T ratio, Equivalent noise temperature, Link budget, Design for uplink, Design for downlink, Design consideration for various bands	08
IV	**Earth Station Technologies:** Earth stations Configuration, classes, Terrestrial tails, Performance criteria of various classes, Earth station antenna, Tracking techniques	04
V	**Communication Techniques:** Hybrid Modulation techniques, multiple Access techniques – FDMA, TDMA, SPADE system, Overheads and efficiency	04
VI	**Applications of Satellite Communication:** Telecom and data communication, Satellite navigation systems (GPS), Indian Regional Navigation Satellite System (IRNSS), Satellite broadcasting systems (DTH, world space radio), Very Small Aperture Terminal (VSAT) systems, Mobile satellite systems, Remote sensing satellite systems	10
VII	**Future Trends in Satellite Communication:** High altitude platforms, High throughput satellite systems, Optical inter-satellite links, Open standards – DVBs	04

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggest List of Tutorials (not restricted to the following):
(Only for information)

Sr. No.	Title of the tutorial	Hours
1	Orbital mechanics – orbital height, velocity and time	01
2	Orbital mechanics – Keplerian elements	01
3	Orbital mechanics - escape velocity, launching	01
4	Link design – Calculation of path loss, noise temperature, noise figure	01
5	Link design – Design and analysis of uplink for C band	01
6	Link design – Design and analysis of downlink for C band	01
7	Link design – Design and analysis of uplink for Ku-Ka band	01
8	Link design – Design and analysis of downlink for Ku-Ka band	01
9	Link design – Design of end-to-end link	01
10	Link design calculator in excel	01
11	Simulation of modulation techniques	01
12	Simulation of error control coding	01
13	Simulation of compression techniques used in satellite communication standards	01
14	Simulation of trilateration technique for location determination	01
15	Calculation of overheads and efficiency for the multiple access techniques	01

Suggested Readings:

1. T. Pratt, Satellite Communication, Wiley publication
2. Dennis Roddy, Satellite Communication, Wiley publication
3. A. K. Maini, Satellite Communication, Wiley publication
4. Bruce R. Elbert, Introduction to Satellite Communication, Artech House