COURSE TITLE	**SATELLITE COMMUNICATION**
COURSE CODE	**01CT1610**
COURSE CREDITS	**4**

Objective:

1 The goal of the course is to introduce students to the fundamentals of satellite Communication. The course enables analysis and design of satellite links for various types of services and familiarity with terms and techniques related to performance evaluation and the availability of such links. It also uses to enable the students to become familiar with satellites and satellite services.

Course Outcomes: After completion of this course, student will be able to:

1 Understand principle, working and operation of various sub systems of satellite as well as the earth station.

2 Apply various communication techniques for satellite communication. 3.Analyze and design satellite communication link

3 Analyze the various methods of satellite access.

4 Interpret role of satellite in various applications

Pre-requisite of course: Analog and digital Communication

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction to Satellite Communication** Historical background, Basic concepts of Satellite Communications, Communication Networks and Services, Growth of Satellite communications. Satellite in Networks	4
2	**Satellite Orbits** Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits, Look Angle Determination, Limits of visibility, eclipse-Sub satellite point, Sun transit outage-Launching Procedures, launch vehicles and propulsion	8
3	**Space Segment** Introduction, The Power Supply, Attitude Control, Spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders: The wideband receiver, The input demultiplexer, The power amplifier, The Antenna Subsystem	5

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Contents : Unit	Topics	Contact Hours
4	**Earth Segment** Introduction – Receive – Only home TV systems, Outdoor unit – Indoor unit for analog (FM) TV, Master antenna TV system, Community antenna TV system, Transmit – Receive earth stations	6
5	**The Space Link** Introduction, Equivalent Isotropic Radiated Power, Transmission Losses: Free-space transmission, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses, The Link-Power Budget Equation, System Noise, Carrier-to-Noise Ratio, The Uplink: Saturation flux density, Input backoff, Downlink, Output back-off, Satellite TWTA output, Combined Uplink and Downlink C/N Ratio. Inter-satellite Link.	6
6	**Satellite Access** Introduction, Single Access, Preassigned FDMA, Demand-Assigned FDMA, Spade System, TDMA, Preassigned TDMA, Demand-assigned TDMA, Satellite-Switched TDMA, Code-Division Multiple Access	5
7	**Satellite Applications** INSAT, VSAT, Mobile satellite services: GSM, GPS, Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), GRAMSAT, Specialized services – E –mail, Video conferencing	4
8	**Advances in Satellite Communication** Satellite based societal application for national development, Disaster management, Microwave remote sensors, Digital signal processing for microwave sensors, Optical and infrared remote sensing.	4
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment-1** Understanding the basic concepts of satellite communication	2
2	**Experiment-2** To setup a communication link between uplink transmitter and downlink receiver using Satellite.	2
3	**Experiment-3** To setup an Active satellite communication link and demonstrate link fail operation	2
4	**Experiment-4** To communicate voice & Video signal through satellite link	2
5	**Experiment-5** Observe the effect of Different combinations of uplink and downlink frequencies on satellite link.	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
6	**Experiment-6** To transmit and receive three separate signals (Audio, Video ,Tone) simultaneously through satellite link	2
7	**Experiment-7** To study radiation pattern and beam width of patch antenna.	2
8	**Experiment-8** To transmit and receive function generator signals through satellite link.	2
9	**Experiment-9** To measure the signal parameters in an analog FM/FDM TV satellite link.	2
10	**Experiment-10** To transmit digital waveforms through a satellite communication link.	2
11	**Experiment-11** To Calculate Bit Error Rate in a satellite communication link.	2
12	**Experiment-12** To write a program to observe the variations in the antenna look angles for the earth station antennas.	2
Total Hours		**24**

Textbook :

1 The Satellite Communication Applications: Hand Book, B. Elbert, Artech House Bostan, London. , 2004

2 Satellite Communication, Timothy Pratt, Charles Bostian, Jeremy Allnutt, John Wiley & Sons, 2019

3 Satellite Communications, Dennis Roddy, McGraw Hill, 1988

References:

1 Introduction to Satellite Communications, Introduction to Satellite Communications, B. Elbert, Artech House, 1999

2 Avionics Navigation systems, Avionics Navigation systems, Myron Kyton, Walfred Fried, John Willy & Sons, 1997

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	30.00	25.00	15.00	5.00

Instructional Method:

1. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
2. Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.
3. Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.
4. The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, Flipped class, Project based learning, Collaborative learning, MOOCs etc. for effective teaching.

Supplementary Resources:

1. https://nptel.ac.in/courses/117105131/
2. https://ocw.mit.edu/search/ocwsearch.htm?q=satellite%20communication 3.www.radio-electronics.com

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