



Kadi Sarva Vishwavidyalaya
Gandhinagar-382 015

B.E Semester: 7
Electronics & Communication Engineering
Subject Name: Satellite Communication
Subject Code : EC-704-A (EP 1)

A. Course Objective:

The educational objectives of this course are

- To present a problem oriented introductory knowledge of Satellite Communication.
- To address the underlying concepts and methods behind Satellite Communication.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EC- 704-A	Satellite Communication	4	0	2	6	5	3	70	30	20	30	150

Syllabus

- 1 **Introduction:**
Overview of satellite communication
- 2 **Orbital Mechanics and launchers:**
Orbital Mechanics, Look Angle Determination, Orbital perturbations, orbit Control system, Telemetry, tracking, Command and monitoring, power systems, Communication subsystems, Transponders, Satellite Antennas, Equipment reliability and space qualification
- 3 **Satellite Link Design:**
Basic transmission Theory, system noise temperature and G/T ratio, Design of downlinks, Satellite systems using small earth stations Uplink design, Design for C/N:Combining C/N and C/I values in satellite links, System design examples.



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4 Multiple access techniques for satellite links:

Multiple access, Frequency division Multiple Access, Time, division Multiple Access, On board processing, Demand access Multiple Access, Random access. Code division Multiple Access.

5 Propagation effects and their impact on satellite-earth links:

Quantifying attenuation and depolarization, propagation effects that are not associated with hydrometers, rain and ice effects, prediction of rain attenuation, prediction of XPD, propagation impairment Countermeasures.

6 VSAT systems:

Network architectures, Access control protocol, Basic techniques, SAT earth station engineering, Calculation of link margins for VSAT star network, system design procedures.

7 Low Earth Orbit and Non-Geostationary Satellite systems:

Orbit considerations, Coverage and frequency considerations, Delay and throughput considerations, Operational NGSO constellation design, introduction to Satellite mobile network.

8 Satellite Navigation and Global Positioning System:

Radio and Satellite navigation, GPS position location principles, GPS receivers and Codes satellite signal acquisition, GPS navigation message, GPS signal levels, timing accuracy, GPS receiver operation.



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C. Lesson Planning

Sr. No.	No. of Hrs.	% Weightage in Exam	Topic
1	06	12	Introduction: Overview of satellite communication.
2	10	15	Orbital Mechanics and Launchers: Orbital Mechanics, Look Angle Determination, Orbital perturbations, orbit Control system, Telemetry, tracking, Command and monitoring, power systems, Communication subsystems, Transponders, Satellite Antennas, Equipment reliability and space qualification.
3	10	15	Satellite Link Design: Basic transmission Theory, system noise temperature and G/T ratio, Design of downlinks, Satellite systems using small earth stations Uplink design, Design for C/N:Combining C/N and C/I values in satellite links, System design examples.
4	07	14	Multiple access techniques for satellite links: Multiple access, Frequency division Multiple Access, Time, division Multiple Access, On board processing, Demand access Multiple Access, Random access. Code division Multiple Access.



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5	07	10	Propagation effects and their impact on satellite-earth links: Quantifying attenuation and depolarization, propagation effects that are not associated with hydrometers, rain and ice effects, prediction of rain attenuation, prediction of XPD, propagation impairment Countermeasures.
6	07	14	VSAT systems: Network architectures, Access control protocol, Basic techniques, SAT earth station engineering, Calculation of link margins for VSAT star network, system design procedures.
7	07	10	Low Earth Orbit and Non-Geostationary Satellite systems: Orbit considerations, Coverage and frequency considerations, Delay and throughput considerations, Operational NGSO constellation design, introduction to Satellite mobile network
8	06	10	Satellite Navigation and Global Positioning System: Radio and Satellite navigation, GPS position location principles, GPS receivers and Codes, satellite signal acquisition, GPS navigation message, GPS signal levels, timing accuracy, GPS receiver operation.
TOTAL	60	100	

D. Instructional Method & Pedagogy

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weight age should be given to all topics while teaching and conduction of all examinations.



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- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- Experiments shall be performed in the laboratory related to course contents.

Suggested list of Experiments

Sr. No Name Of Experiment

- 1 To perform active/passive satellites, uplink/downlink and transponders.
- 2 To perform baseband analog signal transmission.
- 3 To perform analog FM/FDM satellite link.
- 4 To perform carrier to noise ratio.
- 5 To perform signal to noise ratio.
- 6 To perform digital baseband signal.
- 7 To perform telemetry and telecommand.
- 8 To perform polarization of antenna.
- 9 To perform fading effect.
- 10 To perform path loss effect.
- 11 To perform propagation delay.



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E. Students Learning Outcomes

On successful completion of the course

- The student can identify different areas of satellite communication. Can find the applications of all the areas in day to day life. Can identify the operations, working, construction, material etc. aspects of link budget, losses, fading.

F. Recommended Study Materials

Text/ Reference Books:

1. Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnutt, Willey Student edition, second edition
2. Satellite Communication, by Dennis Roddy, TataMcGraw Hill
3. Communication Satellite systems, by James Martyn, Prentice Hall
4. Satellite communication by Wilbur L. Pritchard & Joseph a. Sciulli-PHI