CVM UNIVERSITY
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FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Engineering

Semester I

Course Code: 102430108

Course Title: Satellite Communication

Type of Course: Program Elective II

Course Objectives: This course provides a complete understanding of satellite communication principles and related technologies. Starting from orbital mechanics related to satellite access, the course evolves through satellite link design, signal processing, and various satellite applications

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	30 / 15	20 / 10	70 /35	30 / 15	150 / 75

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Orbits And Launching Methods: Introduction, Kepler's First Law, Kepler's Second Law , Kepler's Third Law, Definitions of Terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbit Perturbations, GEO stationary and Non GEO-stationary orbits, Look Angle Determination, Limits of visibility.	7
2	Radio Wave Propagation: Introduction, Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Other Propagation Impairments	4
3	Satellite Link Design: Satellite uplink and downlink Analysis and Design, link budget, E/N calculation, performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations-System reliability and design lifetime.	7
4	Satellite Access: Introduction, Single Access, Preassigned FDMA, Demand-Assigned FDMA, Spade systems, TDMA, Satellite-Switched TDMA, Code-Division Multiple Access.	8
5	Earth Segment: Introduction, Receive-Only Home TV Systems, Master Antenna TV System, Community Antenna TV System Transmit-Receive Earth Stations.	4
6	Satellite Applications: INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH).	8
7	Case study: IRNSS , GPS	2

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
30	30	20	-	20	-	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1	Dennis Roddy, 'Satellite Communication', McGraw Hill International, 4th Edition, 2006.
2	Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnutt, Willey Student edition, second edition.
3	Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite CommunicationSystems Engineering', Prentice Hall/Pearson, 2007
4	A.K. Maini and V. Agrawal, Satellite Technology, John Wiley and Sons, 2007.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To understand orbits, launching methods and radio wave propagation	**27.5**
CO-2	To calculate link budget for satellite by considering various losses.	**17.5**
CO-3	To understand access and earth segment of satellite	**30**
CO-4	To understand applications of application of satellite.	**25**

List of Practicals / Tutorials:

1	To write a program to calculate the limits of visibility for an earth station.
2	To obtain the plot of Orbital altitude Vs satellite antenna diameter.
3	To obtain plot of semimajor axis versus rate of change of argument of perigee
4	To write program to calculate the rain attenuation (in dB) for horizontal polarization, vertical polarization and circular polarization for satellite wave propagation.
5	To write a program to determine the combined carrier to noise power spectral density ratio for satellite link budget.
6	To write a program to plot the degradation in downlink C/I.
7	To plot the variation in Carrier to Noise power spectral density ratio (uplink, downlink and combined) for changes in the input SFD for uplink and EIRP for downlink.
8	To write a program for plotting Half power beam width Vs. maximum number of days sun transit occurs at an earth station.
9	To demonstrate satellite transmitter system through model satellite trainer kit.
10	To demonstrate satellite receiver system through satellite trainer kit.

Supplementary learning Material:	
1	http://spacejournal.ohio.edu/
2	www.nptel.ac.in

3	http://ocw.mit.edu
4	www.radio-electronics.com

Curriculum Revision:	
Version:	**1**
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22