

Course Code	Course Title	L	T	P	C
BECE310L	Satellite Communications	3	0	0	3
Pre-requisite	BECE306L, BECE306P	Syllabus version			
		1.0			
Course Objectives					
1. To learn the conceptual knowledge of communication through satellites. 2. To provide a detailed understanding of navigation - both inertial and by navigation satellites. 3. To analyze typical challenges of satellite based systems.					
Course Outcomes					
At the end of the course, students will be able to 1. Analyse the concept of orbits, launch vehicles and satellites 2. Comprehend the design of satellite subsystems 3. Imbibe the basics of digital transmission related to satellite communication 4. Analyse the navigation satellite services. 5. Analyse the impact of diverse parameters on satellite link design 6. Apply the satellite systems for various applications					
Module:1	Orbital Mechanics	6 hours			
Overview of satellite communication - Orbital mechanics - Equations of the orbit - Kepler's laws of planetary motion - Orbital elements - Look angle determination - Orbital perturbation and determination					
Module:2	Orbital Launchers	3 hours			
Launches and launch vehicles- Launch vehicle selection factors - Satellite positioning into geostationary orbit - Orbital effects in communication systems performance - Doppler shift -Range variations - Solar eclipse and sun transit outage.					
Module:3	Elements of Communication Satellite Design	5 hours			
Satellite subsystems - Attitude and orbit control electronics - Telemetry and tracking - Power subsystems - Communication subsystems - Satellite antennas - Reliability and redundancy- Frequency modulation techniques.					
Module:4	Digital Transmission Basics	4 hours			
Modulation and Multiplexing -Multiple access techniques – FDMA, TDMA, CDMA, SDMA, ALOHA and its types – Onboard processing- Satellite switched TDMA – Spread spectrum transmission and reception for satellite networks.					
Module:5	Satellite Link Design	9 hours			
Basic transmission theory – System noise temperature and G/T Ratio- Noise figure and noise temperature- Calculation of system noise temperature – G/T ratio for earth stations - Link budgets - Uplink and downlink budget calculations - Error control for digital satellite links - Prediction of rain attenuation and propagation impairment counter measures.					
Module:6	VSAT and NGSO System	7 hours			
Overview of VSAT systems-VSAT Network Architectures, One Way Implementation, Two-Way Implementation, Delay Considerations, VSAT Earth Station Engineering -NGSO Satellite Systems Constellation/ Constellation Design Considerations - Starlink, One Web					
Module:7	Direct Broadcast Satellite Television systems and GPS	9 hours			

DBS Satellite Systems: DVB-S2X Standards -System Design for High-Throughput Applications , Antenna Considerations, Modulation Scheme Considerations, Error Coding Considerations, Remote Sensing Application, Navigation Satellite Systems GPS-Position Calculations and Accuracy, Navigation Messages, Receiver Design,- IRNSS			
<b>Module:8</b>		<b>Contemporary Issues</b>	
		<b>2 hours</b>	
<b>Lecture hours:</b>		<b>Total</b>	
		<b>45 hours</b>	
<b>Text Book(s)</b>			
1.	Pratt, C.W. Boastian and Jeremy Allnutt “Satellite Communication”, 2018, 2nd edition, John Wiley and Sons, Bangalore, India.		
<b>Reference Books</b>			
1.	D.Roddy, “Satellite Communications”, 2011, 4th edition (sixth reprint), Tata McGraw Hill, New York.		
2.	Anil K. Maini, Varsha Agrawal, “Satellite Communications”, 2018, Wiley India Pvt. Ltd, New Delhi, India		
3	G. Maral, M. Bousquet, Z. Sun, “Satellite Communications Systems: Systems, Techniques and Technology”, 2020 (6th Edition), John Willy and sons, New York.		
4	Teresa M. Braun ,”Satellite Communications Payload and System”, 2021, 2 <sup>nd</sup> edition, John Wiley and Sons, USA		
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test			
Recommended by Board of Studies		28-02-2023	
Approved by Academic Council		No. 69	Date 16-03-2023