Course Code	21ECE223T	Course Name	SATELLITE COMMUNICATION AND BROADCASTING	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	ECE	Data Book / Codes / Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	study the background and orbital mechanics of satellite communication systems
CLR-2:	investigate satellite links and identify areas to improve link performance
CLR-3:	identify the various propagation effects and access techniques for satellite communication links
CLR-4:	interpret the applications of satellite communication in VSAT systems, satellite TV, and radios
CLR-5:	explore the concepts of satellite navigation and packet communication

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)												Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	interpret the concept and operation of satellite communication systems	2	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO-2:	analyze satellite launching, link design, link availability, and interference	-	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO-3:	examine the mechanism of multiple access techniques, propagation effects, and their impact on satellite communication	2	-	2	-	-	-	-	-	-	-	-	-	2	-	-
CO-4:	illustrate the practical implementation of VSAT and DBS systems	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO-5:	review the satellite communication navigation and global positioning system applications	3	2	-	-	-	-	-	-	-	-	-	-	-	2	-

Unit-1 – Overview of Satellite Communication — **9 Hour**

Principle, historical developments, frequency allocations for satellite services. Orbital mechanics: Kepler's laws, orbital parameters, look angle determination, orbital perturbations, orbit control system, geostationary orbit, telemetry, tracking, command and monitoring, power systems, communication subsystems, transponders, satellite antennas, equipment reliability and space qualification

Unit-2 – Satellite Link Design — **9 Hour**

Basic transmission theory, system noise temperature and G/T ratio, design of downlinks, satellite systems using small earth stations uplink design, carrier to noise (C/N) ratio, design of satellite links for specified C/N (with and without frequency re-use), link budget, system design examples

Unit-3 – Propagation Effects and their Impact on Satellite-Earth Links — **9 Hour**

Quantifying attenuation and depolarization, rain and ice effects, cloud attenuation, tropospheric and ionospheric scintillation, prediction of XPD, propagation impairment countermeasures Multiple access techniques for satellite links: Multiple access, frequency division multiple access, time division multiple access, demand access multiple access, random access, code division multiple access

Unit-4 – VSAT Systems — **9 Hour**

Network architectures, access control protocol, basic techniques, sat earth station engineering, calculation of link margins for VSAT star network, system design procedures. Direct broadcast satellite (DBS) TV and radio: C-band and Ku-band home satellite TV, DBS modulation, digital DBS-TV, DBS-TV system design, DBS-TV link budget, error control in digital DBS-TV, master control station and uplink, establishment of DBS–TV antennas, satellite radio broadcasting

Unit-5 – Satellite Navigation and Global Positioning System (GPS) — **9 Hour**

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, case study – IRNSS/NAVIC, case study – GAGAN (GPS Aided GEO Augmented Navigation) Satellite packet communication: Message transmission by FDMA, message transmission by TDMA, pure Aloha-satellite packet switching, slotted Aloha, packet reservation

Learning Resources	1. D.Roddy, "Satellite Communications", McGraw Hill Education, 4th Edition, 2017. 2. T.Pratt, C.Bostian and J.Allnutt, "Satellite Communications", Wiley, 2nd Edition, 2013. 3. W. L. Pritchart, H. G. Suyderhoud and R. A. Nelson, "Satellite Communication Systems Engineering", Pearson Education, 2nd Edition, 2012.	4. G. D. Gordon and W. L. Morgan, "Communications Satellite Handbook", Wiley, 2010. 5. L. J. Ippolito Jr, "Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance", John Wiley & Sons, 2nd Edition, 2017. 6. M.Richharia,"Satellite Communication Systems: Design Principles", Macmillan, 2nd Edition, 2003.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	25%	-	25%	-	25%	-
Level 3	Apply	35%	-	35%	-	35%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
.1. Mr. Saivineeth, ML Accelerator Architect @ Google	1. Dr. Venkatesan, Sr. Scientist (Rtd.), NIOT, Pallikkaranai	1 Dr. Sachin Kumar, SRMIST
	2. Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu	