Course Code	18ECO127T	Course Name	5G Technology – An Overview	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Electronics and Communication Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	Familiarize the underlying principles, concepts, and architecture of 5G wireless communication systems.	Blooms level (1-6)
CLR-2 :	Perceive the knowledge of 5G network Architecture.	
CLR-3 :	Explore the different technologies for radio access in 5G	
CLR-4 :	Explore the 5G Security and Privacy, and threats and countermeasures in 5G	
CLR-5 :	Develop skills to design 5G networks based on real-world scenarios; Smart Cities and Autonomous Vehicles	

Course Outcomes (CO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)
CO-1 :	Comprehend the underlying principles, concepts of wireless communication and 5G Technology, its utilization to 5G Use Cases,	2
CO-2 :	Apply the knowledge of Core a Network and Radio Access Network of 5G .and the concept of network slicing and virtualization	3
CO-3 :	Apply the knowledge radio access technologies like New Radio and Millimeter wave communication	3
CO-4 :	Explore the unique requirements and challenges associated with 5G Security and Privacy.	4
CO-5 :	Design the integration of 5G network and IoT	4

Program Outcomes (PO)												Program Specific Outcomes (PSO)		
1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	Professional Achievement	Project Management Techniques	Analyze & Research
3	-	-	3	-	-	-	-	-	-	-	2	-	-	-
-	3	-	3	-	-	-	-	-	-	-	-	-	-	-
-	3	3	-	-	-	-	-	-	-	-	-	-	-	-
-	3	-	3	-	-	-	-	-	-	-	-	-	-	-
-	-	3	-	3	-	-	-	-	-	-		-	-	-

Duration (hour)		Introduction to Wireless Communication Fundamentals and 5G Technology	5G Network Architecture	Radio Access Technologies in 5G	5G Security and Privacy	5G and Internet of Things (IoT)
		9	9	9	9	9
S-1	SLO-1	Wireless Communication Fundamentals: Overview of Wireless Communication Systems;	Introduction to 5G Network Architecture	Introduction to Radio Access Technologies	Security Challenges in 5G Networks	**Internet of Things (IoT) and 5G Integration** – Introduction, Role of 5G in Enabling IoT Applications
	SLO-2					
S-2	SLO-1	Frequency Bands and Spectrum Allocation in 5G;	5G Core Network (5GC	New Radio (NR) Interface: Overview and Features	Authentication and Access Control in 5G	Integration of 5G and IoT Networks
	SLO-2					
S-3	SLO-1	Multiple Access Techniques: FDMA, TDMA, CDMA	Radio Access Network	New Radio (NR) Interface: Key Technologies	Encryption in 5G	Low Power Wide Area Networks (LPWAN) in 5G
	SLO-2					
S-4	SLO-1	Modulation Techniques: QPSK, QAM, OFDM	Network Slicing: Concept and Implementation;	Massive MIMO in 5G	Privacy-Preserving Techniques in 5G	5G-enabled Smart Cities and Industrial Automation
	SLO-2					
S-5	SLO-1	Introduction to 5G Technology: Evolution of Cellular Networks: From 1G to 5G	Virtualization in 5G	Beamforming in 5G	Threats Detection and Mitigation in 5G Networks	**Future Trends and Applications of 5G**: 5G Beyond 2020: 6G and Beyond;
	SLO-2					
S-6	SLO-1	Key Features and Objectives of 5G	Software-Defined Networking (SDN) in 5G	Beamforming Types	Network Slice Isolation	**5G Use Case**: Autonomous Vehicles
	SLO-2					
S-7	SLO-1	5G Use Cases and Applications	Edge Computing	Small Cells in 5G	Virtualized Infrastructure Security	**5G Use Case**: Augmented Reality/ Virtual Reality.
	SLO-2					
S-8	SLO-1	5G Use Cases and Applications	Mobile Edge Computing	HetNets in 5G	Network Function Verification	**5G Use Case**: Smart Cities
	SLO-2					

S-9	**SLO-1**	Challenges and Opportunities in 5G Deployment	Quality of Service requirements.	Millimeter wave Communication	Secure Over-the-Air (OTA) Updates	**5G Use Case**: Health Care
	SLO-2					

Learning Resources	*1. Afif Osseiran, Jose N Mosserrat, Patrick Marsch,"5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.* *2. Theodore S. Rappaport, Robert W. Heath Jr., Robert C. Daniels, James N. Murdock, "Millimeter Wave Wireless Communications", Prentice Hall, 2015.*	*3.Saad Z. Asif, "5G Mobile Communications: Concepts and Technologies" , CRC Press 2019.* *4. Wan Lei , Anthony C.K. Soong , Liu Jianghua , Wu Yong , Brian Classon , Weimin Xiao , David Mazzarese , Zhao Yang , Tony Saboorian, "5G Sytem Design-An End to End Perspective", Springer 2021.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	25%	-	20%	-	30 %	-	-	-	20%	-
Level 2	Understand	25 %	-	25 %	-	40 %	-	-	-	25 %	-
Level 3	Apply	40%	-	35 %	-	30 %	-	-	-	35 %	-
Level 4	Analyze	10 %	-	20 %	-	-	-	-	-	20 %	-
Level 5	Evaluate	-	-	-	-	-	-	50%	-	-	-
Level 6	Create	-	-	-	-	-	-	50%	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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