

Branch Name:	Signal Processing and Communication
Program Code:	ET214
Course Name:	Ultra-Wideband Communication Systems
Course Code:	2ET2140205T
Pre-requisite Course:	Basic Knowledge of Advanced Wireless Communication

Course Objectives:

1. The course focuses on the basis processing techniques that concerns present and future dynamic UWB communication system.
2. The main purpose of this course is to introduce important areassuch as signal processing techniques, channel modeling, modulation methods, pulse generation, antenna radiation and antenna arrays for UWB communication.
3. The course is also including application, standards and advanced topics in UWB communication systems.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40		-	-	-	100

Subject Contents

Sr. No	Topic	Total Hours	Weight (%)
1	Basic properties of UWB signals and systems – Generation of UWB waveforms: introduction, power spectral density, pulse shape, pulse trains, spectral masks, multipath, penetration characteristics, spatial and spectral capacities, speed of data transmission. Damped sine waves, Gaussian waveforms, designing waveforms for specific spectral masks, practical constraints and effects of imperfections.	5	10
2	Signal processing techniques for UWB systems – UWB channel modeling : the effects of a lossy medium on a UWB transmitted signal, time domain analysis, frequency domain techniques, UWB signal processing issues and algorithms, detection and amplification. A simplified UWB multipath channel model, path loss model, two-ray UWB propagation model, frequency domain autoregressive model, IEEE proposals for UWB channel models.	7	20

3	UWB communications- Advanced UWB Pulse Generation: UWB modulation methods, other modulation methods, pulse trains, UWB transmitter, UWB receiver, multiple access techniques in UWB, capacity of UWB systems, comparison of UWB with other wideband communication systems, interference and coexistence of UWB with other systems. Hermite pulses, orthogonal prolate spheroidal wave functions, wavelet packets in UWB PSM.	8	20
4	UWB antennas and arrays – Position and Location with UWB signals: Antenna fundamentals, antenna radiation for UWB signals, suitability of conventional antennas for the UWB system, impulse antennas, beamforming for UWB signals. Wireless positioning and location, GPS techniques, positioning techniques, time resolution issues, UWB positioning and communications.	6	20
5	Applications using UWB systems – UWB communication standards: Military applications, commercial applications, UWB potentials in medicine. UWB standardization in wireless personal area networks, DS-UWB proposal, MB-OFDM UWB proposal, impulse radio	6	15
6	Advanced topics in UWB communication systems: UWB ad-hoc networks, UWB sensor networks, MIMO and space-time coding for UWB system, self-interference in high data rate UWB communications, Coexistence of DS-UWB with Wi-Max, vehicular radars in the 22-29 Ghz band	7	15
Total		39	100

List of Text Book:

1. “Ultra Wideband Signals and Systems in Communication Engineering”, M. Ghavami, L. B. Michael, and R. Kohne, John Wiley and Sons Ltd, 2007

List of Reference Books:

1. “An introduction to Ultra Wide Band Communication System”, Jeffrey H. Reed, Prentice Hall Inc., NJ, USA, 2005

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom’s Taxonomy Level
CLO1	Understand the various components of UWB communication systems.	1 Remembering 2 Understanding
CLO2	Develop a comprehensive overview of UWB system design that includes propagation, transmitter and receiver, antenna implementation, standards.	2 Understanding 5. Evaluate 3 Applying
CLO3	Understand application, advanced topics, modulation and multiple access techniques, issues in the UWB systems.	4 Analyze

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	H				L	M							H	M	L	
CLO2	H		M	M	L					L		H		M	L	
CLO3		M	H		L									H		L

H: High, M: Medium, L: Low