

Course Code	18ECC205J	Course Name	ANALOG AND DIGITAL COMMUNICATION	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	18MAB203T	Co-requisite Courses	Nil	Progressive Courses	18ECC301T, 18ECC302J, 18ECE221T & 18ECE223T
Course Offering Department	ECE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Introduce and Understand the need for modulation, various Amplitude modulators/demodulators, frequency modulators and demodulators				Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)												
CLR-2 :	Comprehend the radio transmitters and receivers using the modulators and demodulators and to analyze the noise performance																		
CLR-3 :	Introduce basics of Digital modulation and detection techniques																		
CLR-4 :	Analyze the pass band data transmission techniques in terms of probability of error																		
CLR-5 :	Introduce basics of spread spectrum techniques and information theory concepts																		
CLR-6 :	Gain hands-on experience to put theoretical concepts learned in the course to practice.																		
Course Learning Outcomes (CLO):																			
		1	2	3															
CLO-1 :	Understand the concepts of analog modulation and demodulation techniques	2	80	70	Engineering Knowledge														
CLO-2 :	Learn the function of radio transmitters and receivers and familiarize with noise performance of various receivers	2	85	75	Problem Analysis	M	-	-	-	-	-	-	-	H	-	-	H	-	-
CLO-3 :	Understand various digital modulation schemes and matched filter receiver	2	75	70	Design & Development	-	M	H	-	-	-	-	-	-	-	-	H	-	-
CLO-4 :	Understand and analyze various digital pass band data transmission schemes	2	85	80	Analysis, Design, Research	M	-	-	-	-	-	-	-	-	-	-	-	M	H
CLO-5 :	Understanding data transmission using spread spectrum and error coding techniques	2	85	75	Modern Tool Usage	-	-	-	M	-	-	-	-	-	-	-	-	M	-
CLO-6 :	Analyze the operation of analog and digital communication systems and take measurement of various communication systems to compare experimental results in the laboratory with theoretical analysis	2	85	75	Society & Culture	-	H	-	-	-	-	-	-	-	-	M	-	H	
					Environment & Sustainability	-	-	-	-	-	-	-	-	-	-	-	-	-	
					Ethics	-	-	-	-	-	-	-	-	-	-	-	-	-	
					Individual & Team Work	-	-	-	-	-	-	-	-	-	-	-	-	-	
					Communication	-	-	-	-	-	-	-	-	-	-	-	-	-	
					Project Mgt. & Finance	-	-	-	-	-	-	-	-	-	-	-	-	-	
					Life Long Learning	-	-	-	-	-	-	-	-	-	-	-	-	-	
					PSO -1: Professional Achievement	-	-	-	-	-	-	-	-	-	-	-	-	-	
					PSO -2: Project Management	-	-	-	-	-	-	-	-	-	-	-	-	-	
					PSO -3: Analyze & Research	-	-	-	-	-	-	-	-	-	-	-	-	-	

		Analog Modulation	Radio Transmitters and Receivers	Digital Modulation System and Baseband Detection	Passband Data Transmission	Spread Spectrum Techniques and Information theory Concepts
Duration (hour)		15	15	15	15	15
S-1	SLO-1	Modulation, Need for Modulation,	AM transmitter : Low Level,	Pulse modulation systems, Overview of PAM,PWM,PPM	Overview of ASK, FSK, PSK	Spread spectrum Communications, Frequency Hopping Spread Spectrum (FHSS)
	SLO-2	Amplitude Modulation, Types of Amplitude Modulation	AM transmitter : High Level Transmitter	Pulse modulation systems, Overview of PAM,PWM,PPM	Overview of ASK, FSK, PSK	Spread spectrum Communications, Frequency Hopping Spread Spectrum (FHSS)
S-2	SLO-1	Double sideband Full carrier	FM transmitter: Direct Method	Pulse modulation systems, Sampling and quantization	Generation, Signal Space Diagram and detection of FSK	Direct Sequence Spread Spectrum (DSSS)
	SLO-2	Double sideband Full carrier	FM transmitter: Direct Method	Pulse modulation systems, Sampling and quantization	Generation, Signal Space Diagram and detection of FSK	Direct Sequence Spread Spectrum (DSSS)
S-3	SLO-1	Double sideband Suppressed carrier	FM transmitter: Indirect Method	PCM systems	Probability of Error for FSK	Direct Sequence Spread Spectrum (DSSS)
	SLO-2	Single sideband Suppressed carrier, VSB	FM transmitter: Indirect Method	Bandwidth of PCM, PCM TDM signal multiplexing, Limitations of PCM system	Probability of Error for FSK	Code Division Multiple Access of DSSS

S 4-5	SLO-1	Lab-1: AM modulator and Demodulator	Lab-4: Pre emphasis and De-emphasis	Lab-7: DPCM and its Demodulation	Lab-10: QPSK Modulation and Demodulation	Lab-13: Mini Project
	SLO-2					
S-6	SLO-1	Generation of AM waves: Linear method-Collector modulator	Classification of radio receiver, Functions and Characteristics of radio receiver	Data formatting	Generation, Detection, Signal Space Diagram of PSK	Code Division Multiple Access of DSSS
	SLO-2	Generation of AM waves: Linear method-Collector modulator	Tuned Radio Frequency receiver	Data formatting	Generation, Detection, Signal Space Diagram of PSK	OFDM Communication
S-7	SLO-1	Non-linear Modulation-Balanced Modulator	Super-heterodyne receiver- AM	Differential PCM (DPCM)	Probability of Error for PSK	OFDM Communication
	SLO-2	Non-linear Modulation-Balanced Modulator	Super-heterodyne receiver- AM	Differential PCM (DPCM)	Probability of Error for PSK	OFDM Communication
S-8	SLO-1	Demodulation of AM waves : Linear diode detector	Super-heterodyne receiver- FM	Delta modulation (DM)	Generation, signal space diagram and detection of QPSK	Measures of Information
	SLO-2	Demodulation of AM waves : Linear diode detector	Super-heterodyne receiver- FM	Delta modulation (DM), Noise in DM	Generation, signal space diagram and detection of QPSK	Measures of Information
S 9-10	SLO-1	Lab-2: DSB-SC modulator and demodulator	Lab-5: PAM,PPM,PWM modulation and demodulation	Lab-8: DM and its Demodulation	Lab-11: DPSK Modulation and Demodulation	Lab-14: Model Practical Exam
	SLO-2					
S-11	SLO-1	Frequency modulation, Types of FM	Sources of Noise	Demodulation and detection process	Probability of Error for QPSK	Source encoding, Shannon's Channel capacity theorem
	SLO-2	Narrow Band FM, Wide Band FM, Phase modulation	Sources of Noise	Demodulation and detection process	Probability of Error for QPSK	Shannon's Channel capacity theorem
S-12	SLO-1	Generation of Narrowband FM	Noise in AM (Envelope Detection),	Maximum likelihood receiver structure, Matched filter receiver	Generation, signal space diagram and detection of $\pi/4$ QPSK	Linear block codes
	SLO-2	Generation of Narrowband FM	Noise in AM (Envelope Detection),	Maximum likelihood receiver structure, Matched filter receiver	Generation, signal space diagram and detection of $\pi/4$ QPSK	Linear block codes
S-13	SLO-1	Demodulation of FM : Foster seely discriminator	Noise in FM	Probability error of the Matched filter, Inter symbol interference, Eye pattern	Generation, signal space diagram and detection of QAM	Cyclic codes
	SLO-2	Demodulation of FM : Foster seely discriminator	Threshold effect, Pre-emphasis and De-emphasis	Probability error of the Matched filter, Inter symbol interference, Eye pattern	Generation, signal space diagram and detection of QAM	Cyclic codes
S 14-15	SLO-1	Lab-3: FM Modulator and Demodulator	Lab-6: Pulse Code Modulation and Demodulation	Lab-9: PSK Modulation and Demodulation	Lab-12: BER performance analysis of various Modulation Schemes	Lab-15: University Practical Exam
	SLO-2					

Learning Resources	<ol style="list-style-type: none"> 1. Simon Haykin and Michael Moher, "Communication Systems," 5th edition, John Wiley & Sons, 2013 2. Singh. R. P & Sapre. S. D, "Communication Systems: Analog & Digital," 3rd edition, McGrawHill Education, Seventh Reprint, 2016. 3. Simon Haykin, "Communication Systems", John Wiley & Sons, 4th Edition, 20008. 4. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 2nd Edition, 2001 	<ol style="list-style-type: none"> 5. Taub & Schilling, "Principle of Communication Systems", McGraw Hill Inc, 2nd Edition, 2003. 6. John G. Proakis, "Digital Communication", McGraw Hill Inc, 5th Edition, 2008. 7. B.P. Lathi, "Modern Digital and Analog Communication System", Oxford University Press, 3rd Edition, 2005. 8. Shu Lin, Daniel Costello, "Error control coding – Fundamentals and Applications", Prentice Hall, Upper Saddle River, NJ, 2nd Edition, 2004. 9. Lab Manual
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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 Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate Create	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Total	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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