

Programme Structure and Course Details of B.Tech in Electronics and Communication Engineering 2022-26

Course Specifications: Digital Communication

Course Title	Digital Communication
Course Code	ECC309A
Course Type	Core Theory
Department	Electronics and Communication Engineering
Faculty	Engineering and Technology

1. Course Summary

This course deals with the principles of digital communication systems. Students are taught the principles and functional analysis of sub blocks such as digital modulation schemes, coherent and non-coherent demodulation schemes, digital receiver structures, equalization, synchronization and multicarrier modulation techniques.

2. Course Size and Credits:

Number of Credits	04
Credit Structure (Lecture: Tutorial: Practical)	3:1:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department Responsible	Electronics and Communication Engineering
Total Course Marks	100
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- CO-1. Describe the baseband pulse modulation schemes, line coding schemes, and Nyquist criterion for digital transmissions.
- CO-2. Discuss geometric representation of signals, M-ary modulation schemes, equalization techniques of digital communication systems
- CO-3. Explain coherent and non-coherent receiver structures, synchronization, spread spectrum techniques and multicarrier modulations
- CO-4. Analyse digital base band communication systems by applying digital coding, Nyquist criterion, PSD, eye pattern and equalization
- CO-5. Evaluate M-ary modulation schemes, digital receiver structures, synchronization and spread spectrum schemes and multicarrier modulations for digital communication systems
- CO-6. Use software tools for programming and performance analysis of blocksets of digital communication system

4. Course Contents

Unit 1 (Baseband Communication): Pulse Modulation-PAM,PPM-and PDM, Line codes - RZ,NRZ, Manchester, Binary N-zero, substitution codes – PSDs – ISI – Nyquist criterion for distortion less transmission, Quantization & Coding, Quantization error, Companding in PCM

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systems. Differential PCM systems (DPCM) – Pulse shaping, Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems. Correlative coding - M-ary PAM schemes – Eye pattern, Equalization – Zero forcing

Unit 2 (Bandpass Signaling): Geometric representation of signals – ML detection - Correlator and matched filter detection, Passband transmission - generation and detection of ASK, FSK, PSK, DPSK, QPSK, M-ary PSK, ASK, FSK BER and Power spectral Density, Comparison - Structure of non-coherent receivers - generation and detection of BFSK, DPSK – Principles of QAM. Band Pass Sampling, BER Analysis.

Unit 3 (Spread Spectrum Techniques): Spread Spectrum - PN Sequences, Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum Systems (FHSS), Processing gain and Jamming Margin, Application in Cellular Systems

Unit 4 (Synchronization Techniques): Synchronization – Carrier, symbol, Carrier phase estimation, Symbol timing estimation.

Unit 5 (Multicarrier Modulation): Discrete Multi-tone modulation, Multicarrier Modulation, Basics of OFDM System – Orthogonal carriers, FFT Based OFDM System

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)		
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1											3		
CO-2	3	2	1										3	2	
CO-3	3	2	1	2									3	2	
CO-4	3	3	3	3	3								3	3	
CO-5	3	3	3	3	3								3	3	
CO-6	3	3	3	3	3								3	3	

3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		40
Demonstrations		05
1. Demonstration using Videos	03	
2. Demonstration using Physical Models / Systems	00	
3. Demonstration on a Computer	02	
Numeracy		15
1. Solving Numerical Problems	30	
Practical Work		00
1. Course Laboratory	00	
2. Computer Laboratory	00	
3. Engineering Workshop / Course/Workshop / Kitchen	00	

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4. Clinical Laboratory	00	
5. Hospital	00	
6. Model Studio	00	
Others		00
1. Case Study Presentation	00	
2. Guest Lecture	00	
3. Industry / Field Visit	00	
4. Brain Storming Sessions	00	
5. Group Discussions	00	
6. Discussing Possible Innovations	00	
Mid Terms, Laboratory Examination/Written Examination, Presentations		10
Total Duration in Hours		70

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the B.Tech. (Electronics and Communication Engineering) Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE, COs are assessed as illustrated in the following Table.

For Theory Courses Only			
Focus of COs on each Component or Subcomponent of Evaluation			
	Component 1: CE (60% weightage)		Component 2: SEE (40% weightage)
Subcomponent Type ▶	Term Tests	Assignments	100 Marks
CO-1	X		X
CO-2	X		X
CO-3	X		X
CO-4	X	X	X
CO-5		X	X
CO-6		X	
The details of number of tests and assignments to be conducted are presented in the Academic Regulations and Programme Specifications Document.			

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures and Assignments

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2.	Understanding	Classroom lectures and Assignments
3.	Critical Skills	Classroom lectures and Assignments
4.	Analytical Skills	Classroom lectures and Assignments
5.	Problem Solving Skills	Classroom lectures and Assignments
6.	Practical Skills	Assignment
7.	Group Work	Assignment
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment and Examination
10.	Verbal Communication Skills	--
11.	Presentation Skills	--
12.	Behavioral Skills	Course work
13.	Information Management	Assignment and Examination
14.	Personal Management	Course work
15.	Leadership Skills	--

9. Course Resources

a. Essential Reading

1. Course Notes
2. Haykin, S. (2005) Digital Communications. John Wiley

b. Recommended Reading

1. Proakis, J.G. (2001) Digital Communication, 4th edition, Mc-Graw Hill
2. Lathi, B.P. (2007) Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press
3. Sklar B, 2007, Digital Communication Fundamentals and Applications, 2nd Edition, Pearson Education

c. Magazines and Journals

1. IEEE Spectrum

d. Websites

1. www.mwrf.com

e. Other Electronic Resources

1. MATLAB
2. SystemVUE