

# Techno India NJR Institute of Technology



## Course File

Session 2021-22

**Analog and Digital Communication (4EC4-07)**

For Techno India N.J.R. Institute of Technology  
पंकज पोखवाल  
Dr. Pankaj Kumar Porwal  
(Principal)

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(Associate Professor)  
**Department of ECE**



# RAJASTHIAN TECHNICAL UNIVERSITY, KOTA

## SYLLABUS

II Year - IV Semester: B.Tech. (Electronics & Communication Engineering)

### 4EC4-07: Analog and Digital Communication

Credit: 3  
3L+0T+0P

Max. Marks: 150(IA:30, ETE:120)  
End Term Exam: 3 Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course	1
2	Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.	8
3	Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation.	7
4	Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers	8
5	Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.	8
6	Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.	8
<b>Total</b>		<b>40</b>

### Course Overview:

Student will learn fundamentals of Analog and Digital communication from this 40-hour course. In this course, student will study the fundamental concepts and application of different analog and digital systems. Also, they will learn different modulation techniques used in various communication system.

### Course Outcomes:

CO.NO.	Cognitive Level	Course Outcome
1	Knowledge	Analyze and compare different analog modulation schemes for their efficiency and bandwidth
2	Application	Analyze the behavior of a communication system in presence of noise
3	Analysis	Investigate pulsed modulation system and analyze their system performance
4	Synthesis	Analyze different digital modulation schemes and can compute the bit error performance
5	Synthesis	Design a communication system comprised of both analog and digital modulation techniques

### Prerequisites:

1. Fundamentals of various signal types.
2. Must have completed the course on signal and systems.
3. Student should be able to solve the problems of various transforms.

### Course Outcome Mapping with Program Outcome:

Course Outcome	Program Outcomes (PO's)											
	Domain Specific					Domain Independent						
CO. NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1				1		
CO2	3	2	3	3	3	1						
CO3	3	2				2						
CO4	3	3				2				1		
CO5	3	2	3	3		3			2	2		

1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)

### Course Coverage Module Wise:

Lecture No.	Unit	Topic
1	1	<b>INTRODUCTION: OBJECTIVE, SCOPE AND OUTCOME OF THE COURSE</b>
2	2	<b>REVIEW OF SIGNALS AND SYSTEMS, FREQUENCY DOMAIN REPRESENTATION OF SIGNALS</b>
3	3	<b>PRINCIPLES OF AMPLITUDE MODULATION SYSTEMS</b>
4	3	DSB Modulation scheme
5	3	SSB Modulation scheme
6	3	VSB Modulation scheme
7	3	Angle Modulation: Representation of FM signals
8	3	Representation of PM signals
9	3	Review of probability and random process
10	3	Noise in amplitude modulation systems
11	3	Noise calculation in DSB and SSB systems
12	3	Noise in Frequency modulation systems
13	3	Pre-emphasis and Deemphasis
14	3	Threshold effect in angle modulation
15	4	<b>PULSE MODULATION</b>
16	4	Sampling
17	4	Pulse code modulation (PCM)
18	4	Quantization
19	4	SNR calculation in PCM system
20	4	Differential pulse code modulation
21	4	Delta modulation
22	4	Time Division multiplexing
23	4	Digital Multiplexers
24	5	<b>ELEMENTS OF DETECTION THEORY</b>
25	5	Optimum detection of signals in noise
26	5	Bandpass Pulse Transmission- Inter symbol Interference
27	5	Nyquist criterion
28	5	Pass band Digital Modulation schemes
29	5	Amplitude Shift Keying
30	5	Phase Shift Keying
31	5	Coherent communication with waveforms- Probability of Error evaluations
32	5	Frequency Shift Keying
33	5	Probability of Error evaluations
34	5	Quadrature Amplitude Modulation

35	5	Continuous Phase Modulation and Minimum Shift Keying
36	<b>6</b>	<b>DIGITAL MODULATION TRADEOFFS</b>
37	6	Optimum demodulation of digital signals over band-limited channels
38	6	Maximum likelihood sequence detection (Viterbi receiver)
39	6	Equalization Techniques
40	6	Synchronization and Carrier Recovery for Digital modulation

### TEXT/REFERENCE BOOKS

1. Principles of Communication Systems, Herbert Taub, Donald Schilling, Goutam Saha, TMH
2. An Introduction To Analog & Digital Communications, Haykins, Wiley
3. Communication Systems Engineering, Proakis J. G. and Salehi M., Pearson Education

### Teaching and Learning resources:

- **MOOC (NPTEL):** - <https://nptel.ac.in/courses/117/105/117105143/>  
<https://nptel.ac.in/courses/117/101/117101051/>

### Assessment Methodology:

1. Practical exam using lab instruments.
2. Two Midterm exams where student have to showcase subjective learning.
3. Final Exam (subjective paper) at the end of the semester.

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4E1222

Roll No. \_\_\_\_\_

Total No of Pages: **3**

**4E1222**

**B. Tech. IV - Sem. (Main) Exam., May - 2019  
PCC Electronics & Communication Engineering  
4EC4 – 07 Analog and Digital Communication  
EC, EI**

**Time: 3 Hours**

**Maximum Marks: 120**

*Instructions to Candidates:*

**PART - A :** Short answer questions (up to 25 words)  $10 \times 2$  marks = **20 marks**.

*All ten questions are compulsory.*

**PART - B :** Analytical/Problem Solving questions (up to 100 words)  $5 \times 8$  marks = **40 marks**.

*Candidates have to answer five questions out of seven*

**PART - C :** Descriptive/Analytical/Problem Solving questions  $4 \times 15$  marks = **60 marks**.

*Candidates have to answer four questions out of five.*

1. NIL

2. NIL

### **PART – A**

- Q.1 Differentiate between 'bit interleaving' and 'word interleaving'.
- Q.2 What is quantization in PCM system?
- Q.3 Write the important properties of line codes.
- Q.4 What is sampling theorem?
- Q.5 Draw the circuit diagram of envelope detector.
- Q.6 Sketch the signal constellation of QPSK modulation technique.
- Q.7 What is the transmission rate of T1 carrier system?
- Q.8 What is correlator?

Q.9 What is minimum shift keying?

Q.10 Discuss the advantages and disadvantages of pulse modulation as compared to continuous wave modulation.

### **PART – B**

Q.1 Sketch the frequency domain representation of DSB-SC and SSB- SC signals, draw and explain the principle of balance modulator.

Q.2 Determine the probabilities of errors of ASK, PSK and FSK systems and required bandwidth of each system. <http://www.rtuonline.com>

Q.3 Determine the signal to quantization ratio of a delta modulator for a sinusoid signal with a bit rate of 64 kbps and input signal bandwidth of 4 kHz.

Q.4 Explain with the help of block diagrams working of QPSK transmitter and receiver.

Q.5 Draw the block diagram of ADM and explain its working and compare with PCM.

Q.6 Explain the terms slope overload and granular noise in Delta Modulation.

Q.7 Explain optimum filter and matched filter.

### **PART – C**

Q.1 What is Inter symbol interference? Explain the causes, effect and remedies to reduce the ISI in communication systems. Why does raised cosine spectrum provide a means for zero ISI?

Q.2 Draw the block diagram of phasing/Third method of generation of SSB-SC signals and detection of SSB-SC signals and briefly explain it. Also write the applications of SSB-

SC.

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Q.3 Discuss the performance of AM and FM systems in presence of noise. Why pre emphasis and de-emphasis are required? Also discuss the threshold effect in angle modulation.

Q.4 What do you mean by companding in PCM system? Why it is required? What are  $\mu$ -law and A- law of companding?

Q.5 A television signal having a BW of 4.2 MHz is transmitted using binary PCM system.

Given that quantization levels are 512. Determine:

- (i) Code word length
  - (ii) Transmission BW
  - (iii) Final bit rate
  - (iv) O/P signal to quantization ratio.
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