Netaji Subhas Institute of Technology, Bihta, Patna

Department of Electrical and Electronics Engineering

COURSE DELIVERY PLAN

ACADAMIC YEAR: 2021-22

YEAR/SEM: III/5TH SEM

COURCE CODE:110501

COURSE NAME: ANALOG AND DIGITAL COMMUNICATION

COURSE CREDIT:3

COURSE FACULTY: Mrs. KIRAN SINGH

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY, BIHTA PATNA, 801108			
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING			
COURSE: B.TECH	BATCH: 2020-2024	SEMESTER: V	ROOM NO: 101

DAY/TIME	P1	P2	P3	LUNCH	P4	P5	P6
	10:00 AM - 11:00AM	11:00 AM - 12:00PM	12:00 PM - 12:45PM	12:45 PM - 01:25PM	01:25 PM - 02:15PM	02:15 PM - 03:15AM	03:15 PM - 04:00 PM
MONDAY		ANALOG & DIGITAL COMM		LUNCH BREAK			
TUESDAY					ANALOG & DIGITAL COMM		
WEDNESDAY	ANALOG & DIGITAL COMM	ANALOG & DIGITAL COMM LAB					
THRUSDAY	ANALOG & DIGITAL COMM						
FRIDAY		ANALOG & DIGITAL COMM					

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29/11/21

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B. Tech. V Semester (EEE)

PCC-EEE-19 Analog and Digital communication

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3-0-2

Max Marks:	100
Final Exam:	70 Marks
Sessional:	20 Marks
Internals:	10 Marks.

Module 1: Basic blocks of Communication System. Analog Modulation - Principles of Amplitude Modulation, DSBSC, SSB-SC and VSB-SC. AM transmitters and receivers.

Module 2: Angle Modulation - Frequency and Phase Modulation. Transmission Bandwidth of FM signals, Methods of generation and detection. FM Transmitters and Receivers.

Module 3: Sampling theorem - Pulse Modulation Techniques - PAM, PWM and PPM concepts - PCM system – Data transmission using analog carriers (ASK, FSK, BPSK, QPSK).

Module 4: Error control coding techniques – Linear block codes- Encoder and decoder. Cyclic codes – Encoder, Syndrome Calculator. Convolution codes.

Module 5: Modern Communication Systems – Microwave communication systems - Optical communication system - Satellite communication system - Mobile communication system.

Text / References:

1. Simon Haykins, 'Communication Systems', John Wiley, 3rd Edition, 1995.
2. D.Roddy & J.Coolen, 'Electronic Communications', Prentice Hall of India, 4th Edition, 1999.
3. Kennedy G, 'Electronic Communication System', McGraw Hill, 1987.

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Mapping of PO's with CO's

Analog and Digital communication system Course code: 110501	
CO1	Understand the basics of communication system.
CO2	Understand and compare various types of analog modulation techniques
CO3	Understand and compare various types of digital modulation techniques.
CO4	Apply the knowledge of digital electronics and study error control coding techniques.
CO5	Study different types of communication systems and its practical applications.

Mapping of Course outcome with POs

	PO											
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	2	1	0	2	0	2	0	0	0	1	0	3
C02	2	3	2	2	1	2	0	0	0	1	1	3
C03	2	3	2	1	1	2	0	0	0	1	1	3
C04	2	3	2	2	0	2	0	0	0	1	0	2
C05	2	2	1	1	2	2	0	0	0	1	1	3

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Institute / School Name :	Netaji Subash Institute of Technology		
Program Name	**B.Tech (EEE)**		
Course Code	PCC-EEE-19		
Course Name	Analog and Digital Communication		
Lecture	3	**Course Credits**	4
Course Coordinator Name	Mrs. Kiran Singh.		

1. **Scope and Objectives of the Course**

This course is designed to review the fundamentals and practices Analog and Digital communication within Electrical and Electronics engineering. Students will explore various types of communication processes in the theoretical and applied real in the fields of communication engineering. Analog and digital communication curriculum is designed to prepare interested students for future careers in telecom sectors.

The course outcomes are:

At the end of this course, students will demonstrate the ability to

1. Understand the basics of communication system, analog and digital modulation techniques.
2. Apply the knowledge of digital electronics and understand the error control coding techniques.
3. Summarize different types of communication systems and its requirements.

2. **Textbooks**

TB1: Simon Haykins, 'Communication Systems', John Wiley, 3rd Edition, 1995.

3. **Reference Books**

RB1: D.Roddy & J.Coolen, 'Electronic Communications', Prentice Hall of India, 4th Edition, 1999.

RB2: Kennedy G, 'Electronic Communication System', McGraw Hill, 1987.

1. **Course Plan**

Lecture Number	Topics	Web Links for video lectures	Text Book / Reference Book / Other reading material
1-2	**Introduction**		TB1
	Basic blocks of Communication System, Types of communication system, simplex, half duplex ,full duplex communication		
3-4	**Analog Modulation**		TB1, RB3
	Basics of different types of modulation ,need of modulation, carrier signal definition of bandwidth and its importance. Types of analog modulation, Principles of Amplitude Modulation		

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5-8	**Modulation techniques**		TB1, RB2
	Introduction, DSBSC, SSB-SC and VSB-SC. AM transmitters and receivers. superheterodyne receiver, frequency spectrum, S/N ratio		
8-12	**Angle Modulation**		TB1, RB2
	Introduction, Frequency and Phase Modulation, types of frequency modulation, frequency spectrum, phasor diagram of FM and PM. Transmission Bandwidth of FM signals, Methods of generation and detection		
13-16	**FM Transmitters and Receivers**		TB1, RB2
	Types of FM transmitters, need of pre-emphasis and de-emphasis, superhertodyne receiver, advantages and disadvantages of FM over Amplitude Modulation, applications		
17-20	**Pulse Modulation Techniques**		TB1, RB3
	Sampling theorem, Nyquist criteria, Nyquist rate, need of sampling, types of sampling, PAM, PWM and PPM concepts		
21-24	**PCM system**		TB1, RB3
	Introduction, block diagram, Data transmission using analog carriers ASK, FSK, BPSK, QPSK. Energy space diagram, block diagram of transmitter and receiver, probability of error for ASK, FSK, BPSK, QPSK.		
25-32	**Error control coding techniques**		TB1, RB3
	Introduction, Types Error control coding techniques, need of error control coding technique, Linear block codes- Encoder and decoder. Cyclic codes – Encoder, Syndrome Calculator. Convolution codes		
32-40	**Modern Communication Systems**		TB1,RB2
	Microwave communication systems, types of antennas, diversity techniques ,advantages, disadvantages, Snell's laws for Optical communication system ,block diagram, types of optical fibers, Satellite communication system, block diagram, Kepler's laws of planetary motion, Mobile communication system ,cell, frequency hopping		

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1. **Evaluation Scheme:**

Component 1*	Sessional Test (ST)*	20
Component 2	Assignment Evaluation	10
Component 3**	End Term Examination**	70
	Total	**100**

SYLLABUS

Topics	No of lectures	Weightage
Introduction: Basic blocks of Communication System. Analog Modulation - Principles of Amplitude Modulation, DSBSC, SSB-SC and VSB-SC. AM transmitters and receivers.	8	20%
Angle Modulation - Frequency and Phase Modulation. Transmission Bandwidth of FM signals, Methods of generation and detection. FM Transmitters and Receivers.	8	20%
Sampling theorem - Pulse Modulation Techniques - PAM, PWM and PPM concepts - PCM system – Data transmission using analog carriers (ASK, FSK, BPSK, QPSK).	8	20%
Error control coding techniques – Linear block codes- Encoder and decoder. Cyclic codes – Encoder, Syndrome Calculator. Convolution codes.	6	14%
Modern Communication Systems – Microwave communication systems - Optical communication system - Satellite communication system - Mobile communication system	10	26%

This Document is approved by:

Designation	Name	Signature
Course Coordinator	Mrs Kiran Singh	Kiran JDalei
H.O.D	Dr. J. Dalei	
Dean		
Date		

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Institute / School Name :	Netaji Subhas Institute of Technology, Bihta, Patna		
Program Name	B.Tech Electrical and Electronics Engneering		
Course Code	110501		
Course Name	Analog and Digital Communication		
Lecture (per week):	3	**Course Credits**	4
Course Coordinator Name			

LECTURE PLAN

Topics	Lecture Number	Date on which the Lecture was taken
Module 1		
Basic blocks of Communication System	1	1/12/2021
Modulation ,types of Modulation	2	2/12/2021
Analog Modulation - Principles of Amplitude Modulation	3	3/12/2021
DSBSC modulation	4	6/12/2021
SSB-SC	5	7/12/2021
VSB-SC	6	8/12/2021
AM transmitters	7	9/12/2021
AM receivers	8	10/12/2021
Module 2		
Angle Modulation	9	13/12/2021
Frequency Modulation	10	14/12/2021
Phase Modulation	11	15/12/2021
Transmission Bandwidth of FM signals	12	16/12/2021
Methods of generation and detection	13	17/12/2021
Methods of generation and detection	14	20/12/2021
FM Transmitters	15	31/1/2022
FM Receivers	16	4/1/2022
Module 3		
Sampling theorem	17	5/1/2022
Pulse Modulation Techniques - PAM, PWM and PPM concepts	18	6/1/2022
PCM system	19	8/1/2022
ASK, FSK	20	17/1/2022
BPSK	21	18/1/2022
QPSK	22	19/1/2022
Probability of error, S/N ratio	23	21/1/2022
Module 4		
Error control coding techniques	24	24/1/2022
Linear block codes	25	25/1/2022
Encoder and decoder	26	26/1/2022
Cyclic codes – Encoder	27	28/1/2022
Syndrome Calculator	28	31/1/2022
Convolution codes	29	1/2/2022
Convolution codes	30	2/2/2022
Module 5		
Modern Communication Systems	31-32	6/12/22/7/12/22
Microwave communication systems	33	8/2/2022
Microwave communication systems	34	9/2/2022
Optical communication system	35	10/2/2022

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Satellite communication system	36	15/02/2022
Satellite communication system	37	17/02/2022

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Department of Electrical and Electronics Engineering
B.Tech.-5thSem. (Session- 2021- 22)

Analog and Digital Communication

Unit-I Assignment

Q1. Define modulation. What are the needs for modulation?
Q2. What is meant by analog communication system?
Q3. What is meant by baseband signal? Give an example.
Q4. What are the advantages and disadvantages of Analog communications?
Q5. For an AM, each of the sideband power is given by 2KW and carrier power is given by 8KW. Find percentage of modulation?
Q6.A carrier signal of 10 cos (2 x pi x 106 t) is amplitude modulated by a message signal of
a. Find all the possible parameters of AM .
b. Plot AM spectrum and identify the spectral components.
cos (4 x pi x 103 t) with $\mu = 0.5$. Antenna resistance is given by 5 Ω.

Q7. A carrier signal of 10 cos (4 x pi x 105 t) is amplitude modulated by a message signal of 6 cos (pi x 104 t).
a. Find all the possible parameters of AM.
b. Find frequency components of resulting AM signal.

Q8. An AM signal is given by
$s(t)=(20+12\cos(2\pi \times 104t)+ 16\cos(4\pi \times 104t))\cos(2\pi \times 106t)$ Find
(1) All possible parameters of AM
(2) Find the frequency components of given AM signal.

Q9. List the advantages of DSB-FC scheme.
Q10. Derive the power calculation of AM signal.

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Analog and Digital Communication

Unit-II Assignment

Q1. What are the types of angle modulation? Define them.
Q2. What is Carson's rule? Explain.
Q3. Draw the circuit diagram of Varactor diode modulator and explain its working.
Q4. Why FM is more immune to effects of noise?
Q5. Derive an expression for single tone Narrowband FM wave.
Q6. Determine the permissible range in maximum modulation index for
i) Commercial FM that has 50Hz to 15KHz modulating frequencies.
ii) Narrow Band system that allows maximum deviation of 10KHz and 100Hz to 5KHz modulating frequencies.
Q7. A 100MHz carrier has a peak Voltage of 5V. The carrier is frequency modulated by sinusoidal modulating waveform of frequency 2KHz such that the frequency deviation is 75KHz. The modulated waveform passes through zero and is increasing at time T=0. Write expression for the modulated carrier waveform.

Q8. A single tone FM signal is given by
V(t)= 10 sin(16∏ *10^6t+20sin2∏*10^3t)V
Determine modulation index, modulating frequency, frequency deviation, carrier frequency and power of FM signal.

Q9. A carrying frequency 10^6 Hz and amplitude 3V is frequency modulated by sinusoidal waveform of frequency 500Hz and peak amplitude of 1V. as a consequence the frequency deviation is 1Khz. The level of modulating waveform is changed to 5V peak, and the modulating frequency is changed to 2KHz. Write the expression for the new waveform.

Q10. A carrier frequency is modulated by a sinusoidal modulating signal of frequency 2KHz, the resulting in frequency deviation of 5Khz. What is the bandwidth occupied by the modulated waveform? The amplitude of the modulating sinusoidal is increased by factor of 3 and its frequency lowered by 1KHz. What is the new bandwidth?

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Analog and Digital Communication

Unit-III Assignment

Q1. What is sampling? Why it is needed?
Q2. State and prove sampling theorem.
Q3. Compare the probability of error for ASK and BPSK modulation techniques.
Q4. What is aliasing effect? How it can be reduced?
Q5. Explain flat top sampling in detail.
Q6. What is differential pulse code modulation? Explain the working of DPCM with proper block diagram.
Q7. Derive the expression of probability of error for BPSK signal.
Q8. Explain how to generate PPM signal from PWM signal.
Q9. What are the noise consideration in PCM.
Q10. Explain the generation of PCM with neat block diagram.

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Analog and Digital Communication

Unit-IV Assignment

Q1. For a Hamming distance of 5,how many errors can be detected? How many errors can be corrected?

Q2. The parity check matrix of a particular linear block code (7,4)is given by

$$H=\begin{matrix}1&1&1&0&1&0&0\\1&1&0&1&0&1&0\\1&0&1&1&0&0&1\end{matrix}$$

i. Find the generator matrix(G).
ii. List all the code vectors.
iii. What is the minimum distance between the code vectors?
iv. How many errors can be detected? How many errors can be corrected?

Q3.the parity check matrix of (7,4)Hamming code is given below

$$H=\begin{matrix}1&1&0&1&1&0&0\\1&1&1&1&0&1&1\\1&0&1&1&0&0&1\end{matrix}$$

Calculate the syndrome vectors for single bit errors.

Q4. For systematic linear block code, the three parity check digits,c_4,c_5 and c_6 are given by

$C_4=m_1 \oplus m_2 \oplus m_3$

$C_5= m_1 \oplus m_2$

$C_6=m_1 \oplus m_3$

i. Construct a generator matrix.
ii. construct code generated by this matrix
iii. prepare a suitable decoding table.
iv. decode the received words 101100 and 000110.

Q5.For a (7,4) cyclic code, determine generator matrix and parity check matrix if $G(x)=1+x+x^3$.

Q6.Draw the encoder for (7,4)cyclic hamming code generated by the generator polynomial $G(x)=1+x+x^3$.

Q7.The generator polynomial of a(15,11)Hamming code is defined by

$$g(X)=1+X+X^4$$

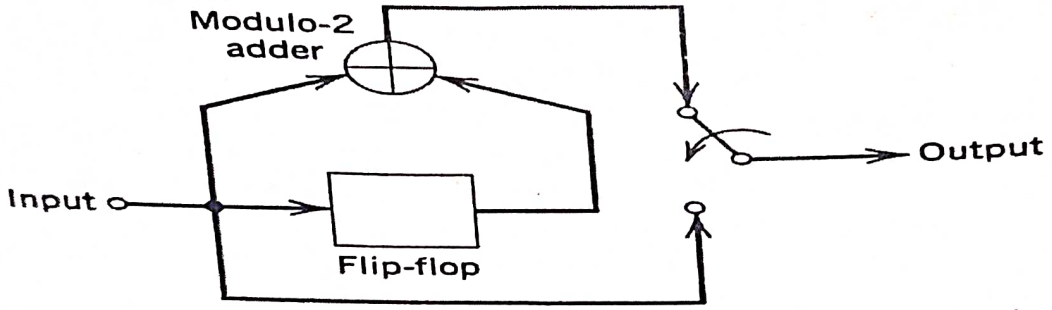
develop encoder and syndrome calculator for this code, using systematic form for the code.

Q8.A convolution encoder has single shift register with two stages, three modulo-2 adder and an output multiplexer. The generator sequence of encoder are as follows:

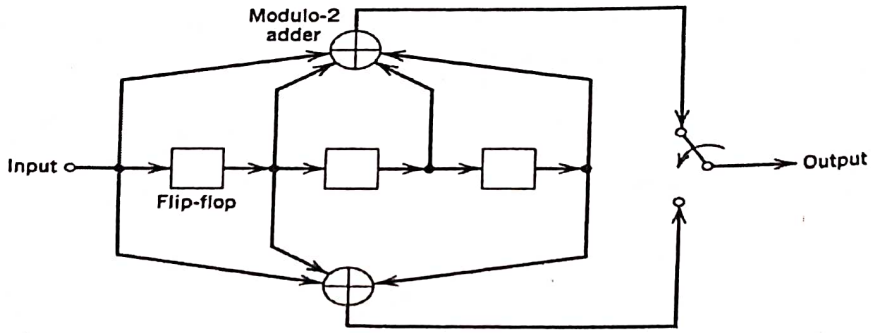
$g^{(1)}=(1\ 0\ 1)$
$g^{(2)}=(1\ 1\ 0)$
$g^{(3)}=(1\ 1\ 1)$

draw the block diagram of encoder.

Q9. Consider the rate r= ½, constraint length K=2 convolutional encoder of fig. the code is systematic. Find the encoder output produced by the message sequence 10111



Q10.Figure shows the encoder for a rate ½ constraint length K=4 convolutional code. Determine the encoder output produced by the message sequence 10111…



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Analog and Digital Communication

Unit-V Assignment

Q1. What is the difference between LEO and GEO satellites?
Q2. State Kepler's laws of planetary motions. Explain ascending and descending nodes of satellites.
Q3. Draw and explain the operation of optical receiver.
Q4. What is a Look angle ?how it is calculated with the shifting of satellite with respect to earth station.
Q5. Explain the telemetry tracking and command control system in detail.
Q6. Explain Snell's law. What is total internal reflection?
Q7. Explain the different types of diversity techniques used in wireless communication.
Q8. What is the need of cladding?
Q9. Define numerical aperture of step index fiber.
Q10. Explain the advantages and disadvantages of satellite communication.

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