Bachelor of Technology (Electronics & Communication Engineering)
Scheme of Studies/Examination
Semester VI

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Examination Schedule (Marks)				Duration of Exam (Hrs)
					Theory	Sessional	Practical	Total	
1	ECE-302N	Digital Signal Processing	3:1:0	4	75	25	0	100	3
2	ECE- 304N	Digital Design Using Verilog	3:1:0	4	75	25	0	100	3
3	ECE-306N	Digital Communication	3:1:0	4	75	25	0	100	3
3	HS-302N	Fundamentals of Management	4:0:0	4	75	25	0	100	3
5	ECE-308N	Computer Communication Network	3:1:0	4	75	25	0	100	3
6	ECE-310N	Digital Signal Processing lab	0:0:3	3	0	40	60	100	3
7	ECE- 312N	Digital Design Using Verilog Lab	0:0:3	3	0	40	60	100	3
8	ECE-314N	Digital Communication lab	0:0:3	3	0	40	60	100	3
9	ECE- 316N*	Personality & Soft Skills Development 2	2:0:0	2	0	100	0	100	3
		Total		31	375	345	180	900	

*** The student will be evaluated on the basis of technical seminar and technical group discussions out of 50 marks for each. All students have to undergo for industrial training after 6th semester which will be evaluated in 7th semester**

ECE-302N	Digital Signal Processing					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessional**	**Total**	**Time**
3	**1**	**0**	**75**	**25**	**100**	**3 Hr.**
Purpose	**To familiarize the students with the basic concepts of Digital Signal Processing, Z-Transform, Fourier transform Designing of FIR and IIR Filters.**					
Course Outcomes						
CO1	**Introduce to Z-Transform, Fourier Transform and their properties.**					
CO2	**To understand the basic concepts of Frequency Domain sampling and implementation of Discrete Time Systems.**					
CO3	**Familiarization with the Design of FIR Filters.**					
CO4	**Familiarization with the Design of IIR Filters.**					

Unit-I

Discrete Transforms: Z- transform and its properties, Inversion of Z-transform, One sided Z-transform and solution of differential equations. Analysis of LTI systems in Z-domain, causality, stability, schur-cohn stability test, relationship between Z-transform and Fourier transform.

Frequency Selective Filters: All pass filters, minimum-phase, maximum-phase and mixed-phase systems, Goertzel algorithm, Chirp Z-transform, applications of Z-Transform.

Unit-II

Frequency Domain Sampling and DFT: Properties of DFT, Linear filtering using DFT, Frequency analysis of signals using DFT, radix 2, radix-4, computation of DFT of real sequences.

Implementation of Discrete Time Systems: Direct form, cascade form, frequency sampling and lattice structures for FIR systems. Direct forms, transposed form, cascade form parallel form. Lattice and lattice ladder structures for IIR systems.

Unit-III

Design of FIR Filters : Characteristics of practical frequency selective filters. Filters design specifications peak pass band ripple, minimum stop band attenuation. Four types of FIR filters, alternation theorem.

Design of FIR filters using windows, Kaiser window method comparison of design methods for FIR filters, Gibbs phenomenon, design of FIR filters by frequency sampling method, design of optimum equiripple FIR filters.

Unit-IV

Design of IIR Filters: Design of IIR filters from analog filters, Design by approximation of derivatives, Impulse Invariance Method, Bilinear Transformation Method, Least Square Methods.

Characteristics of Butterworth, Chebyshev and Elliptical analog filters, Design of IIR filters, Frequency transformation, , design of IIR filters in frequency domain.

Text Books:
John G. Proakis, Digital Signal Processing, PHI.

Reference Books:

1. **S. K. Mitra, Digital Signal Processing , TMH**
2. **Rabiner and Gold, Digital Signal Processing, PHI**
3. **Salivahan, Digital Signal Processing , TMH**
4. **Digital Signal Processing: Alon V. Oppenhelm;PHI**

Note: Question paper template will be provided to the paper setter.

LECTURE PLAN

Lect.	Topics
1.	Z- transform
2.	properties of Z-transform
3.	Inversion of Z-transform
4.	Inversion of Z-transform
5.	One sided Z-transform & solution of differential equations
6.	Analysis of LTI systems in Z-domain
7.	causality, stability, schur-cohn stability test
8.	relationship between Z-transform and Fourier transform. Frequency Selective Filters: All pass filters
9.	minimum-phase, maximum-phase and mixed-phase systems
10.	Goertzel algorithm & Chirp Z-transform
11.	applications of Z-Transform
12.	Frequency Domain Sampling and DFT
13.	Properties of DFT
14.	Linear filtering using DFT
15.	Frequency analysisof signals using DFT
16.	radix 2, radix-4
17.	computation of DFT of real sequences
18.	Implementation of Discrete Time Systems: Direct form,cascade form

19.	frequency sampling and lattice structures for FIR systems
20.	frequency sampling and lattice structures for FIR systems.
21.	Direct forms, transposed form
22.	cascade form parallel form
23.	Lattice and lattice ladder structures for IIR systems
24.	Lattice and lattice ladder structures for IIR systems
25.	Design of FIR Filters : Characteristics of practical frequency selective filters
26.	Filters design specifications
27.	peak pass band ripple. minimum stop band attenuation
28.	Four types of FIR filters, Alternation theorem
29.	Design of FIR filters using windows, Kaiser window method
30.	Comparison of design methods for FIR filters, Gibbs phenomenon
31.	Design of FIR filters by frequency sampling method
32.	Design of optimum equiripple FIR filters
33.	Design of IIR filters from analog filters
34.	Design by approximation of derivatives
35.	Impulse Invariance Method
36.	Bilinear Transformation Method
37.	Least Square Methods
38.	Characteristics of Butterworth, Chebyshev and Elliptical analog filters
39.	Design of IIR filters
40.	Frequency transformation, design of IIR filters in frequency

TUTORIAL SHEET-I

1. Find the Z-Transform and Region of convergence of the discrete time signal

$$X(n)=\begin{cases} a^n, n \geq 0 \\ 0, n < 0 \end{cases}$$

2. Explain the properties of Z-Transform?
3. Determine the inverse Z-Transform of

$$X(z) = \frac{1+2Z^{-1}}{(1-2Z^{-1}+Z^{-2}} \text{ when}$$

a) X(n) is casual
b) x(n) is Anti casual
4. Explain Schur-Cohn stability criteria?
5. Compute 3-point DFT of the sequence

$X(n)= \frac{1}{2},\frac{1}{2},\frac{1}{2},\frac{1}{2},0,0,0,0$ by radix 2 DIT & DIF algorithm.

6. Explain properties of DFT.

TUTORIAL SHEET -2

1.Discuss the direct form and cascade form structures of FIR systems.
2. Explain frequency sampling & lattice structures of FIR systems.
3. Obtain direct form I and II and cascade form realization of a system described by:

$$y(n)-\frac{3}{4}y(n-1)+\frac{1}{8}y(n-2)=x(n)+\frac{1}{2}x(n-1)$$

4. Determine the lattice coefficients corresponding to the FIR filter with system function

$$H(z) = A_3(z) = I + \frac{13}{24}Z^{-1} + \frac{5}{8}Z^{-2} + \frac{1}{3}Z^{-3}$$

5. Discuss various structures of IIR system.
6. Explain direct forms I & II with an example.

TUTORIAL SHEET -3

1. Compare analog filter with digital filters. Also compare FIR and IIR filters.
2. Explain the design of linear phase FIR filters using windows.
3. Explain frequency sampling method of design of FIR filters.
4. Determine the co-efficient of linear phase FIR filters of length M = 15 which has a symmetric unit sample response and frequency response that satisfy the conditions.

$$Hr(\frac{2\Pi k}{15}) = \begin{Bmatrix} 1 if k = 0,1,,2,3 \\ A if k = 4 \\ 0 if k = 5,6,7 \end{Bmatrix}$$

5. Discuss the design of optimum equiripple FIR filters.
6. Explain alteration theorem.

TUTORIAL SHEET -4

1. Explain IIR filter design by approximation of derivatives methods.
2. Explain IIR filters design by impulse invariance.
3. Explain method z-transformation of IIR filter design.
4. Explain least square methods.
5. Discuss the design of IIR filter in frequency domain.

TUTORIAL SHEET -5

1. Explain Gibbs Phenomenon.
2. Explain Frequency wrapping.
3. Discuss the state space structure of lIR filter.
4. Discuss types of FIR filter.
5. Explain BZT.
6. Explain frequency transformation.

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BT-6 / M-18

DIGITAL SIGNAL PROCESSING

Paper–ECE–302N

Time allowed : 3 hours] *[Maximum marks : 75*

Note :- *Attempt any five questions. Selecting at least one question from each unit.*

Unit–I

1. (a) State and prove the correlation property of Z-transform. 7

(b) Determine the inverse z-transform of the sequences system function $H(z) = \frac{1}{(z-1)(z-0.8)}$

For the following ROC, determine the stability of the system: 8

(i) $|z| > 1$

(ii) $|z| < 0.8$

(iii) $0.8 < |z| < 1$

2. (a) State and prove that a causal LTI-system is BIBO stable if and only if its impulse response is absolutely summable. Assume system is initially relaxed. 7

(b) Explain the Chirp Z- transform algorithm for linear filtering approach. 8

Unit–II

3. (a) Given $x(n) = \{1, -1, -1, -1, 1, 1, 1, -1\}$ and $N = 8$, then find $X(k)$ using Radix -2 DIF FFT algorithm. 8

(b) Give the comparison between FIR and IIR systems. 7

4. (a) Explain the lattice structure for a FIR- system. 8

(b) Develop the direct form-I and form-II for the IIR system given by $y(n) = 2b \cos(w_o)\, y(n-1) - b^2 y(n-2) + x(n) - b \cos(w_o)\, x(n-1)$ 7

Unit–III

5. (a) Define window function. Derive an expression for frequency response of a rectangular window function. 8

(b) Find the magnitude and phase response of the linear phase FIR filter, when its impulse response is symmetric. 7

6. (a) A low pass filter is to be designed with the following desired frequency response

$$H_d(e^{jw}) = e^{-j2w} \; ; -\pi/4 \leq w \leq \pi/4$$

$$0 \; ; \text{otherwise}$$

Determine the filter coefficients $h_d(n)$ if the window function is defined as

$$w(n) = 1 \; ; 0 \leq n \leq 4$$

$$0 \; ; \text{otherwise}$$

Also, determine the frequency response $H(e^{jw})$ of the desire filter. 10

(b) Explain the Gibbs phenomenon and its consequences. 5

Unit–IV

7. (a) Convert the analog filter into a digital filter whose system function is given by

ECE-304N	Digital Design Using Verilog					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
3	1	0	75	25	100	3 Hr.
Purpose	To familiarize the students with the conventions of the Verilog HDL programming, algorithmic levels of abstraction for modeling digital hardware systems, Finite State Machines, the concept of test-benches to create testing behavioral environments for simulation based verification.					
Course Outcomes						
CO1	To understand the constructs and conventions of the Verilog HDL programming.					
CO2	To understand the structural, register-transfer level (RTL), and algorithmic levels of abstraction for modeling digital hardware systems.					
CO3	To design and modeling of combinational and sequential digital systems (Finite State Machines).					
CO4	To apply the concept of test-benches to create testing behavioral environments for simulation based verification.					

Unit-I

Introduction: Introduction, conventional approach to digital design, VLSI design, ASIC design flow, Role of HDL.Conventional Data flow, ASIC data flow, Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module, Simulation and Synthesis Tools, Test Benches.

Language constructs and conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks.

Unit-II

Gate level modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flip-flops with Gate Primitives, Delays, Strengths and Contention Resolution, Net Types, Design of Basic Circuits.

Behavioral modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Examples, Assignments with Delays, Wait construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non-blocking Assignments, The case statement, Simulation Flow, if and if-else constructs, assign-deassign construct, repeat construct, for loop, the disable construct, while loop, forever loop, parallel blocks, force-release construct, Event.

Unit-III

Modeling at data flow level: Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators, Additional Examples.

Switch level modeling: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Trireg Nets.

Unit-IV

Functions, tasks, and user defined primitives: Introduction, Function, Tasks, User- Defined Primitives (UDP), FSM Design (Moore and Mealy Machines).

System tasks, functions, and compiler directives: Introduction, Parameters, Path Delays, Module Parameters, System Tasks and Functions, File-Based Tasks and Functions, Compiler Directives, Hierarchical Access, General Observations.

Text Books:

1. **T. R. Padmanabhan, B. Bala Tripura Sundari (2004), Design through Verilog HDL, Wiley & Sons Education, IEEE Press, USA.**

2. J. Bhaskar (2003), A Verilog Primier, 2nd edition, BS Publications, India.

Reference Books:

1. **Samir Palnitkar (2013), Verilog HDL, Pearson India.**
2. **Stephen. Brown, ZvonkoVranesic (2005), Fundamentals of Logic Design with Verilog, Tata McGraw Hill, India.**
3. **Charles H. Roth (2004), Digital Systems Design using VHDL, Jr. Thomson Publications, India.**

Note: Question paper template will be provided to the paper setter.

LECTURE PLAN

Lect.	Topics
1.	HDL.Conventional Data flow
2.	ASIC data flow,
3.	Verilog as HDL
4.	Levels of Design Description
5.	Concurrency
6.	Simulation and Synthesis
7.	Functional Verification,.
8.	System Tasks
9.	Programming Language Interface (PLI),Module
10.	Simulation and Synthesis Tools, Test Benches.
11.	Language constructs and conventions: Introduction, Keywords, Identifiers, White Space Characters,
12.	Comments, Numbers, Strings, Logic Values
13.	Strengths, Data Types, Scalars and Vectors
14.	Parameters, Memory,Operators, System Tasks
15.	Gate level modeling: Introduction, AND Gate Primitive
16.	Module Structure, Other Gate Primitives
17.	Illustrative Examples,
18.	Tri-State Gates, Array of Instances of Primitives,

19.	Additional Examples,
20.	Design of Flip-flops with Gate Primitives
21.	Delays, Strengths and Contention Resolution, Net Types, Design of Basic Circuits.
22.	Behavioral modeling: Introduction, Operations and Assignments, Functional Bifurcation
23.	Initial Construct, Always Construct
24.	Examples, Assignments with Delays, Wait construct, Multiple Always Blocks
25.	Designs atBehavioural Level
26.	Blocking and Non-blocking Assignment
27.	the case statement, Simulation Flow, if and ifelse
28.	constructs, assign-de assign construct, repeat construct, for loop, the disable construct, while loop
29.	forever loop, parallel blocks, force-release construct, Event
30.	Modeling at data flow level: Introduction, Continuous Assignment
31.	Delays and Continuous Assignments, Assignment to Vectors
32.	Structures, Operators, Additional Examples
33.	Switch level modeling: Introduction, Basic Transistor Switches
34.	CMOS Switch, Bi-directional Gates
35.	Time Delays with Switch Primitives, Instantiations with Strengths and Delays
36.	Strength Contention with Trireg Nets
37.	Functions, tasks, and user defined primitives: Introduction, Function, Tasks,
38.	User- Defined Primitives(UDP)
39.	FSM Design (Moore and Mealy Machines).
40.	System tasks, functions, and compiler directives: Introduction, Parameters, Path Delays, Module
41.	Parameters, System Tasks and Functions
42.	File-Based Tasks and Functions
43.	Compiler Directives, Hierarchical Access, General Observations.

TUTORIAL SHEET-I

1. Explain conventional approach to digital design.

2. Explain the difference between Simulation and Synthesis

3. Explain the concept of ASIC design flow and Conventional Data flow.

4. Explain different types of data.

TUTORIAL SHEET-II

1. Explain design of Flip-flops with Gate Primitives.

2. What do you mean by Blocking and Non-blocking assignments.

3. How to design a basic circuit using HDL.

4. Explain the meaning of Functional Bifurcation.

TUTORIAL SHEET-III

1. Discuss Modeling at data flow level.

2. Explain the basic Transistor Switches in relation to switch level modeling.

3. What is time Delays with Switch Primitives.

4. Explain the difference between switch level and data flow modeling.

TUTORIAL SHEET-IV

1. Explain User- Defined Primitives (UDP) in detail.

2. What is FSM Design i.e Moore and Mealy Machines.

3. Explain the concept of Compiler Directives in detail.

4. Discuss File-Based Tasks and Functions.

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BT-6 / M-18

DIGITAL DESIGN USING VERILOG

Paper–ECE-304 N

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt any **five** questions by selecting atleast **one** question from each unit.*

Unit–I

1. (a) Explain ASIC Design flow in detail. 7

2. Explain the following terms.

   (i) $ monitor

   (ii) Nets

   (iii) Ternary operator

   (iv) Memory declaration

   (v) Net Data type 15

Unit–II

3. (a) Design 4:16 decoder circuit using 3:8 decoder and also write its verilog code using gate level modeling. 10

   (b) Explain tri-state gates with its instantiation syntax. 5

4. (a) Explain initial construct and wait construct with syntax. 5

   (b) Design 4-bit left shift register and also write its verilog code using behavioural modeling. 10

Unit–III

5. (a) Define unary and relational operators. 7

   (b) Explain BCD adder and write its verilog code using dataflow modeling. 8

6. (a) Explain switch primitives with their syntax in verilog. 8

   (b) Design three input NAND gate using resistive pullup load. 7

Unit–IV

7. (a) Explain User-defined primitives and write a UDP for 2-input NAND gate. 7

   (b) Explain system tasks and functions. 8

8. (a) Explain compiler directives. 8

   (b) Write a verilog code for 8-bit parity check by calling a function for odd parity. 7

ECE-306N	Digital Communication					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessional**	**Total**	**Time**
3	**1**	**0**	**75**	**25**	**100**	**3 Hr.**
Course Outcomes						
CO1	**Student will be able to perform coding of various sources.**					
CO2	**Student will be able to analyze various basic digital pulse modulation schemes.**					
CO3	**Student will be able to understand base band pulse transmission.**					
CO4	**Student will be able to analyze various basic digital modulation techniques.**					

Unit – I

Information Theory: Introduction, Entropy, Huffman Coding, Channel Capacity,Channel Coding, Linear Block Codes, Matrix Description, Syndrome Decoding, Hamming Code, Cyclic Code,Convolution Code generation and Viterbi decoding.

Unit – II

Pulse Modulation System: Model of digital communication systems, Sampling theorem for basebandand bandpass signals: natural sampling, Flat top sampling, Signal recovery & holding, Quantization of signal, Quantization error, Source coding & companding, Pulse code modulation (PCM), Noise in PCM systems, Differential pulse code modulation (DPCM), Adaptive pulse code modulation (ADPCM), Delta modulation (DM), Comparison of PCM, DPCM and DM, Adaptive delta modulation, Quantization noise, Time division multiplexed systems (T & E type systems), Calculation of O/P signal power, The effect of thermal noise, O/P signal to noise ratio in PCM, Quantization noise in delta modulation, The O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation

Unit – III

Base Band Pulse Transmission: Matched filter and its properties average probability of symbol error in binary enclosed PCM receiver, Intersymbol interference, Nyquist criterion for distortionless base band binary transmission, ideal Nyquist channel raised cosine spectrum, correlative level coding Duo binary signalling, tapped delay line equalization, adaptive equalization, LMS algorithm, Eye pattern.

Unit – IV

Digital Pass Band Transmission: Pass band transmission model; gram Schmidt orthogonalization procedure, geometric Interpretation of signals, Response of bank of correlaters to noise input, detection of known signal in noise, Hierarchy of digital modulation techniques, BPSK, DPSK, DEPSK, QPSK, systems; ASK, FSK, QASK, Many FSK, MSK, Many QAM, Signal space diagram and spectra of the above systems, effect of intersymbol interference, bit symbol error probabilities, synchronization.

Text Books:

1. **Proakis John G., Digital Communication System, McGraw, (2000) 4th ed.**
2. **Simon Haylein, Digital Communication Systems, Wiley India edition, (2009) 2nd ed.**
3. **Information Theory,Coding and Cryptography, Ranjan Bose, TMH, II edition, 2007**

Reference Books :

1. **Lathi B. P., Modern Analog and Digital Communication, , Oxford University Press, (1998) 3rd ed.**
2. **Taub & Schilling, Principles of Communication Systems, McGraw Hill Publications, (1998) 2nd ed.**
3. **Simon Haykin, Communication Systems, John Wiley Publication, 3rd ed.**

4. **Sklar, Digital Communications, Prentice Hall-PTR, (2001) 2nd ed.**
5. **R N Mutagi, Digital Communication: Theory, Techniques and Applications, Oxford University Press, 2nd ed.**

Note: Question paper template will be provided to the paper setter.

LECTURE PLAN

Lect.	Topics
1.	Information Theory: Introduction, Entropy
2.	Huffman Coding
3.	Channel Capacity,Channel Coding
4.	Linear Block Codes
5.	Matrix Description, Syndrome Decoding
6.	Hamming Code
7.	Cyclic Code
8.	Convolution Code generation and Viterbi decoding
9.	Pulse Modulation System: Model of digital communication systems,
10.	Sampling theorem for baseband and band pass signals
11.	natural sampling, Flat top sampling, Signal recovery & holding
12.	Quantization of signal,Quantization error
13.	Source coding & companding
14.	Pulse code modulation (PCM), Noise in PCM systems
15.	Differential pulse code modulation (DPCM), Adaptive pulse code modulation (ADPCM)
16.	Delta modulation(DM)
17.	Comparison of PCM, DPCM and DM, Adaptive delta modulation, Quantization noise
18.	Time division multiplexed systems (T & E type systems)
19.	Calculation of O/P signal power, The effect of thermal noise, O/P

	signal to noise ratio in PCM
20.	Quantization noise in delta modulation
21.	The O/P signal to quantization noise ratio in delta modulation
22.	O/P signal to noise ratio in delta modulation
23.	Matched filter and its properties
24.	average probability of symbol error in binary enclosed PCM receiver
25.	Intersymbol interference
26.	Nyquist criterion for distortionless base band binary transmission
27.	ideal Nyquist channel raised cosine spectrum
28.	correlative level coding Duo binary signalling
29.	tapped delay line equalization
30.	adaptive equalization
31.	LMS algorithm, Eye pattern
32.	Pass band transmission model
33.	gram Schmidt orthogonalization procedure
34.	geometric Interpretation of signals
35.	Response of bank of correlaters to noise input, detection of known signal in noise
36.	Hierarchy of digital modulation techniques, BPSK, DPSK, DEPSK
37.	QPSK, systems; ASK, FSK, QASK, Many FSK, MSK
38.	Many QAM, Signal space diagram and spectra of the above systems
39.	effect of ntersymbol interference
40.	bit symbol error probabilities

Tutorial Sheet-1

1. What are the cyclic codes? Explain the fundamental properties of cyclic codes.

2. Explain the operation of any convolution Encoder.
3. What is the use of syndromes in the decoding of cyclic codes? Explain syndrome decoding.
4. With the help of suitable example, explain the Viterbi algorithm for the decoding of the convolution code.

Tutorial Sheet-2

1. What is the need of sampling. Explain sampling theorem with it's proof.
2. Explain PAM with proper block diagram .also find the relation for Transmission Bandwidth .
3. Discuss PCM in detail .how DPCM differs from it and discuss the advantages associated with DPCM.
4. The information in an analog signal voltage waveform is to be transmitted over a PCM system with an accuracy of +-0.1%(full scale).The analog voltage waveform has a BW of 100 Hz and an amplitude range of +10 V to -10V.
   (i) Find the minimum sampling rate required.
   (ii) Find the no. of bits in each PCM word.
   (iii) Find the minimum bit rate required in the PCM signal.
   (iv) Bit rate or Signaling rate.

Tutorial Sheet-3

1. Explain Matched filter& it's average Probability of Symbol error in binary enclosed PCM receiver .
2. Explain the phenomenon of Intersymbol Interference & Eye Pattern.
3. Define Duobinary Signaling scheme. Compare binary PAM system & Duobinary PAM systems.
4. Write short note on the following
   (i) Adaptive Equalization
   (ii) LMS Algorithm

Tutorial Sheet-4

1. Describe the direct sequence spread sequence spread spectrum with coherent BPSK.
2. Explain Signal Space dimensionality & processing gain .
3. Write a note on following
   (i) Frequency Hopping Spread Spectrum
   (ii) PN Sequence Generation
   (iii) Intersymbol Interference
   (iv) Adaptive Equalization

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BT-6 / M-18
DIGITAL COMMUNICATION
Paper–ECE–306 N

Time allowed : 3 hours] *[Maximum marks : 75*

Note :- *There are total **Eight** questions. Each question carries equal marks. The candidate is required to attempt **five** questions, selecting **one** question from each unit.*

Unit–I

1. (a) For a (6,2) linear block code, the generator matrix G is

$$G=\begin{bmatrix}10 & 1 & 11 & 0\\ 01 & 1 & 01 & 1\end{bmatrix}$$ 7

(i) Construct the code table for this code and determine the minimum distance between code-words.

(ii) Prepare a suitable decoding code.

(b) Define Entropy. Prove that entropy is maximum when all messages are equiprobable. 8

2. (a) A zero memory source emits six messages with probabilities 0.1, 0.2, 0.1, 0.3, 0.05, 0.1, 0.05 and 0.1. Find the 4-ary Huffman code and determine the code efficiency. 7

(b) A continuous signal is band limited to 5 KHz. The signal is quantized to 8 levels with probabilities 0.025, 0.2, 0.2,0.1, 0.1, 0.05, 0.05, 0.05. Calculate entropy and rate of information. 8

Unit–II

3. (a) What is Nyquist rate? Why the sampling below the Nyquist rate results in frequency aliasing? Explain. 8

   (b) A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of system is equal to 50×10^6 b/s. 3+4

   (i) What is the maximum message bandwidth for which the system operates satisfactorily?

   (ii) Determine the output signal-to-(quantization) noise ratio when a full load sinusoidal modulating wave of frequency 1 MHz. is applied to the input.

4. (a) Show that, with a non–uniform quantizer, the mean square value of the quantization error is approximately equal to $(1/12)\sum_i \Delta_i^2 p_i$, where Δ_i is the i^{th} step size and p_i is the probability that the input signal amplitude lies within the i^{th} interval. Assume that the step size Δ_i is small compared with the excursion of input signal. 7

   (b) What is delta modulation? Draw the block diagram of delta modulator transmitter and explain its working with its wavefors. Also, illustrate the problems of delta modulation with necessary waveforms. 8

Unit–III

5. (a) Briefly explain tapped delay line equalization and adaptive equalization. 8

   (b) Binary data at 9600 bits/sec. are transmitted using 8-ary

PAM modulation with a system using a raised cosine roll-off characteristics. The system has a frequency response out to 2.4 kHz. 3+4

(i) What is symbol rate?

(ii) What is roll-off factor of filter characteristics?

6. (a) Define matched filter. Discuss probability of error in data transmission employing a matched filter. 8

(b) What is Intersymbol Interference? How is its effect reduced? 7

Unit–IV

7. (a) Discuss the Gram Schmidt orthogonalization procedure? 7

(b) A set of M signal waveform $\{S_{im}(t)\}$ are complex valued. Derive the equation for the Gram Schmidt procedure that will result in a set of $N \leq M$ orthonormal signal waveforms. 8

8. (a) Explain the generation and detection of QPSK. 8

(b) A continuously operating coherent BPSK system makes errors at the average rate of 100 errors per day. The data rate is 100 bits/s. The single sided noise power spectral density is $N_0=10^{-10}$W/Hz. 3+4

(i) If the system is ergodic, what is the average bit error probability?

(ii) If the value of received average signal power is adjusted to be 10^{-6} W, will this received power be adequate to maintain the error probability found in part (a)?

HS-302N	Fundamentals of Management					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessional**	**Total**	**Time**
4	**0**	**0**	**75**	**25**	**100**	**3 Hrs.**
Purpose	**To make the students conversant with the basics concepts in management thereby leading to nurturing their managerial skills**					
Course Outcomes						
CO1	**An overview about management as a discipline and its evolution**					
CO2	**Understand the concept and importance of planning and organizing in an organization**					
CO3	**Enabling the students to know about the importance of hiring and guiding the workforce by understanding the concept of leadership and communication in detail**					
CO4	**To understand the concept and techniques of controlling and new trends in management**					

Unit-I

Introduction to Management: Meaning, Definition, nature, importance & Functions, Management as Art, Science & Profession- Management as social System, Concepts of management-Administration Evolution of Management Thought: Development of Management Thought- Scientific management, Administrative Theory of Management, Bureaucratic Organization, Behavioral approach (Neo Classical Theory): Human Relations Movement; Behavioral Science approach; Modern approach to management – Systems approach and contingency approach.

Unit-II

Planning: nature, purpose and functions, types of plans, planning process, Strategies and Policies: Concept of Corporate Strategy, formulation of strategy, Types of strategies, Management by objectives (MBO), SWOT analysis, Types of policies, principles of formulation of policies

Organizing: nature, importance, process, organization structure: Line and Staff organization, Delegation of Authority and responsibility, Centralization and Decentralization, Decision Making Process , Decision Making Models, Departmentalization: Concept and Types (Project and Matrix), formal & informal organizations.

Unit-III

Staffing: concept, process, features; manpower planning; Job Analysis: concept and process; Recruitment and selection: concept, process, sources of recruitment; performance appraisal, training and development. Directing: Communication- nature, process, formal and informal, barriers to Effective Communication, Theories of motivation- Maslow, Herzberg, McGregor ; Leadership – concept and theories, Managerial Grid, Situational Leadership. Transactional and Transformational Leadership.

Unit-IV

Controlling: concept, process, types, barriers to controlling, controlling Techniques: budgetary control, Return on investment, Management information system-MIS , TQM-Total Quality Management, Network Analysis- PERT and CPM.

Recent Trends in Management: Social Responsibility of Management–Management of Crisis, Total Quality Management, Stress Management, ., Concept of Corporate Social Responsibility (CSR) and business ethics. Functional aspects of business: Conceptual framework of functional areas of management- Finance; Marketing and Human Resources.

Text Books

1. **Management Concepts - Robbins, S.P; Pearson Education India**
2. **Principles of Management - Koontz &O'Donnel; (McGraw Hill)**

Reference Books

1. **Business Organization and Management – Basu ; Tata McGraw Hill**
2. **Management and OB-- Mullins; Pearson Education**
3. **Essentials of Management – Koontz, Tata McGraw-Hill**
4. **Management Theory and Practice – Gupta, C.B; Sultan Chand and Sons, new Delhi**
5. **Prasad, Lallan and S.S. Gulshan. Management Principles and Practices. S. Chand & Co. Ltd., New Delhi.**
6. **Chhabra, T.N. Principles and Practice of Management. DhanpatRai& Co., Delhi.**
7. **Organizational behavior – Robins Stephen P; PHI.**

Note: Question paper template will be provided to the paper setter.

LECTURE PLAN

Lecture	Topic
L1	Meaning, Definition, nature, importance & Functions of Management
L2	Management as Art, Science& Profession
Add on's	Business Objectives
L3	Management as social System,
L4	Concepts of management-Administration Development of Management Thought- Scientific management
L5	Administrative Theory of Management
L6	Bureaucratic Organization
L7	Behavioral approach (Neo Classical Theory)
L8	Human Relations Movement; Behavioral Science approach
L9	Modern approach to management – Systems approach
L10	Modern approach to management – contingency approach.
Add on's	Business Environment
L11	**Planning**: nature, purpose and functions, , planning process
L 12	types of plans,
L 13	Strategies and Policies: Concept of Corporate Strategy
L 14	formulation of strategy,
L 15	Types of strategies
L 16	Management by objectives (MBO)
L 17	SWOT analysis
L18	Types of policies, principles of formulation of policies
L 19	**Organizing**: nature, importance, process, organization structure: Line and Staff

	organization
L 20	Delegation of Authority and responsibility
L21	Centralization and Decentralization
L 22	Decision Making Process , Decision Making Models
L 23	Departmentalization: Concept and Types (Project and Matrix)
L24	formal & informal organizations
L 25	**Staffing**: concept, process, features; manpower planning
L 26	Job Analysis: concept and process
L27	Training and development
Add on's	Application /Uses of job Analyses
L 28	Recruitment and selection: concept, process, sources of recruitment; performance appraisal
L 29	**Directing**: Communication- nature, process, formal and informal, barriers to Effective Communication
L30	Theories of motivation-Maslow, Herzberg, McGregor
L31	Leadership – concept and theories, Managerial Grid, Situational Leadership. Transactional and Transformational Leadership
L32	**Controlling**: concept, process, types, barriers to controlling, controlling Techniques: budgetary control, Return on investment,
L 33	**Controlling**: concept, process, types, barriers to controlling, controlling Techniques: budgetary control, Return oninvestment,
L 34	Management information system-MIS , TQM-Total Quality Management, Network Analysis- PERT and CPM.
L 35	Management information system-MIS , TQM-Total Quality Management, Network Analysis- PERT and CPM.
L 36	Social Responsibility of Management–Management of Crisis, Total Quality Management
L 37	Stress Management,
L 38	Concept of Corporate Social Responsibility (CSR) and business ethics
L 39	Functional aspects of business: Conceptual framework of functional areas of management- Finance; Marketing and Human Resources
Add on's	Financial Objectives,Decisions & Sources of Finance
Add on's	Human Resourse Development & Functions
Add on's	Marketing Mix & Scope of marketing
Add on's	Role of Marketing in Economic Development

Tutorial sheet 1

Q1 Explain in detail the principles of Management.

Q2 What do you understand by approaches of Management?

Q3 Management is an Art , science or Profession.

Q4 Differentiate between Management and administration.

Q5 What do you mean by Management ? Describe its Significance and Functions.

Tutorial Sheet 2

Q1. What do you mean by MBO? How will you explain benefits and problems of MBO.

Q2What do you mean by SWOT analysis? Discuss its significance for the organization.

Q3. What is planning? Explain the elements of effective planning and bring out the various types of planning.

Q4. Explain the process of Organizing and describe various elements of Organizational Structure.

Q5. What do you mean by decision making in an organization in an organization? Explain the process and models of decision making.

Tutorial Sheet 3

Q1. What do you mean by Communication? Discuss its barriers.

Q2. Differentiate between Recruitment & Selection. And also explain the sources of Recruitment.

Q3. What are the methods to appraise the performance of employees?

Q4. What are the differences between Training & Development? Explain their methods.

Q5. Discuss in detail theories of Motivation.

Q6. What do you think: Leaders are born or human made?

Tutorial Sheet 4:

Q1. Explain the process of controlling. What are the techniques?

Q2. Discuss

a. **TQM**
b. **MIS**

Q3. What is stress? List out the stress coping strategies.

Q4. Explain Network Analysis- PERT and CPM.

Q5 Explain in detail Corporate Social Responsibility.

Q6 Discuss the Functional areas of management

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BT-3 / D-16
FUNDAMENTALS OF MANAGEMENT
Paper–HS-201 N

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt five questions in all selecting at least one question from each unit. Each question carries equal marks.* 15×5=75

Unit–I

1. "A Manager plans, organises, staffs, directs and controls." Discuss.

2. Discuss the contributions of Fayol and Taylor to the management thought.

Unit–II

3. What is the role of planning in modern business organisation. Enumerate the steps involved in the planning process ?

4. Distinguish between formal and informal organisation. Explain the principle features of sound organisation.

Unit–III

5. Write the detailed process of Recruitment and Selection ? Why these both are converse in nature ?

6. Why Direction and Leadership are vital for effective management? What are different types of leadership styles ?

Unit–IV

7. "Planning identifies actions and controlling sees that the actions are carried out." Explain.

8. Write notes on :
   (a) Corporate Social Responsibility
   (b) Tools for Stress Management.

ECE-308N	Computer Communication Networks					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessional**	**Total**	**Time**
3	**1**	**0**	**75**	**25**	**100**	**3 Hr.**
Purpose	**To familiarize the students with the concepts of basic computer networks used in communication. Also familiarize the students with the various layers of OSI and TCP/IP model.**					
Course Outcomes						
CO1	**To understand the concept of basics of computer networks and physical layer& media.**					
CO2	**To understand the concept and processes of data link layer and medium access sublayer.**					
CO3	**To familiarize with the concept and design issues of network, transport & session layer.**					
CO4	**To familiarize with the concept and protocols of presentation and application layer.**					

Unit – I

Introduction:

Introduction to Computer Networks, Protocols and standards, Network Models: The OSI Model, Layers in the OSI Model, TCP/IP protocol suite, Introduction to addressing.

Physical Layer and Media:

Analog and Digital (signals & data), Transmission media : Guided &Unguided, The Telephone System, Narrowband ISDN, Broadband ISDN and ATM.

Unit -II

The Data Link Layer:

Data Link Layer Design issues, Error Detection & correction, Data link control: Framing, Flow & Error control, Noiseless channels, Noisy channels, HDLC, Point to Point protocols.

The Medium Access Sublayer:

Aloha Protocols, LAN Protocols: wired LAN,s ,Wireless LAN, Networks, Satellite Networks.

Unit -III

Network Layer:

Design issues, IPv4 addresses, IPv6 addresses, internetworking,IPv4, IPv6 ,congestion control algorithms.

Transport & Session Layer:

Protocol design issues, Process to process delivery, UDP, TCP connection Management, remote procedure calls.

Unit – IV

Presentation Layer:

Design issues, abstract Syntax notation, data compression technique, cryptography.

Application Layer:

Design issues, file transfer, access and and management, electronic mail, virtual terminals, WWW & HTTP .

Text Books:

1. **Forouzan B.A, Data Communications and Networking, Tata-Mc-Graw Hill.**
2. **Tanenbaum A.S, Computer Networks, PHI.**

Reference Books:

1. **Stallings W, Data and Computer Communications, PHI.**
2. **Leon –Garcia, Computer Networks, Mc Graw Hill**

Note: Question paper template will be provided to the paper setter.

LECTURE PLAN

Lect.	Topics
1.	Introduction to Computer Networks
2.	Protocols and standards
3.	Network Models: The OSI Model
4.	Layers in the OSI Model
5.	TCP/IP protocol suite
6.	Introduction to addressing, Analog and Digital (signals & data)
7.	Physical Layer and Media
8.	Transmission media : Guided &Unguided
9.	The Telephone System, Narrowband ISDN, Broadband ISDN
10.	ATM ,Data link layer
11.	Data Link Layer Design issues
12.	Error Detection & correction
13.	Data link control: Framing, Flow & Error control
14.	Noiseless channels, Noisy channels
15.	HDLC, Point to Point protocols
16.	The Medium Access Sublayer: Aloha Protocols
17.	LAN Protocols: wired LAN,s ,Wireless LAN
18.	Networks, Satellite Networks
19.	Network Layer
20.	Design issues
21.	IPv4 addresses
22.	IPv6 addresses
23.	Internetworking,IPv4, IPv6

24.	Congestion control algorithms
25.	Transport & Session Layer: Protocol design issues
26.	Process to process delivery, UDP
27.	TCP connection Management, remote procedure calls.
28.	Presentation Layer:Design issues,
29.	abstract Syntax notation,
30.	data compression technique
31.	cryptography.
32.	Application Layer:Design issues
33.	file transfeR
34.	access and and management
35.	electronic mail,virtual terminals,
36.	WWW & HTTP

TUTORIAL SHEET-I

1. Explain what is networking? Why we need of computer networks?

2. Explain the application of networking?

3. What is network hardware & network softwares?

4. Explain Open System Interconnection model of networking?

5. Explain TCP/IP reference model.

TUTORIAL SHEET-2

1. What is the theoretical basis for data communication in physical layer?

2. Explain different types of transmission media.

3. Explain Asynchronous Transmission Mode and cellular radio?

4. Explain working of telephone system.

5. Difference between narrowband & Broadband ISDN.

6. Explain fiber optic Networks.

TUTORIAL SHEET-3

1. Explain error detection & detection in data link layer.

2. Explain sliding window protocol.

3. What is protocol and various specification of protocol?

4. Differentiate between pure & slotted aloha protocol.

5. Write a short note on LAN protocol.

6. Explain Remote Procedure calls.

TUTORIAL SHEET-4

1. What is IEEE standard and explain IEEE standard for LAN?

2. Write a short note on FDDI ring and internet LAN.

3. What is routing? Explain various static and dynamic algorithms for routing.

4. Explain congestion control algorithm.

5. Explain connection management.

6. Write a short notes on:

i) FTP

ii) Email

iii) Virtual Terminals

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BT-6 / M-18

COMPUTER COMMUNICATION NETWORKS

Paper–ECE-308N

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** questions in all, selecting **one** question from each unit.*

Unit–I

1. (a) What are various connecting devices used in computer networks ? Give a short description. 5

   (b) Explain the OSI model, with a neat block diagram. Consider a source, destination machine and some intermediate nodes for discussion. 10

2. (a) Write a note on guided and unguided transmission media. 7

   (b) What is broad band ISDN networks, explain ? 3

   (c) How addresses employed in internet employing TCP/IP protocol can be classified ? Explain. 5

Unit–II

3. (a) Draw and discuss Ethernet frame format. 5

   (b) Explain the various station types, configurations, response modes and frame formats in HDLC. 10

4. Write a note on : 3×5=15
   (a) Point to Point protocol
   (b) MAC 802.3 protocol and frame format
   (c) Two different kind of sevices as defined in IEEE 802.11.

Unit–III

5. (a) What is the need of transmission from IPV4 to IPV6 ? What are the strategies devised by IETF to help the transmission ? 10
   (b) What is classless addressing in IPV4 ? What is a mask ? Explain. 5

6. (a) Compare TCP and UDP. 5
   (b) Give and explain some issues related to protocol design. 5
   (c) What is process to process delivery ? Explain. 5

Unit–IV

7. (a) What are the main functions of the presentation layer ? 3
   (b) List 3 different file types that use compression. 3
   (c) Explain in your own words why the term *presentation* is used to name this layer of the OSI model ? 5
   (d) What is cryptography in computer network security ? 4

8. Write note on the following : 15
   (a) Email (b) Web browsing
   (c) Virtual terminals (d) FTP

ECE-310N	Digital Signal Processing Lab					
Lecture	**Tutorial**	**Practical**	**Sessional**	**Practical**	**Total**	**Time**
0	**0**	**3**	**40**	**60**	**100**	**3 Hr.**
Course Outcomes						
CO1	**Introduction to MATLAB.**					
CO2	**Study of different function and signals of DSP.**					
CO3	**Study of DFT and DTFT with their properties.**					
CO4	**Study of z-transform and its properties.**					

List of Experiments:

1. **Introduction to MATLAB.**
2. **Write a program to plot the Sine wave, cosine wave and Tangent wave.**
3. **Write a program to plot the following functions: a)impulse function b)unit step c)unit ramp d) exponential e) sinusoidal**
4. **Write a program to plot the convolution and multiplication of two signals.**
5. **Define a function to compute DTFT of a finite length signal. Plot the magnitude and phase plots using subplots.**
6. **Verify the Symmetry, time shifting and modulating properties of DTFT with a rectangular pulse.**
7. **Study the aliasing effect by using a Sinusoidal Signal. Show the plots of' continuous time Signal. Sampled Signal and reconstructed signals by using subplot.**
8. **Write a program to plot real, imaginary phase and magnitude of exponential function.**
9. **Study different window functions available in signal processing.**
10. **Verify the properties of Discrete Fourier Transform (DFT).**
11. **Write a program to find the convolution of two sequences using in built convolution function.**
12. **Write a program to study the frequency shift property of DTFT.**
13. **Write a program to study circular shift property of DTFT.**
14. **Write a program to study scaling property of DFT.**
15. **Write a program to study the sampling theorem of a continuous time signal.**
16. **Write a program to study the Z-Transform.**

17. Write a program to study the various Properties of Z-Transform.

Note: At least 10 experiments are to be performed with atleast 7 from above list, remaining 3 may either be performed from the above list or designed & set by concerned institution as per the scope of the syllabus.

ECE-312N	Digital Design Using Verilog Lab					
Lecture	**Tutorial**	**Practical**	**Sessional**	**Practical**	**Total**	**Time**
0	**0**	**3**	**40**	**60**	**100**	**3 Hr.**
Purpose	**To familiarize the students with the basics of design of conventional electronic circuits, the features of Verilog HDL, design circuits using gate level modeling.**					
Course Outcomes						
CO1	**To describe, design, simulate, and synthesize circuits using the Verilog hardware description language.**					
CO2	**To design and modeling of combinational and sequential digital systems.**					
CO3	**To develop program codes for synthesis-friendly combinational and sequential logic circuits.**					
CO4	**To understand the advanced features of Verilog HDL and be able to write optimized codes for complex systems.**					

List of Experiments:

1. **Write a Program to implement logic gates.**
2. **Write a Program to implement half-adder.**
3. **Write a Program to implement full-adder.**
4. **Write a Program to implement 4 bit addition/subtraction.**
5. **Write a Program to implement a 3:8 decoder.**
6. **Write a Program to implement an 8:1 multiplexer.**
7. **Write a Program to implement a 1:8 demultiplexer.**
8. **Write a Program to implement 4 bit comparator.**
9. **Write a Program to implement Mod-10 up counter.**
10. **Write a program to perform serial to parallel transfer of 4 bit binary number.**
11. **Write a program to perform parallel to serial transfer of 4 bit binary number.**
12. **Write a program to implementa8 bit ALU containing 4 arithmetic & 4 logic operations.**

ECE-314N	Digital Communication Lab					
Lecture	**Tutorial**	**Practical**	**Sessional**	**Practical**	**Total**	**Time**
0	**0**	**3**	**40**	**60**	**100**	**3 Hr.**

Course Outcomes	
CO1	Student will be able to perform coding techniques.
CO2	Student will be able to understand Optical fibre communication process
CO3	Student will be able to **understand base band pulse transmission.**
CO4	Student will be able to analyze various basic digital modulation techniques.

List of Experiments:

1. **To Study ASK**
2. **To Study PSK**
3. **To Study FSK**
4. **To Study Balanced Modulator & Demodulator**
5. **To Study PCM**
6. **Setting up a Fiber Optic Analog Link**
7. **Setting up a Fiber Optic Digital Link**
8. **Losses in Optical Fiber**
9. **Measurement of Numerical Aperture**
10. **Time Division multiplexing of signals.**

Note: At least 10 experiments are to be performed with atleast 7 from above list, remaining 3 may either be performed from the above list or designed & set by concerned institution as per the scope of the syllabus.