Bansilal RamnathAgarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

Syllabus for
S.Y.B.Tech.
Electronics & Telecommunication
(Pattern 2018)

Department of
Electronics & Telecommunication
Engineering

VISION:

- Excellence in Electronics & Telecommunication Engineering Education

MISSION:

- Provide excellent blend of theory and practical knowledge
- Establish centre of excellence in post graduate studies and research
- Prepare engineering professionals with highest ethical values and a sense of responsible citizenship

Program Educational Objectives (PEO):

1. Graduates of the program will become competent electronic engineers suitable for industry.
2. Graduates of the program will apply the mathematical and analytical abilities gained through core courses of Electronics and Communication engineering.
3. Graduates of the program will apply problem solving skills to develop hardware and/or software.
4. Graduates of the program will become responsible citizen.

Program Outcomes (PO):

A graduate of the program will have

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding ofthe engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO):

Graduates will be able to

1. Apply and demonstrate the usage of hardware and software platforms for variety of applications.
2. Apply different mathematical and statistical methods for analysis and design of signal processing and communication systems.

Graduate attributes:

1. Engineering knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Investigations of Complex Problems
5. Modern Tool Usage
6. The Engineer and Society
7. Environment and sustainability
8. Ethics
9. Individual and Teamwork
10. Communication
11. Project management and Finance
12. Life –long Learning

Second Year B. Tech. Electronics & Telecommunication Engineering (SYBT) - Semester III (Pattern 2018)

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
			L	T	P	ISE T1	ISE T2	CE	ESE	PR/ OR		
ES20181ET/ ETUA20181	Engineering Mathematics III/ Signals and systems	TH	3	1	-	20	10	20	50	-	100	4
ES21182ET	Probability & Statistics	TH	3	-	-	20	10	20	50	-	100	3
ETUA21183	Engineering Circuit Analysis*	TH	3	-	-	20	10	20	50	-	100	3
ETUA21184	Electronics Devices & Circuits*	TH	3	-	-	20	10	20	50	-	100	3
ETUA21185	Digital System Design *	TH	3	-	-	20	10	20	50	-	100	3
ETUA21186	Lab Practice -I	CE-PR/OR	-	-	6	-	-	50	-	50	100	3
ETUA21187	Electronic Instruments and Measurements	CE	2	-	2	-	-	100	-	-	100	3
M2	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	**17**	**1**	**8**	**100**	**50**	**250**	**250**	**50**	**700**	**22**

L: 1Hr. = 1 Credit, P: 2 Hrs. = 1 Credit, T: 1 hr. = 1 Credit, Audit Course: No Credits
*Courses have lab practice component of 2 hrs./week each under Lab Practice - I head.

Mandatory Course: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge

BoS Chairman **Dean Academics** **Director**

Second Year B. Tech. Electronics & Telecommunication Engineering (SYBT) - Semester IV (Pattern 2018)

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
			L	T	P	ISE T1	ISE T2	CE	ESE	PR/ OR		
ETUA20181/ ES20181ET	Signals and systems / Engineering Mathematics III	TH	3	1	-	20	10	20	50	-	100	4
ETUA22182	Data structures*	TH	3	-	-	20	10	20	50	-	100	3
ETUA22183	Analog and Digital Communication *	TH	3	-	-	20	10	20	50	-	100	3
ETUA22184	Analog Circuits *	TH	3	-	-	20	10	20	50	-	100	3
ES22185ET	Effective Technical Communication	TH	3	-	-	20	10	20	50	-	100	3
ETUA22186	Lab Practice-II	CE-PR/OR	-	-	6	-	-	50	-	50	100	3
ETUA22187	Electronics Workshop	CE	2	-	2	-	-	100	-	-	100	3
ETUA22188	Electromagnetics	CE	2	-	-	-	-	100	-	-	100	2
M2	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	**19**	**1**	**8**	**100**	**50**	**350**	**250**	**50**	**800**	**24**

L: 1Hr. = 1 Credit, P: 2 Hrs. = 1 Credit, T: 1 hr. = 1 Credit, Mandatory Course: No Credits
*Courses have lab practice component of 2 hrs./week each under Lab Practice II head.

Mandatory Course: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge

BoS Chairman **Dean Academics** **Director**

Semester – I

ETUA20181: Signals and Systems

Teaching Scheme
Credits : 4
Lectures : 3 Hrs/week
Tutorial: 1 Hr/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Basics of integration, derivatives, basics of series and it's convergence criterion, graph sketching (EM-I, EM-II)

Course Objectives:

- To model the signals in time and frequency domain mathematically.
- To analyze Linear Time Invariant (LTI) systems in time and transform domain.
- To prepare basics for further understanding of courses like Signal processing and communication related course.
- To provide basis for correlation of different signal parameters.

Course Outcomes:
On completion of the course, students will able to:

1. define and classify signals mathematically
2. evaluate systems classification based upon the characteristics
3. apply convolution to analyze LTI systems
4. illustrate Fourier analysis for characterizing signal in frequency domain
5. apply Laplace transform for analysis and simplification of LTI systems
6. calculate the similarity measures and evaluate the spectral characteristics of signals

Unit- I : Introduction to Signals
Definition of signal (Signals related to Communication, control systems etc.). Elementary signals: exponential, sine, step, impulse and its properties, ramp, rectangular, triangular, signum, sinc. Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting and folding, precedence rule. Classification of signals: Continuous time and discrete time, even/odd, periodic/non periodic, deterministic/ non deterministic, energy and power.

Unit –II : Introduction to Systems
Definition of system, Classification of system: linear/non linear, time variant/invariant, causal/non-causal, static/dynamic, stable/unstable, invertible/non-invertible.
System modeling: Input output relation, impulse response, block diagram, integro-differential equation.

Unit –III : Linear Time Invariant (LTI) System Analysis
Definition of convolution, convolution integral, computation of convolution integral using graphical method and mathematical definition for following signals: unit step with unit step, unit step with exponential, exponential with exponential and unit step with rectangular, rectangular with rectangular only. Computation of convolution sum. Properties of convolution, system interconnection, system properties in terms of impulse response, step response in terms of impulse response.

Unit -IV: System Analysis in Frequency Domain using Fourier Transform
Definition and necessity of continuous time (CT) and discrete time (DT) Fourier series and Fourier transforms. Analogy between continuous time Fourier series (CTFS), discrete time Fourier series (DTFS) and continuous time Fourier transform (CTFT), discrete time Fourier transform (DTFT). continuous time Fourier series (CTFS), continuous time Fourier transform (CTFT) and its properties, problem solving using properties, amplitude spectrum, phase spectrum. Interplay between time and frequency domain.

Unit V: Laplace Transform

Limitations of Fourier transform (FT) and need of Laplace transform (LT). Definition and properties of Laplace transform (LT), Region of convergence (ROC) and pole zero concept. Application of Laplace transforms to the Linear Time Invariant (LTI) system analysis. Inversion using duality, numerical based on properties. Signal analysis using Laplace transform (LT).

Unit VI : Correlation and Spectral Analysis

Definition of Correlation and Spectral Density, correlogram, comparision between computation of correlation and convolution, auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, relation between correlation and spectral density.

Text books :

1. Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India.
2. Mrinal Mandal, Amir Asif, "Continuous and Discrete Time Signals and Systems" First Edition, Cambridge University Press

Reference Books :

1. B. P. Lathi, "Linear Systems and Signals", 2nd Edition, Oxford University Press, 2004.
2. Charles Phillips, "Signals, Systems and Transforms", 3rd Edition, Pearson Education
3. Simon Haykins, "Introduction to Analog and Digital Communications", Wiley India.

Signals and Systems (List of Tutorials)

1 Sketch and write defining mathematical expression for the following signals in continuous time (CT) and discrete time (DT)
a) Unit Step., b) Rectangular, c) Exponential, d) Signum, e) Sine, f) SinC, g) Triangular
h) Unit Impulse., i) Unit Ramp

2 Classify and find the respective value for the above signals
Periodic / Non Periodic, Energy / Power /Neither

3 Take any two continuous time (CT) signals and perform the following operation Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting, folding and combination of operations

4 Take any two discrete time (DT) signals and perform the following operation Amplitude scaling, addition, multiplication, differentiation, accumulation, time scaling, time shifting and folding and combination of operations

5 Express any two system mathematical expressions in input output relation form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time in variant, Invertible

6 Evaluate continuous time Fourier Series (CTFS) and discrete time Fourier series (DTFS) of given signals.

7 State and prove the properties of Fourier Transform. Take rectangular and sinc signal as examples and demonstrate the applications of CTFT properties. And also demonstrate the interplay between the time and frequency domain.

8 State and prove the properties of Laplace Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis

9 Find the following for the given energy signal
a) Autocorrelation, b) Energy from Autocorrelation, c) Energy from definition
d) Energy Spectral Density by definition e) ESD from Autocorrelation.

10 Find the following for the given power signal
a) Autocorrelation, b) Power from Autocorrelation, c) Power from definition,
d) Power Spectral Density by definition e) PSD from Autocorrelation

ES21182ET: Probability & Statistics

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Basics of mathematics

Course Objectives:

- To provide students with a good understanding of the concepts probability, random variables and statistics
- To help the students develop the ability to solve problems using probability and statistics.
- To connect probability and statistics to other fields both within and without mathematics.
- To develop abstract and critical reasoning by studying logical proofs and the axiomatic method as applied to probability and statistics.

Course Outcomes:
On completion of the course, students will be able to:

1. Apply basic of probability and related theorems to real life problems.
2. Map the given input to desired range of output using random variable.
3. evaluate different statistical measure and classify observed samples into standard random distribution
4. demonstrated the concepts of joint distribution
5. apply the concepts of random process in communication engineering
6. evaluate different sampling test and regression models

Unit- I : Probability
Introduction to probability, sets, fields, events, Axiomatic definition of probability, Joint, Conditional and Total Probabilities, Bayes theorem and its applications. Bernoulli trials, Binomial theorem.

Unit –II : Random Variable
Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function
One dimensional Random variable, Problems on one dimensional RV, Mean variance and moments

Unit III : Basic Statistics
Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions:
Binomial, Poisson, Uniform, exponential and Normal - evaluation of statistical parameters for these distributions.

Unit IV: Pairs of Random Variables
Two Random Variables, Pairs of Discrete Random Variables, The Joint cdf of X and Y, The Joint pdf of Two Continuous Random Variables, Independence of Two Random Variables, Joint Moments and Expected Values of a Function of Two Random Variables, Conditional Probability and Conditional Expectation, Functions of Two Random Variables Pairs of Jointly Gaussian Random Variables, Generating Independent Gaussian Random Variables

Unit V : Random Processes

Basic Definitions and Important Random Processes, Useful classifications of Random Processes, Random Sequences and Linear systems, Mean and covariance functions, Wide Sense Stationary Random Sequences, Ergodicity, Transmission of random process through LTI. Power spectral density

Unit VI : Small samples and Regression

Central Limit theorem and its significance; Some sampling distributions like chi-square, t, F
Simple linear regression model, Least square estimators, polynomial regression, Correlation

Text Books:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
2. Schaum's outline Of Theory and Problems of Probability, Random Variables, and Random Processes

Reference Books:

1. Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers
3. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press

ETUA21183: Engineering Circuit Analysis

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Basics of Electrical engineering, Engineering Mathematics

Course Objectives:

- To understand, analyze the basic AC and DC circuits using KCL, KVL, network theorems and different network simplification techniques.
- To understand, analyze and design different types (low pass, high pass, band pass and band stop) of filters
- To model and analyze the network in terms of network parameters
- To understand and analyze the transmission lines
- To understand the initial conditions, and apply Laplace transform for RL, RC, and RLC circuits and carry out its transient analysis.

Course Outcomes:
On completion of the course, students will be able to

1. Apply various network simplification techniques for the analysis of networks.
2. Apply different network theorems to analyze ac and dc networks.
3. Analyze frequency selective networks and compare them on the basis of different performance parameters.
4. Assess the requirements of filters and design them for the given specifications.
5. Formulate and solve the differential equations using Laplace Transform for analysis of different networks
6. Analyze transmission lines

Unit- I : Basic Circuit Analysis and Simplification Techniques
Kirchoff's Current and Voltage Laws, Independent and dependent sources and their interconnection, Network Analysis: Mesh, Super mesh, Node and Super Node analysis, Source transformation.

Unit–II: Network Theorems
Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorem, Millman's Theorem. (DC & AC circuit analysis).

Unit–III: Frequency Selective Networks
Significance of Quality factor, Series Resonance: Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity. Effect of Rg on BW & Selectivity, Magnification factor. Parallel resonance: Resonant frequency and admittance variation with frequency, Bandwidth and selectivity.

Unit-IV : Four terminal Networks
Z0 and alpha, Classification of Filters, T - Network, π-Network. Characteristics of filters.
Constant-K LPF, HPF, BPF and BSF

Unit–V: Laplace Transform for analysis of Electric circuits
Initial conditions, transformed circuits, source free RL and RC circuits, properties of exponential response, Driven RL and RC circuits, Natural and Forced response of RL and RC circuits. Introduction to Source free and driven series RLC circuit. Over damped and Under damped series RLC circuit.

Unit–VI: Transmission line

Concept of characteristics impedance & propagation constant, Primary and secondary parameters of transmission line, Transmission line equations, Application of Transmission line equations, VSWR

Text books :

1. William H Hayt, Jack E Kemmerly and Steven M. Durbin, Engineering Circuit Analysis Tata McGraw-Hill Publishing Company Ltd., 6th ed.2006.
2. John D. Ryder, Networks, Lines and Fields, Prentice-Hall of India Pvt. Ltd., 2nd ed.
3. D. Roy Choudhury, Network and Systems, New Age International Publishers

Reference Books :

1. Ravish R. Singh, Network Analysis and Synthesis, Tata McGraw-Hill Publishing Company Ltd.
2. M.E. Van Valkenburb, Network Analysis, 3rd Edition
3. Schaum's Outline of Electric Circuits, 6th edition (Schaum's Outlines)

ETUA21184: Electronic Devices & Circuits

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Basics of Electrical engineering, Engineering, Semiconductor Theory

Course Objectives:

- To introduce the students to semiconductor devices (such as Diode, BJT, JFET, and MOSFET) and their characteristics, operation, circuits and applications.
- To design and analyze various BJT, JFET and MOSFET circuits for small signal at low and high Frequency.
- To implement hardwired circuit to test its performance as per the design.
- To simulate electronics circuits using computer simulation software to obtain desired results.

Course Outcomes:
On completion of the course, students will be able to:

1. Apply knowledge of mathematics, physics and electronic to understand and analyze diode based circuits.
2. Summarize concepts of BJT and working of BJT amplifiers.
3. Analyze, and design different biasing techniques for JFET amplifiers.
4. Interpret, Design and analyze DC response of MOSFET amplifiers.
5. Interpret, Design and analyze AC response of MOSFET amplifiers.
6. Explore different design alternatives for feedback amplifiers and oscillators using JFET for given specification.

Unit - I : Unit I – Diode Circuits and Applications
Introduction to different areas of Electronics and their applications in Engineering, Construction and working of PN junction diode, Characteristics of P-N Junction Diode, Diode applications- Half-wave rectifier, Full-wave rectifiers (center-tapped and bridge), Capacitor Filters, Zener diode- working, Characteristics, & its applications, Light Emitting Diodes (LED), Photodiodes & their application.

Unit - II : Bipolar Junction Transistors (BJT)
The Operating Point, Bias Stability, Self-Bias or Emitter Biasing, Stabilization against Variations in I_{CO}, V_{BE} and β, Thermal Runaway, BJT as a switch, Two Port Devices and the Hybrid Model, Transistor Hybrid Model, Study of Common Emitter amplifier. Comparison of Common Emitter (CE), Common Collector(CC) and Common Base (CB) configured Amplifiers

Unit - III : JFET and its DC–AC Analysis
Introduction to Junction Field Effect Transistor (JFET), Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET amplifier configurations: Common Source(CS), Common Drain(CD), Common Gate(CG) and their Comparison, Biasing of JFET, Small signal model, JFET as CS amplifier and its analysis, frequency response of CS amplifier.

Unit - IV : MOSFET Theory and its DC Analysis
Basics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET), Transistor operation, Construction of n-channel and p-channel E-MOSFET, n-channel and p-channel E-MOSFET ideal Id vs. Vgs and Id vs. Vds characteristics & parameters, non-ideal voltage current characteristics, non-ideal effects viz. Finite output resistance, channel length modulation, body effect, sub-threshold conduction,

breakdown effects and temperature effects. MOSFET DC circuit analysis: common source circuit, biasing, Load Line and Modes of operation.

Unit - V : AC Circuit Analysis of MOSFET

MOSFET Low frequency and high frequency small signal equivalent circuits, MOSFET small signal parameters: gate transconductance, bulk transconductance and small-signal output resistance, MOSFET parasitic capacitances,Basic MOSFET amplifier configurations: common-source configuration, Common-source amplifier with source resistor and source bypass capacitor, common-drain amplifier (source follower), and common-gate amplifier.

Unit - VI : Feedback Amplifiers and Oscillators

Four types of amplifiers. Feedback topologies. Examples of voltage series and Current series FET feedback amplifiers and their analysis. Barkhausen criterion, General form of LC oscillator. FET RC Phase Shift oscillator, Wein bridge oscillator, Hartley and Colpitt oscillators.

Text books :

1. Floyd, "Electronic Devices and Circuits", Pearson Education.
2. David A.Bell, "Electronic Devices and Circuits", 5th Edition, Oxford press.
3. Donald Neamen, "Electronic Circuits Analysis and Design", 3rdEdition, TMH.

Reference Books :

1. Millman, Halkias, "Integrated Electronics- Analog and Digital Circuits and Systems", 2nd TMH.
2. Boylstad, Nashlesky, "Electronic Devices and Circuits Theory", 9th Edition, PHI, 2006.

ETUA21185: Digital System Design

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Boolean Algebra, Electronic Devices

Course Objectives:
- To understand the different simplification techniques of digital circuits.
- To be familiar with different digital logic families.
- To understand and design combinational and sequential circuits.

Course Outcomes: By the end of the course, students will able to
1. Practice binary and other number system, conversion operation on number systems. Analyze and apply minimization techniques.
2. Design, analyze and implement combinational logic design
3. Understand operation of flip-flops, registers and design register application
4. Design and analysis of finite state machines
5. Analyze digital logic families and PLDs
6. Apply, analyze and simulate different modeling styles for design of combinational and sequential circuits using VHDL.

Unit –I: Number Systems and Minimization Techniques
Introduction to number systems, conversion, binary arithmetic, digital codes, logic gates, Boolean algebra and logic simplification using Boolean rules and laws.
Standard representations for logic functions, k map representation of logic functions (SOP & POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions, Quine McCluskey method.

Unit –II: Combinational Logic Design
Design Examples: Arithmetic Circuits, BCD - to – 7 segment decoder, Code converters. Adders and their use as subtractions, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees, De multiplexers and their use in combinational logic designs, Decoders, de multiplexer trees.

Unit -III: Flip-Flops
1 Bit Memory Cell, Latch, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops, Conversion of flip flops, Registers, Shift registers and its applications.

Unit IV: Sequential Logic Design
Counters, ripple counters, up/down counters, synchronous counters, lock out. Clock Skew, Clock jitter effect on synchronous designs. Basic design steps- State diagram, State table, State reduction, State assignment, FSM (Mealy and Moore machines)

Unit- V: Digital Logic Families
Classification of logic families, Characteristics of digital ICs. TTL logic. Operation of TTL NAND gates. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired

logic, open drain output. Interfacing CMOS and TTL. Comparison of TTL & CMOS logic families. Memory elements, concept of PLD's like PAL/PLA/PROM/FPGA/CPLD.

Unit VI: Introduction to HDLs

Library, Entity, Architecture, Modeling styles, Data types and objects, Concurrent and sequential statements, Design examples on basic combinational and sequential circuits.

Text books :

1. R. P. Jain, "Modern digital electronics", 4th edition, TMH Publication.
2. T. L. Floyd, "Digital Fundamentals", 9th edition, Pearson International Edition.
3. J. Bhaskar, "VHDL Primer", 3rd Edition, PHI Publication.

Reference Books :

1. Anand Kumar, "Fundamentals of digital circuits" 1st edition, PHI publication.
2. J F Wakerly, "Digital Design: Principles and Practices", 3rd edition, Pearson Education.

ETUA21186: Lab Practice-I

Teaching Scheme
Credits : 3
Practical : 6 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

Course Outcomes: On completion of the course, student will be able to:

- Verify various network simplification techniques and network theorems.
- Design and analyze filters and attenuators for the given specifications.
- Design and Analyze biasing and amplifier circuits using JFET.
- Design and simulate feedback amplifiers and oscillators using JFET.
- Design and implement digital circuits using hardware.
- Simulate digital circuits using EDA tools.

A. Engineering Circuit Analysis (List of Experiments)

1. To analyze resistive network using network simplification technique.
2. To verify Thevenin's theorem
3. To verify Maximum power transfer theorem
4. To verify Superposition theorem
5. To study Series resonance
6. To study parallel resonance
7. To study Z and Y parameters of a two p ort network
8. To design and verify constant-k prototype LPF and HPF for the given specifications
9. To design and verify T and π type of attenuators
10. To analyze network using modern tool such as MATLAB or Multisim.

B. Electronic Devices & Circuits (List of Experiments)

1. Study of equipment and instruments required to perform experiments.
2. Build and test clipper and clamper circuits using diode.
3. Bipolar Junction Transistor (BJT) as a switch to drive LED, relay and single seven segment display (common Anode).
4. Design, build and test self-bias circuit for JFET amplifier and verify DC operating parameters.
5. Design and build and test single stage CS amplifier using JFET with and without bypass capacitor. Calculate Av, Ri, Ro theoretically and practically.
6. Simulate transient, AC, and DC response of JFET single stage CS amplifier (use circuit build in experiment number 6).
7. Build and test MOSFET as a switch to drive LED, relay and single seven segment display (common Anode).
8. Simulate transient, AC, and DC response of MOSFET single stage CS amplifier.
9. Simulate Voltage-Series feedback amplifier and calculate Rif, Rof, Avf and Bandwidth.
10. Simulate LC/RC oscillator using JFET.

C. Digital System Design (List of Experiments)

1. Design and Implement full adder and subtractor function using IC-74LS138.
2. Design and Implement 1 digit BCD adder using IC-74LS83 (4-bit Adder)
3. Study of IC74LS85 as a magnitude comparator
4. Study of IC 74LS153 as a Multiplexer
5. Design and Implement MOD-N and MOD-NN using IC-74LS90 (Decade Counter)

6. Design and Implement MOD-N and MOD-NN using IC-74LS93 (mod 16 Counter)
7. Design and Implement Pulse train generator using IC-74HC194/IC74LS95 (Use right shift/left shift).
8. Design and simulate the given combinational circuit using EDA tools.
9. Design and simulate the given sequential circuit using EDA tools.
10. Write, simulate and verify, VHDL code for ALU (four bit logical and arithmetic operations).

Note: any 9 experiments from 1 to 11

ETUA21187: Electronics Instruments and Measurements

Teaching Scheme
Credits:3
Lectures: 2 Hrs/week
Practicals: 2 Hrs/week

Examination Scheme
Formative Assessment: 100 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Basic electrical engineering

Course Objectives:
- To provide a brief knowledge of measurements and measuring instruments.
- To make student competent for handling measuring instruments and able to select proper instrument for the purpose of measurement under different conditions.

Course Outcomes: On completion of the course, students will be able to:-
1. Apply fundamental of electronics Measurements for different Measurements.
2. Classify and select appropriate Power Supply , Signal Generator and oscilloscopes
3. Identify and illustrate specifications, features and capabilities of electronic measuring instruments
4. Develop test set up for the measurement of electrical parameter professionally.

Unit 1: Basic of Measurement System
Static and dynamic characteristics of measurement systems, Basics Parameters of Measurement system such as Accuracy, Precision, Resolution, repeatability, Dynamic Range, Linearity, Settling Time, Typical instrument block diagram. Need of calibration, levels of calibration. Errors and their analysis, Standards of measurement.

Unit 2: Power Supply, Signal Generators and Oscilloscopes
Types of power supply Linear and SMPS. Types of Signal Generator, Different Functions -Duty cycle, symmetry, attenuation, offset. CRO, CRO Block diagram, Digital Storage Oscilloscope, DSO Block Diagram, Measurements on oscilloscope. Power scope, Specification of an Oscilloscope. Measurements on Logic analyzer.

Unit 3: Electronic Measuring Instruments
Time Domain Measurement:
Measurement of Voltage, current and frequency. Analog meter, DVMs, True RMS meter. Current probe, LCR Q meter, Bridge Measurement: DC bridges- Wheatstone bridge.
Frequency Domain Measurement:
Total Harmonic distortion measurement and Harmonic measurement, Introduction of Spectrum analyzer, Vector Network analyzer.

Unit 4: Case Study
Testing of various electronic circuits using electronic instruments
1. Frequency response of Filters, Small Signal Amplifier.
2. Efficiency of Power Amplifier.
3. Frequency response of Filters.
4. Validating Digital circuits
5. THD Measurement of signal generator and electronic circuit

Text Books :

1. Albert D Helfrick; William D Cooper, "Modern electronic instrumentation and measurement techniques", Pearson.
2. H.S Kalsi, "Electronic instrumentation", Tata McGraw–Hill.

Reference Books :

1. Car Joseph, "Elements of Electronics Instrumentation and Measurement", PHI
2. Coombs, Clide F. Jr., "Electronic instrument handbook", McGraw–Hill.

List of Experiments:

1. Statistical Analysis of Digital Voltmeter
2. Study of Digital Multimeter.
3. Study of Function Generator
4. Study of CRO
5. Study of DSO
6. Study of True RMS Meter
7. Study of LCR Q Meter
8. Study of Spectrum Analyzer
9. Calibration of Digital Voltmeter (DVM)
10. Testing of various electronic circuits using electronic instruments (Case Study)

Semester – II

ES20181ET: Engineering Mathematics -III

Teaching Scheme
Credits: 4
Lectures: 3 Hrs/week
Tutorial: 1 Hr/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite:
Basics of Derivatives, Integration, Trigonometry, Vector algebra &Partial differentiation

Course Objectives:

- To study the Linear Differential equations and their applications.
- To impart knowledge of Fourier transform and Z- transform.
- To apply Numerical techniques for data analysis.
- To apply statistical techniques for data analysis.
- To solve probability distributions.
- To solve complex variables and complex integrations.

Course Outcomes:
On completion of the course, students will be able to:

1. Solve the Linear Differential equations, modelling of mass spring systems, free and forced damped and undamped systems.
2. Solve Fourier Transform and Z-Transform.
3. Solve Numerical technique to analyses the data,
4. Solve statistical technique to analyze the data.
5. Solve Different Probability Distributions
6. Solve Complex variables and Applications of CR Equations.

Unit- I : Linear Differential Equations
LDE of nth order with constant coefficients, Method of Variation of Parameters, Cauchy's & Legendre's DE, Solution of Simultaneous Differential Equations, Modeling of Electrical circuits.

Unit –II : Transforms,
Fourier Transform (FT): Fourier Integral Theorem, Sine & Cosine Integrals, Fourier Transform, Fourier Sine and Cosine Transform and their Inverses.
Introductory Z-Transform (ZT): Definition, Standard Properties, ZT of Standard Sequences and their Inverses. Solution of Simple Difference Equations..

Unit III : Numerical methods
Numerical Differentiation, Numerical Integration, The Trapezoidal rule, Simpson's one-third Rule, Simpson's three-eight Rule. Solutions of Differential equations by Euler method, Modified Euler method, Runge-kutta 4^{th}order method

Unit - IV Complex Variables
Complex Variables Functions of Complex Variables, Analytic Functions-R Equations, Conformal Mapping, Bilinear Transformation, Cauchy's Integral Theorem, Cauchy's Integral formula, Residue Theorem.

Unit - V : Vector Spaces and orthogonally
Vector spaces, Subspaces, Linear combinations and subspaces spanned by a set of vectors, Linear dependence and Linear independence, Orthogonal vectors and subspaces, Inner product, Inner product Spaces, Cauchy – Schwarz inequality, Norm, Orthogonality, Gram – Schmidt orthonormalization, Orthonormal basis

Unit - VI : Eigenvalues and Eigenvectors

Requirement of diagonalization, Eigenvalue – Eigenvector pairs, characteristic equation, Algebraic multiplicity, Eigenvectors, Eigen spaces and geometric multiplicity, discrete dynamic systems, applications to differential equations

Text books:

1. A Text book of Applied Mathematics by P.N. Wartikar, U.N.Wartikar ,Pune Vidyarthi Griha Prakashan ,Pune
2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)

Reference Books :

1. Higher Engineering Mathematics by B.S.Grewal ,KhannaPublication,Delhi
2. Advanced Engineering Mathematics by Wylie C.R &Barrett L.C. McGraw-Hill,INC
3. Advanced Engineering Mathematics by Peter V.O'Neiol

ETUA22182: Data Structures

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative assessment:50 marks
Summative assessment: 50 marks

Prerequisite: Readers/students are expected to know the following concepts:
Fundamentals of Programming Languages, 'C++' programming

Course Objectives:

- To impart basic concepts of data structures.
- To understand basic concepts of stacks, queues, lists ,trees and graphs.
- To enable them to write algorithms of solving problems with the help of fundamental data structures.
- To make the students familiar with basic concepts and techniques of object oriented programming in Java

Course Outcomes:
On completion of the course, students will be able to

1. Apply theory and principles of classes, objects in C++ language to solve a programming problem.
2. Evaluate problem statement and solve using Linked list.
3. Identify appropriate algorithm from stack, queue to solve given problem.
4. Compare different terminologies and traversals of trees to find best method
5. Apply the theory of classes, methods to write programs in JAVA.

Unit I : Introduction to Data Structures
Basic Terminology; Elementary data organization, Data Structures, Data structure operations, Review of C++, Declaration of variable, Reference variables, Scope resolution operator, Classes & Objects: Specifying a class, Defining member functions, A C++ program with class, Constructors & Destructors

Unit- II : Linked List
Singly Linked Lists: Concept, Representation of Linked list in Memory, Traversing a linked list, Searching a linked list, Memory Allocation; Garbage collection, Insertion into Linked list, Deletion from a linked list, Circularly Linked list, Doubly Linked List.
Linked list for embedded system programming.

Unit III: Stacks
Stacks: Concept, operations of stacks, Array representation of stack, Linked representation of stack, Application of stacks: Arithmetic expressions.
Concept, Array representation of queues, Linked representation of queue, Circular queue ,
Applications of queue

Unit IV: Trees
Binary Trees: Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree, Binary Search Trees (BST), Searching, Traversing a binary search tree, Application of Trees: Expression Tree.

Unit VI : JAVA fundamentals
Evolution of Java, Comparison of Java with other programming languages, Java features, Java Environment, Simple Java Program, Java Tokens, Java Statements, Constants, variables, data types,

Mathematical functions, Control statements- Decision making & branching, Decision making & looping. Class Fundamentals, Declaring Objects, Assigning Object reference variables, Methods.

Text Books :

1. Yashavant Kanetkar, Data Structures through C++, BPB Publication, 2nd Edition
2. Data structures, Algorithms and Applications in C++, 2nd Edition, Sartaj Sahni, Universities Press.
3. E Balagurusamy, "Object Oriented Programming Using C++ and JAVA"

Reference Books :

1. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum – Data structures using C and C++ - PHI Publications (2nd Edition).
2. Ellis Horowitz, Sartaj Sahni- Fundamentals of Data Structures – Computer Science Press.

ETUA22183: Analog and Digital Communication

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite:
Basics of signals & systems, transforms

Course Objectives:

- To make students familiar with mathematical interpretation related to the fundamentals of analog and digital communication system.
- To impart knowledge regarding concepts of AM, FM modulation and detection
- To analyze the design and operation of Radio receivers
- To familiarize the students to pulse and digital modulation and its reconstruction techniques.
- To analyze error performance of a digital communication system in presence of noise.
- To impart concept of spread spectrum communication system with respect to the modern communication systems.

Course Outcomes:
On completion of the course, students will be able to have :

1. An ability to interpret transmitter & receiver for digital communication system with interpretation of time & frequency domains
2. An ability to interpret, compare and contrast the AM and FM transmission modes
3. An ability to analyze AM and FM receivers.
4. An ability to use basics blocks in a digital communication system to design a transmitter and receiver section
5. An ability to impart knowledge of contemporary issues in spread spectrum communication system.
6. An ability to use the simulation tools necessary for analyzing digital communication system in terms of error rate and spectral efficiency.

Unit- I : Fundamentals of Electronic Communication Systems
Representation of electronic communication system, Comparison of analog and digital communication system, Modulation and Multiplexing, Need for modulation, Transmission media, Frequency spectrum and filtering, Basics of SNR, bandwidth. Normalized power in frequency domain, PSD, effect of transfer function on PSD. Orthogonal representation of signals. Interpretation of signals and their spectra using simulation tool (e.g. Matlab, Python, R programming or any other tool).

Unit –II : Amplitude and Frequency Modulation
Need for frequency translation, Amplitude modulation: Double sideband with carrier (modulator and demodulator), spectrum and power efficiency, SSB modulation and demodulation, Introduction to VSB, FM modulator and demodulator.

Unit III: Radio Receiver
Block diagram of AM and FM Receivers, Super heterodyne Receiver, Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection and IFRR. Tracking, Mixers. Super heterodyne FM Receiver, Pre emphasis & De-emphasis.

Unit IV: Digital Baseband Modulation and waveform

Introduction to Digital Communication System: Block Diagram, Digital Communication Nomenclature. Digital Versus Analog Performance Criteria, Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation, Differential Pulse Code Modulation, Data Formats and their spectra.

Unit V: Digital signal transmission and detection

Baseband and Pass band transmission and detection, Integrate and dump type receiver, and computation of Error Probability. Generation and detection of BPSK, BFSK, QPSK and M-ary modulation. Geometric representation.

Unit VI: Spread Spectrum Techniques

Introduction, Pseudo noise sequences, A notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Signal space dimensionality & processing gain, Concept of jamming, Frequency hop spread spectrum, Ethics in digital communication.

Text Books :

1. Taub, Schilling, "Principles of communication system"3rd Edition, Tata McGraw-Hill
2. Dennis Roddy & Coolen, "Electronic Communication",4th Edition, Prentice Hall.
3. B. P. Lathi , "Modern Digital and Analog. Communication Systems", 3rd Edition, Oxford.

Reference Books :

1. Frenzel, "Principles of Electronic Communication Systems"3rd Edition, Tata McGraw-Hill.
2. Bernard Sklar, Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications" Second Edition, Pearson Education.
3. A.B Carlson, P B Crully, J C Rutledge, "Communication Systems", Fourth Edition,McGraw Hill Publication.
4. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons

ETUA22184: Analog Circuits

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite: Readers/students are expected to know the following concepts/courses:
Engineering circuit analysis, Electronic Devices and circuits

Course Objectives:

- To understand the characteristics of Op-Amp and study the internal structure
- To study of various op-amp parameters, frequency response and transient response for Op-Amp
- To analyze and design linear and nonlinear applications of Op-Amp
- To analyze and design PLL and understand working of its applications

Course Outcomes: The students will be able to

1. Comprehend internal structure of Op-Amp and its parameters
2. Design and test linear applications of Op-Amp
3. Design and test Non Linear applications of Op-Amp
4. Identify signal conditioning requirements for signal processing applications such as filtering and design the same
5. Apply the knowledge about converters while selecting them in different signal conditioning applications
6. Design PLL based systems for different applications

Unit- I : OP-AMP Fundamentals and Parameters
Block diagram of OP-AMP, Explanation of each block, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configuration using 'r' parameters, Level shifter, ideal parameters and practical parameters of OP-AMP and their comparison, current mirror, symbol and ideal equivalent circuit of OP-AMP, frequency response, frequency compensation

Unit –II : Linear Applications of OP-AMP
Inverting and Non-inverting amplifier, voltage follower, voltage scaling, difference amplifier, Ideal integrator, errors in ideal integrator, practical integrator, frequency response of practical integrator, applications of integrator, Ideal differentiator, errors in ideal differentiator, practical differentiator, frequency response of practical differentiator, applications of differentiator, Requirements of Instrumentation amplifier, 3 OP-AMP Instrumentation amplifier, Instrumentation amplifier Applications

Unit III : Non-linear Applications of OP-AMP
Comparator, characteristics of comparator, applications of comparator, Schmitt trigger(symmetrical/asymmetrical), Square wave generator, triangular wave generator, Need of precision rectifier, Half wave , Full wave precision rectifiers, peak detectors, sample and hold circuits.

Unit IV: Active Filters
Difference between active and passive filters, Order of filter, First order and second order Butterworth LPF, First order and second order Butterworth HPF, Higher order filters (Concept level only), Need of higher order filters

Unit V:Converters using OP-AMP
I-V and V-I converter, ADC And DAC ,V-F and F-V converter(concept level only)

Unit VI : PLL and its applications

Block diagram and working of PLL, Characteristics/parameters of PLL. Different applications of PLL.

Text Books :

1. Ramakant A. Gaikwad, "Op-Amps and Linear Integrated Circuits", Pearson Education
2. Salivahanan and Kanchana bhaskaran, "Linear Integrated Circuits", TMH
3. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", TMH

Reference Books :

1. George Clayton and Steve Winder, "Operational Amplifiers", Newnes
2. D. Roy Choudhury & Shail Jain, "Linear integrated Circuits", New Age Publications
3. Operational amplifiers, with linear ICs , William Stanley, Pearson Education(2007)

ES22185ET: Effective Technical Communication

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite: Readers/students are expected to know written and oral English communication

Course Objectives:

- To understand the importance of effective technical communication
- To make familiar with technical documentation styles and methods
- To brief professional ethics and beliefs required at work place
- To prepare for effective oral and interview competency
- To impart tool assisted technical writing

Course Outcomes: The students will be able to

1. Understand information design and development
2. Write effective technical reports thematically and grammatically
3. Understand professional ethics and beliefs
4. Communicate orally as well in writing technical contents effectively
5. Understand work culture and etiquettes
6. Prepare technical document with auto formatting tool such as Latex

Unit –I : Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Unit-II : Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

Unit III: Self-Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

Unit IV: Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Unit V: Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Unit VI : LaTeX
Introduction, Document structure, Text formatting, Tables and Arrays, including graphics in the document, Mathematical typesetting, Creating bibliography.

Text Books :

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New
2. York, 2004
3. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003.
4. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.

Reference Books :

1. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
2. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004.
3. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New
4. Delhi 2002.
5. Leslie Lamport, "LaTeX - Document Preparation System – Users Guide and Reference Manual," Addision-Wesley publishing company.
6. Stefan Kottwitz, "LaTeX Beginner's Guide," PACKT Publishing

ETUA22186: Lab Practice-II

Teaching Scheme
Credits : 3
Practical : 6 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

Course Outcomes: On completion of the course, student will be able to:

1. Discuss the computational efficiency of the principal algorithms such as sorting & searching.
2. Describe how arrays, records, linked structures are represented in memory and use them in algorithms.
3. Interpret signal representation in time and frequency domain and compare and contrast spectrums of various analog and digital modulation techniques.
4. Compare and contrast various analog and digital modulation techniques by practically observing various parameters e.g. bandwidth, data rate signal and noise power.
5. Select the operational amplifier to design and analyze linear and nonlinear applications
6. Design ,build and test linear and Non Linear op amp based circuits

A: Data Structures (List of Experiments)

1 Create a singly linked list with options: a.Create b.Insert c.Display
2 Implement Stack using arrays. Write a menu driven program to perform following operations on stack a) Push b) Pop c) Display
3 Implement Queue using arrays. Write a menu driven program to perform following operations on Queue a) Insert b) Delete c) Display
4 Implement Stack using Linked Lists. Write a menu driven program to perform following operations on stack a) Push b) Pop c) Display
5 Implement Queue using linked List. Write a menu driven program to perform following operations on Queue a) Insert b) Delete c) Display
6 Binary search tree: Create, search, recursive traversals.
7 Graph using adjacency Matrix with BFS or DFS traversal.
8 Write a program in Java with class Rectangle with the data fields width, length, area and colour. The length, width and area are of double type and colour is of string type. If the area and colour both are the same for the objects then display " Matching Rectangles", otherwise display " Non-matching Rectangle".
9 Write some simple programs in Java such as
i) To find factorial of number.
ii) To display first 50 prime numbers.
iii) To find sum and average of N numbers.
10 Develop an application based on linear and nonlinear data structures.

B: Analog and Digital Communication (List of Experiments)

1. AM Generation (DSB-FC) using IC 1496/1596 and Detection: Calculation of modulation index by waveform and trapezoidal method.
2. Generation of DSB-SC with the help of Balanced Modulator IC1496/1596 & its detection.
3. Frequency Modulator (FM) generation and demodulation.
4. Verification of Sampling Theorem and types of sampling: (Flat top & Natural sampling)
5. Generate AM and FM waveform for given modulation index, signal frequency and carrier Frequency using modern tool like MATLAB or any other simulation tool.
6. Study of PCM
7. Study of DM and ADM.

8. Study of Generation &detection of BPSK and QPSK.
9. Study of Generation &detection of BFSK.
10. Study of line codes (NRZ, RZ, POLAR RZ, BIPOLAR (AMI), MANCHESTER) & their spectral analysis.
11. Study of Generation of PN Sequence and its spectrum.
12. Study of Generation &detection of DS-SS coherent BPSK & its spectrum.
13. Signal generation and analysis using Vector Signal Generator.

Note: Any 7 from 1 to 12 and 13 is compulsory

C: Analog Circuits (List of Experiments)

1 Design, build and test closed loop Inverting and Non inverting amplifier
- Design closed loop Inverting and Non inverting amplifier for given voltage gain
- Observe Input and output waveform and verify the voltage gain
- Also observe the output of op-amp without feedback

2 Measure op-amp parameters and compare with the specifications.
- Measure slew rate (LM741C and LF356)
- Measure CMRR
- Compare the result with datasheet of corresponding Op-Amp.

3 Design, build and test integrator (LF356).
- Design Integrator for given fa.
- Verify practical and theoretical frequencies fa and fb.
- Observe output waveform at fa and fb for Sine and Square wave input. Plot frequency response for integrator

4 Design, build and test three Op-amp instrumentation amplifier
- Plot the graph of output voltage versus input difference voltage. Comment on the nature of plot.

5 Design, build and test precision full wave rectifier.
- To implement precision full wave rectifier.
- Plot input and output waveforms.

6 Design, build and test Schmitt trigger.
- Design of symmetric Schmitt trigger circuit for given specifications. (LF356).Observe voltage waveforms and hysteresis. Calculate UTP, LTP and hysteresis theoretically and practically.
- Demonstrate the effect of external reference voltage source on UTP and LTP and hysteresis voltage.

7 Design, build and test first order/second order Butterworth high pass active filter
- Plot the frequency response, verify cut off frequency from plot with theoretical value

8 Design, build and test PLL
- Study PLL IC 565.
- Find the free running frequency.
- Find lock range and capture range.

9 Design, build and test square wave generator.
- Design of Square wave generator for given specifications
- Calculate frequency of output waveform theoretically and practically.

10 Demonstrate V to I convertor with grounded load using LabVIEW/Breadboard (Not to be included in practical exam)

Note: Any 8 from 1 to 10

ETUA22187: Electronics Workshop

Teaching Scheme
Credits: 3
Lectures: 2 Hrs/week
Practicals : 2 Hrs/week

Examination Scheme
Formative Assessment:100 Marks

Prerequisite:
Digital System Design, Electronics Devices and circuits, Engineering Circuit analysis

Course Objectives:

- To make the student familiar with electronic components
- To imbibe good soldering design practices for robust design of electronic systems.
- To highlight the importance and teach PCB artwork with an EDA tool.
- To orient the students towards hardware implementation
- To learn the steps in electronic circuit through simulation and hardware implementation
- To imbibe good soldering design practices for robust design of electronic systems.
- To understand the importance of documentation by compiling Project Report

Course Outcomes: On completion of the course, students will be able to:

1. Interpret and summaries the specifications of different components required to build electronic circuit.
2. Identify appropriate components and devices for designing small electronic circuit
3. Use skillful an EDA tool in designing of electronic circuit schematic and simulation
4. Select optimal PCB design for building small circuit.
5. Skillfully solder any robust design PCB of electronic systems.
6. Elaborate the use of designed circuit in different applications.

Unit I : Introduction to Electronics Components

a) Passive Components:
   i) Resistor: Types (Fixed, Variable), Standard Values, Tolerance, Wattage, Linear and Log Potentiometer.
   ii) Capacitor: Types (Ceramic, Electrolytic, tentalium), Standard Values, Tolerance, WVDC, Temperature, Application Areas
   iii) Inductor: Core Types, Construction, SWG Table, Application Areas

b) Active Components:
   i) Diodes: Types (small signal, rectifier, Switching, zener, Power) Parameters (PIV, IF, IFM(rep.) IFM (non rep), trr, Bulk resistance, PZmax, IZmax, IZK, Derating)
   ii) BJT: Types (Small signal, Power), Parameters (BVCEO, ICmax, Pdmax, Derating, SOA)
   iii) FET: Types (FET, MOSFET), Parameters (BVDS, IDmax, Pdmax, Rds)

Transformer: Power Transformer construction, Audio Frequency Transformer, High Frequency Transformer, Relay Types

Unit - II : Building small electronic circuit and EDA Tools

Selecting a small electronic circuit involving discrete devices, op amp, and LSI devices only. Understanding the working of circuit with validating the circuit feasibility, category, component selection, Simulating the selected circuit using EDA tools e.g. Proteus, Multisim, PCB Software

Unit - III : Development of PCB and Soldering Practice

Types of PCB, concept of PTH, design guidelines for PCB, routing topology, grounding methodologies, simple artwork on single sided PCB, Solder Iron Types (Wattage), Solder metal types, flux, Types of soldering and soldering process, Disordering. Building own PCB.

Unit - IV: Circuit Testing and Documentation

Bare board testing and final completed PCB testing with the help of various electronic instruments. To prepare report mentioning simulation, results and hardware results, Bill of Materials

Reference Books:

1. Simulation Software's Help Manual (Examples. Multisim, Proteus, Altium Design)
2. Data Books
3. Magazine (Examples. Everyday Practical Electronics , Elektor, Electronics For You, various online magazines)

List of experiments

1. Statistical analysis for electronic components (Resistor). Finding Mean, Median, Mode, Varience and standard deviation for resistor value using calibrated DMM.
2. Study of electronics instruments DMM, CRO, DSO, Function Generator, Logic Analyzer,
3. Study of passive electronic components Resistor, Capacitor, Inductor.
4. Study of active electronic components Diode, BJT, MoS FET, IGBT.
5. Designing and simulating electronic circuit using simulation software (Mutism / Proteus).
6. Designing of single sided PCB artwork for circuit using PCB software (PADS/ EAGLE/PROTEL).
7. Developing single sided PCB through chemical etching process.
8. Bare board testing complete PCB testing after assembly.
9. Hand on practice for skilled Soldering and de-soldering of PCB.
10. Writing a technical report

ETUA22188: Electromagnetics

Teaching Scheme
Credits: 2
Lectures: 2 Hrs/week

Examination Scheme
Formative Assessment: 100 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Vectors, Differential equations

Course Objectives:

- To study Basic Electrostatic and Magneto static Laws, Theorems.
- To understand Maxwell's Equation and apply to the basic electromagnetic problem.
- To analyze boundary conditions, and understand the field at the interface of two different media.
- To analyze time varying electric and magnetic fields, wave propagation in different types of media.

Course Outcomes: On completion of the course, students will be able to:

1. Apply Electrostatic and laws and theorems to solve electric field problems.
2. Apply Magnetostatic laws and theorems to solve magnetic field problems.
3. Interpret the electromagnetic problem and solve using Maxwell's equations.
4. Apply boundary conditions to different media, and formulate uniform plane wave equation, which is the basic of Antenna and wave propagation.

Unit –I: Electrostatics

Coulomb's Law & Electric Field Intensity, Electric Field due to Point Charge & Continuous Charge Distributions, Electric Flux Density, Gauss's Law and its Applications, Divergence & Divergence Theorem, Electric Potential, Electric Dipole and Flux Lines, Energy Density in Electrostatic Field, Polarization in Dielectrics, Capacitance, Boundary Conditions, Poisson's and Laplace's Equations.

Unit II : Magnetostatics

Biot-Savart's Law, Ampere's Circuit Law and its Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Classification of Magnetic Materials, Magnetic Boundary Conditions.

Unit III: Time Varying Fields and Maxwell's Equations

Faraday's Law, Displacement Current, Maxwell's Fundamental equations for free space propagation, Wave Propagation in Dielectrics , Power and Poynting Theorem, Polarization of Wave: Linear, Circular & Elliptical, Reflection of a Plane Wave at Normal Incidence

Unit IV: Wave propagation

Ground, sky & space wave propagations. Virtual height, MUF, Skip distance

Antenna fundamentals: Introduction, Types of Antenna, Radiation Mechanism, Definitions of antenna parameters, Study of standing wave low frequency smart antenna, design of wire antenna, Microstrip, aperture antenna, Introduction to arrays, Antenna Arrays: Two element array, pattern multiplication N-element linear array: uniform amplitude and spacing, broad side and end-fire array, array factor,Simulation and modeling for Linear antennas.

Text Books:

1. Matthew N.O. Sadiki, "Principles of Electromagnetics", 4th Edition, Oxford University Press, 2009.
2. R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw-Hill Education, 2005

Reference Books:

1. Edminister J. A, "Electromagnetics", Tata McGraw - Hill.
2. Hayt & Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw- Hill\
3. Narayana, "Elements of Engineering Electromagnetics" PHI