Title of the Course: ENGINEERING MATHEMATICS-III Course Code: UETC0301	**L**	**T**	**P**	**Credits**
	03	01	---	04

Course Pre-Requisite: Basic terminologies of differential equations, vector algebra, concepts of probability, rules and formulae of derivative integration.

Course Description: This Course contains linear differential equations, vector calculus, Laplace transform, probability distributions, Fourier series, Fourier Transform and Z transform.

Course Objectives:

1. To develop abstract, logical and critical thinking and the ability to reflect critically upon their work.
2. To study various mathematical tools like differential equations, integral transforms, vector calculus, probability and Z-transform to devise engineering solutions for given situations.
3. The student must be able to formulate a mathematical model of a real life and engineering problem, solve and interpret the solution in real world.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive Level	Descriptor
CO1	**Solve** linear differential equations with constants coefficients and **apply** them to realistic problems.	III	Applying
CO2	**Find** directional derivatives and **apply** knowledge of vector differentiation to find curl and divergence of vector fields.	I	Remembering
CO3	**Define the** Laplace transform and **use** it to get solution of boundary value problems .	I	Remembering
CO4	**Determine** the defectiveness in items / products using probability distributions.	V	Evaluating
CO5	**Develop Fourier series expansion of a** function over the given interval.	III	Applying
CO6	Apply the knowledge of Z transform to discrete data in the form a function	III	Applying

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	2	-	-	-	-	-	-	-	-
CO4	-	-	3	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	-	3	-

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three units)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three units) covered after MSE.

Course Contents:

Unit 1: Linear Differential Equations with Constant Coefficients and Its Applications 1.1 Definition, general form, complete solution 1.2 Rules for finding complementary function 1.3 Rules for finding particular integral 1.4 Applications to electric circuits	8 Hrs.
Unit 2: Vector Calculus 2.1 Differentiation of vectors 2.2 Velocity and acceleration 2.3 Gradient of scalar point function and Directional derivative 2.4 Divergence of vector point function 2.5 Curl of a vector point function 2.6 Solenoidal and Irrotational vector fields	7 Hrs.
Unit 3: Laplace Transform 3.1 Definition, transforms of elementary functions, properties of Laplace transform 3.2 Transforms of derivative and integral 3.3 Inverse Laplace transform 3.4 Inverse Laplace transforms by using partial fractions and Convolution theorem. 3.5 Transform of periodic functions and Heaviside unit step function. 3.6 Solution of linear differential equations with constant coefficients by Laplace transform method.	8 Hrs.
Unit 4: Probability Distributions 4.1 Random variable 4.2 Probability mass function and probability density function 4.3 Binomial distribution 4.4 Poisson distribution 4.5 Normal distribution	6 Hrs.

Unit 5: Fourier Series& Fourier Transform 5.1 Definition, Euler's formulae, Dirichlet's conditions. 5.2 Change of interval 5.3 Expansion of odd and even periodic functions 5.4 Half range series 5.5 Introduction, Definition , Fourier Transform 5.6 Properties of Fourier transform 5.6.1 Change of scale property 5.6.2 Shifting property. 5.7 Convolution theorem for Fourier transform 5.8 Parseval's identity for Fourier transform	7 Hrs.
Unit 6: Z Transform 6.1 Introduction, Definition- Z transform 6.2 Z transform of basic sequences 6.3 Properties of Z transform 6.4 Z transform of some standard discrete function 6.5 Evaluation of Inverse Z transform 6.6 Application to Difference equation	6 Hrs.
Recommended Books: 1. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers, Delhi. 2. A Text Book of Applied Mathematics, Vol. I and vol. II by P. N. Wartikar& J. N. Wartikar, Pune VidyarthiGrihaPrakashan, Pune.	
Reference Books: 1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India Pvt. Ltd. 2. Advanced Engineering Mathematics by H. K. Dass, S. Chand, New Delhi. 3. A text book of Engineering Mathematics by N. P. Bali, Iyengar, Laxmi Publications (P) Ltd., New Delhi. 4. Mathematics for Engineers Vol-I &Vol-II by RakeshDube, Narosa Publishing House.	

Unit wise Measurable Learning Outcomes:

Unit 1: Linear Differential Equations with Constant Coefficients and Its Applications

Students are able to

a) Solve linear differential equations with constant coefficients.
b) Solve the problems on **electrical circuits.**

Unit 2: Vector Calculus

Students are able to

a) Differentiate vector quantity.
b) Find the directional derivative of scalar point function.
c) Find the divergence and curl of vector point function.
d) Determine solenoidal and irrotational fields with the help of divergence and curl respectively.

Unit 3: Laplace Transform

Students are able to

a) Find Laplace transform by using definition
b) Recall properties of Laplace transform and use to find transforms of given functions.
c) Use Laplace transforms method to solve linear differential equations.

Unit 4: Probability Distributions

Students are able to

a) Verify the function as probability mass and density function.
b) Use probability distributions in solving physical and engineering problems.

Unit 5 : Fourier Series & Fourier Transform

Students are able to

a) Define Fourier series, Euler's formulae.
b) Develop Fourier series in an interval.
c) Expand function as the half range sine or half range cosine series.
d) find Fourier transform of various functions

Unit 6: Z Transform

Students are able to

a) Find Z transform of discrete sequence
b) Obtain inverse Z transforms of function
c) Solve the difference equation.

Title of the Course: Analog Circuits - I	**L**	**T**	**P**	**Credit**
Course Code: UETC0302	03	-	-	03

Course Pre-Requisite: 12th Physics

Course Description: This course has been designed to introduce students with construction, theory and characteristics of various electronics devices. Also this course will lay strong fundamental base of discrete electronics and to develop capacity to analyze, interpret and design different electronics circuits.

Course Objectives:

1. To **explain** the differences between the various types of diode
2. To **explain** the operation of transistor and its different configurations
3. To **explain** the working of electronic circuits like diodes and amplifiers using BJT and MOSFETs.
4. To **explain** the small signal models used for performance analysis of electronic circuits.
5. To **illustrate** the methods of designing the electronic circuits using discrete components.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		Level	Descriptor
CO 1	To **understand** the working of diode and transistors	Cognitive	Under-standing
CO 2	**Analyze** the performance of electronic circuits (Voltage amplifiers) using small signal models such as hybrid-parameter model.	Cognitive	Analyzing
CO 3	**Evaluate** the performance of diodes and Voltage amplifiers.	Cognitive	Evaluating
CO 4	**Design** the electronic circuits (rectifiers, filters and amplifiers) for given specifications using discrete components such as diodes, BJT, FET and MOSFET.	Cognitive	Creating
CO 5	**Select** an appropriate rectifier, filter and amplifier for given application.	Psycho-motor	Applying

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	3	
CO3	-	-	3	2	-	-	-	-	-	-	-	-
CO4	-	-	3	2	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	-

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.	
Course Contents:	
Unit 1: Semiconductor Diode **PN Junction Diode**: VI characteristics, current components, drift and diffusion current, Diode current equation, temperature dependence of VI characteristics, diode equivalent circuits, diode resistance and capacitance, various breakdown mechanisms **Introduction to Special Semiconductor Diodes:** Zener diode, PIN diode, Photo diode, LED - construction, characteristics, symbol, equivalent circuits. (Numericals are expected).	08 Hrs.
Unit 2: Unregulated Power Supplies **Rectifiers:** Half, Full and Bridge Rectifier, Analysis for different parameters: PIV, TUF, efficiency, ripple factor, regulation, etc. **Filters:** Need of filters, Types: Capacitor, Inductor, LC, CLC, Analysis for ripple factor and regulation. Design of unregulated power supply with and Without filter.	08 Hrs.
Unit 3: Voltage Regulators Need of voltage regulator, Stabilization factors Analysis & Design of Shunt regulator (using Zener diode & BJT), series voltage regulator (using BJT) Series voltage regulator with Pre- regulator & Overload protection circuit.	08 Hrs.
Unit 4: Transistors **a. Bipolar Junction Transistor:** Construction, Operation. Common Base Configuration, Transistor Amplifying Action, Common Emitter Configuration, Common Collector Configuration, Limit of Operation, Transistor Data Sheet, Power Dissipation, Heat Sinking. **b. Field Effect Transistor:** *n*-Channel JFET, Characteristics of *n* – Channel JFET, *p* – Channel JFET, JFET Data Sheet and Parameters, FET Voltage Amplification, JFET Construction, FET Equivalent Circuit, MOSFET.	08 Hrs.
Unit 5: Transistor Biasing **BJT**: DC Load Line and Bias Point, Fixed Current Bias, Collector-to-Base Bias, Emitter Current Bias, Thermal Stability, AC Biasing, AC Load Line, Biasing Transistor Switching Circuits. FET: DC Load Line and Bias Point, Fixed Voltage Bias Circuit, Self-Bias Circuit, Potential Divider Bias, Biasing MOSFETs, Biasing FET Switching Circuits.	08 Hrs.
Unit 6: BJT and MOSFET Amplifiers BJT: H-Parameters, Hybrid model for transistor and their approximate model (CE, CB& CC configuration), Analysis of CE, CC (emitter follower) amplifier. Design of CE amplifier MOSFET: Small-Signal Equivalent Model, Analysis of Common Source (CS) and Common Drain (Source Follower) amplifier. Design of Common Source (CS).	08 Hrs.
Textbooks: 1. *Electronic Devices and Circuits*, R. Boylestad & L. Nashelsky, Prentice Hall International, 8th Edition, 2005. *2.* Allen Mottershed —'Electronic devices & circuits'-Prentice- Hall India 3. N.C. Goyal & R.K. Khetan-' A Monograph on Electronics Design Principles'-Vth Edition-	

Khanna Publishers

References:

1. David A. Bell —‘Electronic devices & circuits’- IVth Edition- Prentice- Hall India
2. Millman & C.Halkias -‘Electronic devices & circuits’-IInd Edition- Tata McGraw Hill Publication

Unit wise Measurable students Learning Outcomes:

1. **Compare and Contrast** between the various types of diode
2. To **understand** the working of transistors and its configurations
3. **Apply** the small signal models (tools) to **analyze** the performance of voltage amplifiers built using BJT.
4. **Analyze** the performance of rectifiers, BJT & FET amplifiers.
5. **Analyze** and **Design** BJT & MOSFET amplifiers.

Title of the Course: Digital System	**L**	**T**	**P**	**Credit**
Course Code:UETC0303	03	--	--	03

Course Pre-Requisite: Basic knowledge of numbering system and logic gates.

Course Description:

It is a core and fundamental subject. The course focuses on basic skills in method of design and analysis of digital system like counters, registers,FSM etc.

Course Objectives: The course aims to:

1.Explain Boolean algebra and the various methods of Boolean function reduction, Kmap reduction and QuineMcCluskey method.

2. Understand principles, characteristics and operations of combinational & sequential logic circuits.

3. Design, implement and analyze asynchronous and synchronous sequential circuits(FSM) using flip flops.

4. Explain the various 74XX series components and their applications in designing combinational & low complexity sequential circuits.

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO 1	**Apply** Boolean laws/K-Map-method to reduce a given Boolean function.	Application	Apply
CO 2	Design & realize combinational logic circuits using logic gates, MSI circuits,	Synthesis	Design
CO 3	Demonstrate the operation of flip-flops, counters and shift registers.	Comprehension	Demonstrate
CO 4	Design Synchronous sequential machine using Moore and Mealy machine	Create	Design

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	1	3	3	3	2	--	--	--	--	--	--
CO2	3	1	3	3	3	2	--	--	--	--	--	--
CO3	2	2	3	2	3	2	--	--	--	--	--	--
CO4	2	2	3	3	3	2	--	--	--	--	--	--

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Unit 1:---Logic Simplification and Combinational Logic Design SOP, POS, Simplification of Switching function & representation (Maxterm &Minterm), Boolean expression & representation using logic gates, Propagation delay in logic gate. Boolean optimization, K-map optimization**,** Boolean optimization, K-map optimization**.**	6 Hrs.
Unit 2:Combinational Logic Circuits Adder, Subtractor, code converters (binary to gray & gray to binary, BCD to Excess 3 and vice versa, BCD to 7 segment display)(IC 7447, 7448), Multiplexer and Demultiplexer, encoder, priority encoder, decoder, adder with look ahead carry generator, Parallel adder (IC 7483), Subtractor using adder, 4 bit Magnitude Comparator (7485)	6 Hrs.
Unit 3:---Sequential Logic Circuits 1 Bit Memory Cell Flip-flop & Timing Circuits: SR latch, Gated latch, Edge triggered flip-plop:- D, JK, T Flip-flop, flip flop asynchronous inputs ,characteristic table of Flip-flop, excitation table of Flip-flop, , master slave JK flip flop, inter conversion of Flip-flop. Study of timing parameters of flip-flop: clock to Q, setup time, hold time, timing parameters of flip flop asynchronous input.	6 Hrs.
Unit 4:--- : **Applications of Sequential circuits** Shit resistor: buffer register, controlled buffer register. Data transmission in shift resistor SISO, SIPO, PISO, PIPO, Bidirectional shift resistor universal shift resistor. Counter: Classification, Ripple or asynchronous counter, Effect of propagation delay in ripple counters, up-down counter, Mod-n counter, synchronous counter, Ring counter, Johnson counter.	8 Hrs.
Unit 5:---Synchronous Sequence Machines FSM, Moore/Mealy machines, representation techniques, state diagram, state table, state assignment and state reduction, implementation using D flip flop.	4 Hrs.
Unit 6:---Logic Families and Semiconductor Memories: Characteristic of Digital ICs, Transistor – Transistor Logic, Complementary MOS (CMOS) Logic, Comparison of TTL and CMOS families. Memory Devices: ROM, PROM, EPROM, EEPROM, RAM, SRAM, DRAM. TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing.	6 Hrs.
Textbooks: 1. Anand Kumar ‘Fundamentals of Digital Circuits’--. PHI 2. M. Morris Mano ‘Digital Design’-- (Third Edition),. PHI	
References: 1] Willim I. Fletcher.’An Engineering Approach to Digital Design’—PHI/ Pearson 2] NormanBalabanianBradle Carlson. ‘Digital Logic Design Principals,.’ Wiley Publication. 3] Rajkamal ‘Digital Systems Principals and Design’—Pearson 4] A.P. Malvino, D.P. Leach ‘Digital Principles &Applications’ -VIth Edition-Tata McGraw Hill, Publication.5] R.P. Jain-‘Modern Digital Electronics’ IIIrd Edition- Tata McGraw Hill, Publication	
Unit wise Measurable students Learning Outcomes: Upon successful completion of this course students will be able to: 1. Explain various Boolean laws and it’s reduction technique. 2. Understand principles, characteristics and operations of combinational logic circuits. 3. Understand principles, characteristics and operations of sequential logic circuits. 4.Design applications of sequential logic circuits 5. Analyze Finite state machines. 6. Explain logic families and memories.	

Title of the	**L**	**T**	**P**	**Credit**

Course: Network Analysis Course Code: UETC0304	03	01	-	04

Course Pre-Requisite:
Basic Electrical Engineering.(KCL,KVL,Voltage division rule, Current division rule, Ohm's Law, Series and parallel combination of R,L and C components).
Engineering Mathematics-I, II, III.(Partial fraction expansion, matrices, determinants calculus and differential equations).

Course Description: Course deals with different types of Circuit Theorems apply to AC and DC network & Graph theory. Also we discuss two port network and their interconnection. Also we study Resonance, different filters and Transient response of various AC and DC network.

Course Objectives:
1. To introduce the basic terminologies related to the electrical parameters and sources and adopt the network solving techniques and graph theory.
2. To Study different theorems and understand the need and necessity of different theorems.
3. To study and classify 2-port network parameters and to understand concept of frequency domain, pole-zero and network stability issues.
4. To analyze different resonance circuits.
5. To design different types of Filters.
6. To design and analyze transient response of R-L-C circuit by using integro-differential equations and/or Laplace transform approach

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Explain the graph theory and solve problems related to different theorems used for network analysis.	Cognitive(Comprehension)	Explain
CO2	Demonstrate two port networks and its parameters.	Cognitive(Comprehension)	Demonstrate
CO3	Explain series and parallel resonance and its effects.	Cognitive(Comprehension)	Explain
CO4	Identify and study type of transient system.	Psychomotor(Analysis)	Identify
CO5	Classify different filter approximations.	Cognitive(Synthesis)	Classify

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	3	-	1	3	-	-	-	-	1	
CO2	2	3	3	-	3	3	-	-	-	-	3	
CO3	2	3	3	-	3	3	-	-	-	-	3	
CO4	-	3	3	-	3	3	-	-	-	-	3	
CO5	-	3	3	-	3	3	-	-	-	-	3	

Assessments :
Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Development of Basic Circuit Concepts And Graph Theory: Conventions for describing networks, network Equations, Kirchhoff 's Law, source transformations, Lumped Circuit elements, Ideal Sources (Dependent & Independent), Linear Passive elements relationship of Circuit elements-Definitions: Node, Loop, Path & Branch, source transformation, star-delta transformation, loop analysis, node analysis, Super mesh and super node analysis. (Examples – Kirchhoff's Laws and Application, formulations of networks, loop analysis, node analysis (Both AC & DC). **Graph Theory:** Graph of a network, Trees, chords and branches, Incidence matrix, loop matrix, Tie-set and cutest of a graph, examples based on above concepts.	06Hrs.
Unit 2:--- Network Theorems: (Both DC & AC Circuit Analysis) : Superposition Theorem, Millman's Theorem, Norton's Theorem, Thevenin's Theorem, Maximum Power Transfer Theorem, Duality theorem, Millers theorem.	08 Hrs.
Unit 3:--- Two Port Network & Network Functions: Two port Network: Relationship of Two-port variables, short-circuit admittance parameters, the open circuit impedance parameters, transmission parameters, the hybrid parameters, relationships between parameters sets, parallel and series connections of two-port network. Network Function: Transfer functions of two port network, Poles and Zeros of network function, time domain response from pole zero plot, amplitude and phase response from pole zero plot.	06 Hrs.
Unit 4:--- Resonance: Introduction to AC circuit, steady state analysis of RL, RC and RLC circuits, Impedance, phase diagrams, power and power factor, Series resonance: Bandwidth Factor. Parallel resonance: Bandwidth, Q Factor,Tank circuit.	06Hrs.
Unit 5:--- Filters: Introduction, Classification, filter fundamental such as attenuation constant (O), phase shift (N) propagation constant (S) characteristic impedance (Zo). Design of Low pass, High pass, Band pass & Band reject filter, Design & analysis of constant K, M derived & composite filters (low pass, high pass, band pass & band stop filters).	06Hrs.
Unit 6:--- Transient Response:	

Network Solution using Laplace transforms, Initial Conditions of elements. Steady state & transient response (Voltage) DC response of RL circuit DC response of RC circuit DC response of RLC circuit Sinusoidal response of RL, RC & RLC circuit	04Hrs.

Textbooks:

1) A. Sudhakar ,Shyammohan S.Palli 'Circuit & Network – Analysis & Synthesis' IIIrd Edition – Tata McGraw Hill Publication (Unit II,IV,VI)
2) A.Chakrabarti 'Circuit Theory (Analysis & Synthesis)' - IIIrd Edition (Unit I,II) Dhanpat Rai & co
3) D. Roy Choudhury 'Networks & Systems' - New Age International Publisher (Unit I,II,III)
4) Soni Gupta 'Electrical Circuit Analysis' Dhanpat Rai & Co. (Unit III,IV,V,VI)
5) Boylestad 'Introductory Circuit Analysis – Universal book stall, New Delhi.(Unit I,II)

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Reference Books:

1) William H Hayt, Jack E Kimmerly and Steven M.Durbin, Engineering Circuit Analysis, Tata McGraw Hill
2) M.E.Van Valkenburg ' Network Analysis' – IIIrd Edition , Pearson Education / PHI
3) Josheph Edministrar 'Theory & Problems of Electronic Circuit (Schaum's series) Tata McGraw Hill, Publication
4) R.G .Kaduskar, S.O.Rajankar, T.S. Khatavkar, Network Fundamentals and Analysis – Wiley India

Unit wise Measurable students Learning Outcomes:

After the completion of the course the student should be able to

1) Explain the graph theory and analyze the circuit using graph theory.
2) Solve problems related to different theorems used for network analysis.
2) Describe & demonstrate different types of AM Receivers.
3) Demonstrate two port networks and its parameters.
4) Explain series and parallel resonance and its effects.
5) Apply and implement filter approximations.
6) Identify and study the type of transient system.

Title of the Course: Electronic Instrumentation & Measurement **Course Code:** UETC0305	**L**	**T**	**P**	**Credit**
	03	-	-	03

Course Pre-Requisite: Basics of electronics

Course Description:

The course aims to Provide knowledge of different parts of Measurement system, instrumentation system & different types of transducers

Course Objectives:

This course aims to

1. Provide introduction of different types of Transducers & sensors
2. Provide knowledge of different parts of Measurement system
3. Provide basic knowledge of measurement system
4. Provide basic understanding of different Electronic instruments
5. Provide knowledge of different types of bridges

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's level	Descriptor
CO 1	Select appropriate transducer as per requirement	Cognitive	Analysis
CO 2	Identify suitable linear & nonlinear circuits	Cognitive	Knowledge
CO 3	Illustrate analog signals parameters related to electronic measurement	Cognitive	Application
CO 4	Explain the basic features & block diagram of oscilloscope	Cognitive	Comprehension

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	3	3	3	1	-	-	-	-	-	-
CO2	3	3	3	2	2	2	-	-	-	-	-	-
CO3	3	1	3	2	1	1	-	-	-	-	-	-
CO4	3	1	3	3	3	1	-	-	-	-	-	-

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Transducers & Sensors: Definition, Various Types of Transducers, Classification of Transducers, Selection Factors and General Applications of Transducers, Detailed Study of Transducers: (i) Motion, (ii) Flow, (iii) Pressure, (iv) Temperature, (v) Force , (vi) Sound Transducer, Hall Effect Transducers, Digital Transducers, Proximity Devices, optical Sensors, Piezo – electric sensors	6 **Hrs.**
Unit 2:--- Introduction to Measurement: Introduction of measurement system, Performance Characteristics, Static Characteristics, Error in Measurement, Types of Static Error, Sources of Error, Dynamic Characteristics, Statistical Analysis, Electrical Standards	5 **Hrs.**
Unit 3:--- Signal Conditioning & Data Acquisition System: Introduction, analog DAS, digital DAS, multi channel DAS, data converters-ADC integrating type ADC, dual slope integrating type ADC, successive approximation type ADC, flash type ADC. DAC-multiplexer, sample and hold circuit	6 **Hrs.**
Unit 4:--- Measuring Instruments: Analog Instruments- Introduction, types of analog instruments, PMMC, MI, solid state electronic instruments, ohmmeter. Digital voltmeters- Introduction, Types of DVM , general specifications of DVM, digital multimeter, digital measurements of time, digital frequency meter , Q meter,	7 Hrs
Unit 5:--- Oscilloscope: CRO: Dual Beam, Dual Trace, Digital storage, Measurement of phase and frequency using Lissajous pattern, CRO probes: active, passive, current, attenuators, LED, LCD, Graphics Display **Function generator & analyzer:** Sine wave generator, square wave and pulse generator, function generator, wave analyzer, harmonic distortion analyzer, spectrum analyzer, logic analyzer	7 **Hrs.**
Unit 6:--- Bridges: DC Bridges- Introduction, Wheatstone bridge, Kelvin's bridge. AC Bridges-Introduction, measurement of inductance-Maxwell's bridge, Hay's bridge, Andersons bridge, measurement of capacitance- Schering bridge, wein bridge	5Hrs
Textbooks: 1] A course in Electrical, Electronics measurement and Instrumentation, A.K. Sawhney 2]Electronic Instrumentation, H. S. Kalsi, MGH, 3rd Edition	
References: 1] Electronic Instrumentation and Measurement Techniques, Helfrick Cooper. 2] Instrumentation for Engineers And Scientists , John Turner ,II Edition , Wiley 3] Electronic Instrumentation and Measurements, David A Bell, Third Edition, Oxford 4]Instrumentation for Engineering Measurements, James W Dally, II Edition , Wiley	
Unit wise Measurable students Learning Outcomes: Upon successful completion of this course students will be able to: 1] Identify and classify error sources and explain how their effects can be minimized in Measurement 2] Analyze different systems used in data acquisition 3] Explain operating principle of measuring instruments like DVM, DMM. 4] Apply knowledge of lissajous pattern to determine frequency of a signal 5] Understand principle of operation of transducers & Apply knowledge of transducer and sensor for various applications6] Design bridge circuits	

Audit Course-I

Shivaji University, Kolhapur
Second year undergraduate compulsory course in
ENVIRONMENTAL STUDIES
Course Code : UETC0361
Lecture :02
Syllabus

1. Nature of Environmental Studies. (4 lectures)

Definition, scope and importance.
Multidisciplinary nature of environmental studies
Need for public awareness.

2. Natural Resources and Associated Problems. (4 lectures)
a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources.
d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems.
e) Energy resources: Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources.
Solar energy, Biomass energy, Nuclear energy.
f) Land resources: Solar energy , Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
Role of an individuals in conservation of natural resources.

3. Ecosystems (6 lectures)
Concept of an ecosystem.
Structure and function of an ecosystem.
Producers, consumers and decomposers.
Energy flow in the ecosystem.

Ecological succession.
Food chains, food webs and ecological pyramids.
Introduction, types, characteristics features, structure and function of the following ecosystem :-
a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem,
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

4. Biodiversity and its conservation (6 lectures)
Introduction- Definition: genetic, species and ecosystem diversity.
Bio-geographical classification of India.
Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
India as a mega- diversity nation.
Western Ghat as a biodiversity region.
Hot-spot of biodiversity.
Threats to biodiversity habitat loss, poaching of wildlife, man- wildlife conflicts.
Endangered and endemic species of India.
Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5. Environmental Pollution (6 lectures)
Definition: Causes, effects and control measures of: Air pollution,
Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.
Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of a individual in prevention of pollution.

6. Social Issues and the Environment (8 lectures)
Disaster management: floods, earthquake, cyclone, tsunami and landslides.
Urban problems related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns.
Environmental ethics: Issue and possible solutions.
Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.
Wasteland reclamation.
Consumerism and waste products.

7. Environmental Protection (8 lectures)
From Unsustainable to Sustainable development.
Environmental Protection Act.
Air (Prevention and Control of Pollution) Act.
Water (Prevention and control of Pollution) Act.
Wildlife Protection Act.
Forest Conservation Act.

Population Growth and Human Health, Human Rights.

8. Field Work (10 lectures)

Visit to a local area to document environmental assets-
River/Forest/Grassland/Hill/Mountain.

or

Visit to a local polluted site - Urban / Rural / Industrial /Agricultural.

or

Study of common plants, insects, birds.

or

Study of simple ecosystems - ponds, river, hill slopes, etc.

References :

1) Agarwal, K.C.2001, Environmental Biology, Nidi Pub. Ltd., Bikaner.
2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380013, India, Email:mapin@icenet.net (R)

Title of the Course: Object Oriented Programming Course Code:UETC0333	**L**	**T**	**P**	**Credit**		
			01	--	--	01

Course Pre-Requisite: A working knowledge of C programming is sufficient**.**

Course Description:

This course is an extension of courses exposing students to the many concepts of programming. The course is an expository of the object-oriented programming methodology with emphasis on software design and code reuse as its core objectives. As a practical course, the focus is to equip students with adequate high-level object-oriented programming techniques required for successful design, development, and deployment of today's complex software systems. Furthermore, the students are actually mentored to master how the C++ and Java technology can be used to develop modern software systems.

Course Objectives:

1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. Understand fundamentals of object-oriented programming in C++ including defining classes, invoking methods, using classes.
3. Be aware of the important topics and principles of software development.
4. Have the ability to write a computer program to solve specified problems.
5. Be able to use the C++ concepts and Java SDK environment to create, debug and run programs.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor

CO 1	Explain the basics of objective oriented programming concepts.	Cognitive	Explain
CO 2	Model simple OOPs using classes and objects.	Cognitive	Apply
CO 3	Demonstrate use of polymorphism and Inheritance	Cognitive	Demonstrate
CO 4	Illustrate various operations related to file handling.	Cognitive	Apply

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	3	3	3	1	1	2	2	3	2	3	3
CO2	3	3	2	2	2	3	1	1	2	1	3	2
CO3	2	2	1	1	1	1	1	1	1	1	1	2
CO4	3	2	2	2	3	2	1	1	1	1	2	1
CO5	2	3	3	2	2	3	2	2	2	3	1	3
CO6	3	3	3	3	2	3	2	1	2	3	1	1

Course Contents:

Unit 1: Introduction to OOP Object oriented programming [C++], applications of OOP & C++, dynamic initialization of variables, storage classes. Functions in C++, function prototype, call & return by reference, inline function, Default & Constant argument.	2 Hrs.
Unit 2:Classes and objects Introduction, structures, classes, defining member function, making an outside function inline, Nesting member function, private member function, Arrays within a class, memory allocation for objects, Array of objects, pointer to members. Pointers to objects this Pointers.	3 Hrs.
Unit 3: Constructors and Destructors Constructors, parameterized and multiple, constructors with default arguments, Dynamic initialization of objects (new, delete) copy constructor, dynamic constructors and destructors.	2 Hrs.
Unit 4: Polymorphism Function overloading, Unary & binary operator overloading, manipulation of strings using operators. Friend function & friend class.	2 Hrs.
Unit 5: Inheritance Single, multiple, multilevel, Hybrid, Hierarchical inheritance, virtual base classes, Abstract classes. Templates, exception handling.	3 Hrs.
Unit 6: File Handling Classes for file stream operations, opening and closing of files, file modes, file pointer & their manipulations, sequential I/O operations.	2 Hrs.

Textbooks:

1. E Balgurusamy –‘Object oriented programming with C++’ -, IIIrd Edition- Tata Mc-Graw Hill Publication
2. Rajesh K.Shukla-‘Object – Oriented Programming in C++’WILEY,INDIA .
3. Herbert Schildt, “Complete reference Java 2”, TMGH publication.

References:

1. Schildt –‘The Complete Reference C++’ - IIIrd Edition - Tata McGraw Hill Publication
2. D Ravichandran.-‘Programming with C++ ‘-IInd Edition- Tata McGraw Hill Publication
3. RohitKhurana-‘Object oriented programming with C++’-second edition-Vikas publication

Unit wise Measurable students Learning Outcomes:

1. Explain the basics of objective oriented programming concepts.
2. Apply the features of object oriented programming such as objects, classes, user defined data types, enumerations, constructors, destructors, overloading, inheritance polymorphism etc.
3. Implement, test, and debug the programs in an object-oriented programming languages. (C++ and Java)

Title of the Course: Analog Circuits – I Lab	**L**	**T**	**P**	**Credit**
Course Code: UETC0331	-	-	02	01

Course Pre-Requisite: Basic Electrical Engineering

Course Description: This course has been designed to introduce students with construction, theory and characteristics of various electronics devices. Also this course will lay strong fundamental base of discrete electronics and to develop capacity to analyze, interpret and design different electronics circuits.

Course Objectives :

1. To explain the working operation of diode and transistors
2. To **explain** the working of electronic circuits like rectifiers, filters and voltage amplifiers using BJT, FET and MOSFETs.
3. To **illustrate** the methods of designing the electronic circuits using discrete components.
4. To **explain** the practical ways of **measuring** AC and DC parameters of electronic circuits like rectifiers, filters, voltage regulators and voltage amplifiers for their performance analysis.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Taxonomy	
		Level	Descriptor
CO 1	**Demonstrate** the working of electronic circuits (rectifiers, filters and voltage amplifiers) built using BJT, JFET and MOSFET.	Cognitive	Understanding
CO 2	**Test** and **analyze** the performance of rectifiers, filters and voltage amplifiers built using BJT, JFET and MOSFET.	Cognitive	Analyzing
CO 3	**Evaluate** the performance of rectifiers, filters, voltage regulators and voltage amplifiers.	Cognitive	Evaluating
CO 4	**Design** the electronic circuits (rectifiers, filters and voltage amplifiers) for given specifications using discrete components such as BJT, FET and MOSFET.	Psychomotor	Creating

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3											
CO2	3										3	
CO3			3	2								
CO4			3	2								
CO5						2						

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50**
ESE	50

ISE are based on practical performed/ Quiz/ **Project Based Learning**/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

** Project Based Learning - 25 Marks of ISE

Course Contents:

Experiment No. 1:--- **Aim and Objectives:** Study of ratings of Electronic components and laboratory Equipments. **Outcomes:** Student will be able to learn the handling of laboratory equipments and identify the electronic components **Theoretical Background:** Knowledge of R, L and C components **Experimentation:** Identifying the electronic components and measuring or observing various signals on laboratory equipments **Results and Discussions:** **Conclusion:**	02 Hrs
Experiment No. 2:--- **Aim and Objectives:** Study V-I characteristics PN diode and Zener diode **Outcomes:** Student will be able to understand V-I characteristics various diodes **Theoretical Background:** V-I characteristics various diodes	02 Hrs

Experimentation: Performing V-I characteristics various diodes **Results and Discussions:** Comparison between Practical and Theatrical V-I characteristics **Conclusion:**	
Experiment No. 3:--- **Aim and Objectives:** Design & analysis of Half wave rectifier (HWR) with & without filter by calculating performance parameters **Outcomes:** Student will be able to design unregulated power supply **Theoretical Background:** Rectifiers and filters **Experimentation:** Performing of Half wave rectifier (HWR) with & without filter **Results and Discussions:** Comparison between Practical & Theatrical analysis results **Conclusion:**	02 Hrs
Experiment No. 4:--- **Aim and Objectives:** Design & analysis of Full wave rectifier (FWR) with & without filter by calculating performance parameters **Outcomes:** Student will be able to design unregulated power supply **Theoretical Background:** Rectifiers and filters **Experimentation:** Performing of full wave rectifier (HWR) with & without filter **Results and Discussions:** Comparison between Practical & Theatrical analysis results **Conclusion**	02 Hrs
Experiment No. 5:--- **Aim and Objectives:** Design & analysis of Bridge rectifier with & without filter by calculating performance parameters **Outcomes:** Student will be able to design unregulated power supply **Theoretical Background:** Rectifiers and filters **Experimentation:** Performing of bridge rectifier (HWR) with & without filter **Results and Discussions:** Comparison between Practical & Theatrical analysis results **Conclusion**	02 Hrs
Experiment No. 6:--- **Aim and Objectives:** Design & analysis of Zener shunt or Transistorized shunt voltage regulator. **Outcomes:** Student will be able to design Zener shunt or Transistorized shunt voltage regulator. **Theoretical Background:** Zener diode as voltage regulator **Experimentation:** Line regulation and load regulation of voltage regulator **Results and Discussions:** Comparison between Practical & Theatrical analysis results **Conclusion:**	02 Hrs
Experiment No. 7:--- **Aim and Objectives:** Design & analysis of series pass regulator with & without feedback **Outcomes:** Student will be able to design series pass regulator with & without feedback **Theoretical Background:** series pass regulator **Experimentation:** Line regulation and load regulation of voltage regulator **Results and Discussions:** Comparison between Practical & Theatrical analysis results **Conclusion:**	02 Hrs
Experiment No. 8:--- **Aim and Objectives:** Study of common emitter (CE) configuration using BJT **Outcomes:** Student will be able to get working operation of CE configuration **Theoretical Background:** Common Emitter (CE) configuration	02 Hrs

Experimentation: Performing input output characteristics of CE configuration **Results and Discussions:** Calculation of H parameter using input output characteristics **Conclusion:**	
Experiment No. 9:--- **Aim and Objectives:** Calculation of performance parameters using characteristics of JFET. **Outcomes:** Student will be able to calculate **Theoretical Background:** Junction Field Effect Transistor **Experimentation:** Obtaining performance parameter using JFET characteristics. **Results and Discussions:** Comparison between Practical & Theatrical performance parameter. **Conclusion:**	02 Hrs
Experiment No. 10:--- **Aim and Objectives:** Design & analysis of Voltage divider biasing circuit. **Outcomes:** Student will be able to design Voltage divider biasing circuit **Theoretical Background:** Transistor biasing **Experimentation:** Analysis of Voltage divider biasing circuit **Results and Discussions:** Comparison between Practical & Theatrical analysis results **Conclusion:**	02 Hrs
Experiment No. 11:--- **Aim and Objectives:** Determination of H-parameters from transistor CE characteristics. **Outcomes:** Student will be able to determine **Theoretical Background:** **Experimentation:** **Results and Discussions:** Comparison between Practical & Theatrical analysis results **Conclusion:**	02 Hrs
Experiment No. 12:--- **Aim and Objectives:** Calculation of performance parameters (Av, Ai, Ri, Ro) for single stage RC coupled amplifier. **Outcomes:** Student will be able to calculate for single stage RC coupled amplifier. **Theoretical Background**: Generalize theory of Av, Ai, Ri, Ro **Experimentation:** Obtaining performance parameter for single stage RC coupled amplifier **Results and Discussions:** Comparison between Practical & Theatrical analysis results **Conclusion:**	02 Hrs
Project Based Learning	Entire Semester
Textbooks: 1. Allen Mottershed —'Electronic devices & circuits'-Prentice- Hall India 2. J. Millman&C.Halkias -'Electronic devices & circuits'-IIndEdition- Tata McGraw Hill Publication 3. N.C. Goyal& R.K. Khetan-' A Monograph on Electronics Design Principles'-Vth Edition- Khanna Publishers	
References: 1. David A. Bell —'Electronic devices & circuits'- IVth Edition- Prentice- Hall India 2. Robert L. Boylsted, Louis Nashelsky- 'Electronic devices & circuit theory'- (IXth edition)-	

Pearson Education
3 National Semiconductor Data Manual.

Measurable Students Learning Outcomes :

1. **Compare and contrast** the amplifier circuits implemented using BJT, JFET and MOS-FET.
2. **Analyze** the performance of rectifiers, filters and voltage amplifiers.

Project Based Learning

Course Name: Analog Circuit I Lab
Course Code: Course Code: UETC0331
For example:-
Problem Statement:

Most modern day home appliances include electronic circuits such as microcontroller, LCD display etc which need DC power supply. Could you come up with a solution that can help them regulated DC power with renewable energy sources.

Abstract of the Problem:

The problem defined above is with the intention that the students should be able to understand how to convert renewable energy source to regulated DC power.

Activities/Steps/Milestones with duration to solve the problem:

- **Milestone 1 : (1 Week)**
  - Introduction to PBL
  - Why and What is PBL
  - Problem discussion and Team formation
  - Rubrics Plan
- **Milestone 2 : (2 Week)**
  - Critical Thinking
  - Project Specifications
- **Milestone 3 : (1 Week)**
  - Circuit diagram
  - Components Survey
- **Milestone 4 : (1 Week)**
  - In semester examination for 10 Marks (Case Study and Presentation)
- **Milestone 5 : (1 Week)**
  - Circuit Mounting and Testing on Breadboard
- **Milestone 6 : (2 Week)**
  - Circuit Mounting, Soldering and Testing on General Purpose PCB.
- **Milestone 7 : (1 Week)**
  - Results
  - Discussion Project Costing and Simulations (1 Week)
- **Milestone 8 : (1 Week)**

- Reports
- Presentation

- **Milestone 9 : (1 Week)**
  - In semester examination for 15 Marks (Reports, Product Validation and Question Answering)

- **Assessment Scheme:**

Type of Assessment	Marks
In-Semester Examination 1	10 (Case Study & Presentation)
In-Semester Examination 2	15(Report, Product Validation and Question Answering)

- **Evaluation Scheme for 25 Marks**

Heads	**Marks**
Case Study	05
Presentation	05
Report	05
Product Validation	05
Question Answering	05

Title of the Course: Digital System Lab **Course Code:** UETC0332	**L** --	**T** --	**P** 02	**Credit** 01
Course Pre-Requisite: There are no pre-Requisite for this course, however the knowledge of numbering system and working of basic gates will be beneficial.				
Course Description: This course focuses on designing of combinational and sequential circuits.				
Course Objectives: This course aims to 1. Understand the operation of combinational circuits and its applications 2. Demonstrate the operation of several types of flip-flops 3.Design and analyze different types of counters and sequence generator. 4.Understand the basic principles of shift registers and RAM				

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Design and Perform combinational logic circuits.	Synthesis	Design
CO2	Design and Perform sequential logic circuits.	Synthesis	Design
CO3	Design an application based on combinational and sequential logic circuits.	Synthesis	Design

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	1	3	3	3	2	---	---	---	----	----	---
CO2	3	1	3	3	3	2	---	--- -	---	---	---	---
CO3	2	2	3	2	3	2	---	---	----	----	----	---

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	25
ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- **Aim and Objectives:** Design and implement NAND and NOR as Universal gate **Outcomes:** Students will be able to design various gates using NAND and NOR **Theoretical Background:** Logic gates. **Experimentation:** Observe the truth table of all gates by following the desig**n** **Results and Discussions:** Truth table verification **Conclusion:** Fundamental and derived gates can be designed using NAND and NOR gate.	2Hrs.
Experiment No. 2:--- Aim and Objectives: Design and implement Adder and Subtractor Outcomes: Students will be able to design various gates using NAND and NOR Theoretical Background: Logic gates. Experimentation: Observe the truth table Results and Discussions: Truth table verification Conclusion: Fundamental and derived gates can be designed using NAND and NOR gate.	02Hrs.
Experiment No. 3:--- Aim and Objectives: Study of K- map Outcomes: Students will be able to reduce Boolean function using K-map and can implement it using universal gate.	02Hrs.

Theoretical Background: K-map design. Experimentation: Observe the truth table. Results and Discussions: Truth table verification Conclusion: Boolean function can be reduced using K-map and implementit using universal gate.	
Experiment No. 4:--- Aim and Objectives: Design and Implement 4-bit Binary code to Gray code converter Outcomes: Students will be able to design code converter and implement using logic gates. Theoretical Background: K-map. Experimentation: Observe the truth table Results and Discussions: Truth table verification Conclusion: Code converter can be designed using K-map.	02Hrs.
Experiment No. 5:--- Aim and Objectives: Design and implement following Boolean function using Mux Outcomes: Students will be able to design any Boolean function using Mux. Theoretical Background: Multiplexer. Experimentation: Observe the truth table Results and Discussions: Truth table verification Conclusion: Boolean function can be implemented using multiplexer	02Hrs.
Experiment No. 6:--- Aim and Objectives: Design and implement Full *Adder* using Demux Outcomes: Students will be able to design Full adder using Demux. Theoretical Background: De multiplexer theory. Experimentation: Observe the truth table Results and Discussions: Truth table verification Conclusion: Full Adder can be implemented using De multiplexer	02Hrs.
Experiment No. 8:--- Aim and Objectives: Design and implement S-R flip-flop and D flip-flop and JK flip-flop using logic gates Outcomes: Students will be able to flip flops using logic gates. Theoretical Background: Sequential logic circuits. Experimentation: Observe the truth table Results and Discussions: Truth table verification Conclusion: Flip flops can be designed using logic gates**.** **Experiment No. 9:---** Aim and Objectives: Design and implement Johnson Counter Outcomes: Students will be able to design Johnson Counter using D flip flops. Theoretical Background: Counter theory. Experimentation: Observe the truth table Results and Discussions: Truth table verification Conclusion: Johnson Counter can be designed using D flip flops	02Hrs.
Experiment No. 10:--- Aim and Objectives: Design and implement Shift Register. Outcomes: Students will be able to design Shift register using D flip flops. Theoretical Background: Shift Register theory. Experimentation: Observe the truth table	02Hrs.

Results and Discussions: Truth table verification Conclusion: Data is shifted right or left according to design.	
Experiment No. 11:--- **Mini Project :**Fairly complex application oriented mini-project with digital input and output and appropriate display	
Textbooks: 1. Anand Kumar 'Fundamentals of Digital Circuits'--. PHI 2. M. Morris Mano 'Digital Design'-- (Third Edition),. PHI	
References: 1] Willim I. Fletcher.'An Engineering Approach to Digital Design'—PHI/ Pearson 2] NormanBalabanianBradle Carlson. 'Digital Logic Design Principals,.' Wiley Publication. 3] Rajkamal 'Digital Systems Principals and Design'—Pearson 4] A.P. Malvino, D.P. Leach 'Digital Principles &Applicatios' -VIth Edition-Tata McGraw Hill, Publication. 5] R.P. Jain-'Modern Digital Electronics' IIIrd Edition- Tata McGraw Hill, Publication	

Title of the Course: Object Oriented Programming Lab **Course Code:**UETC0333	**L**	**T**	**P**	**Credit**
	--	--	02	01
Course Pre-Requisite: A working knowledge of C programming is sufficient**.**				
Course Description: This course is an extension of courses exposing students to the many concepts of programming. The course is an expository of the object-oriented programming methodology with emphasis on software design and code reuse as its core objectives. As a practical course, the focus is to equip students with adequate high-level object-oriented programming techniques required for successful design, development, and deployment of today's complex software systems. Furthermore, the students are actually mentored to master how the C++ and Java technology can be used to develop				

modern software systems.

Course Objectives:

1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. Understand fundamentals of object-oriented programming in C++ including defining classes, invoking methods, using classes.
3. Be aware of the important topics and principles of software development.
4. Have the ability to write a computer program to solve specified problems.
5. Be able to use the C++ concepts and Java SDK environment to create, debug and run programs.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Explain the basics of objective oriented programming concepts.	Cognitive	Explain
CO 2	Model simple OOPs using classes and objects.	Cognitive	Apply
CO 3	Demonstrate use of polymorphism and Inheritance	Cognitive	Demonstrate
CO 4	Illustrate various operations related to file handling.	Cognitive	Apply

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	3	3	3	1	1	2	2	3	2	3	3
CO2	3	3	2	2	2	3	1	1	2	1	3	2
CO3	2	2	1	1	1	1	1	1	1	1	1	2
CO4	3	2	2	2	3	2	1	1	1	1	2	1

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	25
ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- **Aim and Objectives:** To study concepts of Object oriented programming. **Outcomes:** After the completion of the experiments the student should be able to Explain the basics of objective oriented programming concepts. **Theoretical Background: Basic knowledge of programming**	02 Hrs.
Experiment No. 2:--- **Aim and Objectives:** To study of classes and Objects. **Outcomes:** After the completion of the experiments the student should be able to	02 Hrs.

write declaration of class and should explain types of defining functions in class.	
Experiment No. 3:--- **Aim and Objectives:** To Study Constructor and destructor. **Outcomes:** After the completion of the experiments the student should be able to explain syntax and types of different constructors and destructor.	02 Hrs.
Experiment No. 4:--- **Aim and Objectives:** To Study Overloading.**Outcomes:** After the completion of the experiments the student should be able to explain function and operator overloading.	02 Hrs.
Experiment No. 5:--- **Aim and Objectives:** To Study Concept of Friend function.**Outcomes:** After the completion of the experiments the student should be able to explain definition and declaration of friend function.	02 Hrs.
Experiment No. 6:--- **Aim and Objectives:** To Study Inheritance. **Outcomes:** After the completion of the experiments the student should be able to explain importance and various types of Inheritance in OOP.	02 Hrs.
Experiment No. 8:--- **Aim and Objectives:** To Study Polymorphism. **Outcomes:** After the completion of the experiments the student should be able to explain concept of Polymorphism.	02 Hrs.
Experiment No. 9:--- **Aim and Objectives:** To Study File handling. **Outcomes:** After the completion of the experiments the student should be able to explain concept of file handling in OOP.	02 Hrs.
Experiment No. 10:--- **Aim and Objectives:** Mini project based on any engineering application. **Outcomes:** After the completion of the experiments the student should be able to explain concept of file handling in OOP.	02 Hrs.
Textbooks: 1. E Balgurusamy –‘Object oriented programming with C++’ -, IIIrd Edition- Tata Mc- Graw Hill Publication 2. Rajesh K.Shukla-‘Object – Oriented Programming in C++’WILEY, INDIA .	
References: 1. Schildt –‘The Complete Reference C++’ - IIIrd Edition - Tata McGraw Hill Publication 2. D Ravichandran.-‘Programming with C++ ‘-IInd Edition- Tata McGraw Hill Publication 3. RohitKhurana-‘Object oriented programming with C++’-second edition-Vikas publication	

Title of the Course: Electronic Instrumentation & Measurement Lab Course Code: UETC0334	**L**	**T**	**P**	**Credit**
	-	-	02	01
Course Pre-Requisite: Basics of electronics				
Course Description: The course aims to Provide knowledge of different parts of Measurement system, instrumentation system & different types of transducers				
Course Objectives: This course aims to 1. Provide introduction of different types of Transducers & sensors 2. Provide knowledge of different parts of Measurement system				

3. Provide basic knowledge of measurement system
4. Provide basic understanding of different Electronic instruments
5. Provide knowledge of different types of bridges

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's level	Descriptor
CO1	Select appropriate transducer as per required	Cognitive	Analysis
CO2	Identify suitable linear & nonlinear circuits	Cognitive	Knowledge
CO3	Illustrate analog signals parameters related to electronic measurement	Cognitive	Application
CO4	Explain the basic features & block diagram of oscilloscope	Cognitive	Comprehension

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	**3**	**3**	**3**	**3**	**3**	**1**	-	-	-	-	-	-
CO2	**3**	**3**	**3**	**2**	**2**	**2**	-	-	-	-	-	-
CO3	**3**	**1**	**3**	**2**	**1**	**1**	-	-	-	-	-	-
CO4	**3**	**1**	**3**	**3**	**3**	**1**	-	-	-	-	-	-

Assessments :
Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- **Aim and Objectives:** Study of weight measurement using strain gauge **Outcomes:** Students will be able to explain application of strain gauge for weight measurement **Theoretical Background:** Principle of operation of strain gauge **Experimentation:** Study datasheets of various op-amp ICs to study their electrical parameters **Results and Discussions:** Measure the weight placed on load cell **Conclusion:** Strain gauge can be used as load cell for measure the unknown	02 Hrs.

weights	
Experiment No. 2:--- **Aim and Objectives:** Study of displacement measurement using LVDT. **Outcomes:** Students will be able to explain operation of LVDT **Theoretical Background:** Principle of operation of LVDT **Experimentation:** Measure the displacement of the core in either direction **Results and Discussions:** Compare the actual displacement and observed displacement **Conclusion:** LVDT can be used to measure displacement of any object in either direction by connecting the object to the core	02 Hrs.
Experiment No. 3:--- **Aim and Objectives:** Study of temperature measurement using RTD **Outcomes:** students will be able to explain operation of RTD **Theoretical Background:** Principle of operation of RTD **Experimentation:** Immerse the RTD in boiling water & note down the temperature of water and corresponding resistance of RTD indicated on DPM. **Results and Discussions:** Plot a graph of temperature v/s Resistance of RTD. **Conclusion:** It is observed that as temperature increases resistance of RTD also increases.	02 Hrs.
Experiment No. 4:--- **Aim and Objectives:** Study of angular displacement measurement using capacitive pickup **Outcomes:** Students will be able to explain operation of capacitive pick up for angular displacement measurement **Theoretical Background:** Principle of operation of capacitive pick up **Experimentation:** Rotate the shaft in clockwise direction. Note down the reading corresponding to the input angular displacement and indicated angular displacement on the DPM **Results and Discussions:** Note down the reading corresponding to the input angular displacement and indicated angular displacement on the DPM **Conclusion:** The angular displacement of capacitive transducer gives linear change in the output.	02 Hrs.
Experiment No. 5:--- **Aim and Objectives:** Study of speed measurement using proximity switch & photoelectric pick up. **Outcomes:** Students will be able to explain operation of proximity switch & photoelectric pick up for measurement of speed **Theoretical Background:** Operating principle of proximity switch and photo transistor **Experimentation:** Increase the speed of motor. Measure the speed by switching proximity switch and phototransistor. **Results and Discussions:** If speed of shaft is 1500 rpm this corresponds to 25	02 Hrs.

revolutions per second & hence frequency of pulse is 25 Hz or delay between successive pulses is 40 msec. This time period is measured & an average time period for successive pulse is calculated. Then a simple formula is used to calculate the gating period for digital counter. **Conclusion:** speed of motor can be found out by using proximity switch and phototransistor	
Experiment No. 6:--- **Aim and Objectives:** Study of CRO. **Outcomes:** Students will be able to explain use of CRO and its various knobs **Theoretical Background:** Operating principle of CRO **Experimentation:** Display various signals on CRO using function generator. Measure the amplitude & frequency of the signal **Results and Discussions:** compare the actual & observed values of amplitude & frequency **Conclusion:** CRO can be used to observe o/p of various systems	02 Hrs.
Experiment No. 7:- **Aim and Objectives:** Measurement of phase and frequency by lissajous pattern using CRO **Outcome:** Students will be able to determine frequency of unknown signal & phase difference between two signals **Theoretical Background:** Operating principle of CRO & function generator **Experimentation:** Lissajious figure is a stable pattern that is obtained by connecting known frequency to vertical input & varying the frequency of the known standard signal connected to the horizontal input of a dual oscilloscope activated in X-Y mode **Results and Discussions:** The unknown frequency is calculated using formula, $F_V = F_{H*} (T_H / T_{V)}$ Phase angle $\theta = \sin^{-1} Y_{HY} / Y_M$. **Conclusion:** Thus we can measure frequency and phase by observing Lissajous pattern on CRO.	02 Hrs.
Experiment No. 8:- **Aim and Objectives:** Study of function generator **Outcomes:** Students will be able to demonstrate use of function generator **Theoretical Background:** Internal block diagram of function generator **Experimentation:** Observe sine, square and triangular waveforms of various amplitude & frequency. **Results and Discussions:** Discuss the functionality of various knobs of front panel of function generator **Conclusion:** Using function generator sine, square and triangular waveforms of various amplitude & frequencies can be generated	02 Hrs.
Experiment No.9:-	02 Hrs.

Aim and Objectives: Study of linear displacement measurement using linear potentiometer **Outcomes:** Students will be able to explain operation of potentiometer for displacement measurement **Theoretical Background:** Principle of operation of potentiometer**.** **Experimentation:** By moving the shaft, the resistance of potentiometer is changed. The displacement & corresponding resistance of potentiometer is indicated on DPM **Results and Discussions:** Observe displacement of shaft and resistance of potentiometer. **Conclusion:** The resistance of the potentiometer varies linearly with variation in displacement	
Experiment No. 10:- **Aim and Objectives:** Study of DC bridges **Outcomes:** Students will be able to calculate value of unknown resistance using DC bridge **Theoretical Background:** Principle of operation of DC bridges **Experimentation:** For a particular bridge values of resistors for different arms will be given. Students will have to calculate value of unknown resistor using bridge balance condition **Results and Discussions:** Calculate value of unknown resistor. **Conclusion:** DC bridges can be used to determine value of unknown resistor.	02 Hrs.
Textbooks: 1] A course in Electrical, Electronics measurement and Instrumentation, A.K. Sawhney 2]Electronic Instrumentation, H. S. Kalsi, MGH, 3rd Edition	
References: 1] Electronic Instrumentation and Measurement Techniques, Welfrick Cooper. 2] Instrumentation for Engineers And Scientists , John Turner ,II Edition , Wiley 3] Electronic Instrumentation and Measurements, David A Bell, Third Edition, Oxford 4]Instrumentation for Engineering Measurements, James W Dally, II Edition , Wiley	
Experiment wise Measurable students Learning Outcomes: 1) Students will be able to explain application of strain gauge for weight measurement 2) Students will be able to explain operation of LVDT 3) Students will be able to explain operation of RTD 4) Students will be able to explain operation of capacitive pick up for angular displacement measurement5) Students will be able to explain operation of proximity switch & photoelectric pick up for measurement of speed6) Students will be able to explain use of CRO and use of various knobs on its front panel 7) Students will be able to determine frequency of unknown signal & phase difference between two signals8) Students will be able to demonstrate use of function generator.9) Students will be able to explain operation of potentiometer for displacement measurement10) Students will be able to calculate value of unknown resistance using DC bridge	

Title of the Course: Analog Circuits - II	**L**	**T**	**P**	**Credit**
Course Code: UETC0401	03	-	-	03

Course Pre-Requisite: Analog Circuits – I

Course Objectives:

1. To explain the frequency response of BJT (CE) and MOSFET (CS) amplifiers.
2. To **explain** the working of electronic circuits like power amplifiers, feedback amplifiers, wave shaping and regulators.
3. To **explain** the small signal models used for performance analysis of electronic circuits.
4. To **illustrate** the methods of designing the electronic circuits using discrete components.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO1	**Analyze** the performance of electronic circuits (like amplifiers, feedback amplifiers) using small signal models such as hybrid-parameter model.	Cognitive	Analyzing
CO2	**Evaluate** the performance of power amplifiers, feedback amplifiers, wave shaping, & Voltage Regulators	Cognitive	Evaluating
CO3	**Design** the electronic circuits (power amplifiers, wave shaping, & Voltage Regulators) for given specifications using discrete components such as BJT and IC	Cognitive	Creating
CO4	**Select** appropriate power amplifiers, feedback amplifiers, wave shaping & Voltage Regulators for given application.	Psycho-motor	Applying

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3										3	
CO2			3	2								
CO3			3	2								
CO4						2						

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with60-70% weight age for course content (normally last three modules) covered after MSE.	
Course Contents:	
Unit 1: Frequency Response Amplifiers Low Frequency: BJT (Common Emitter) and FET (Common Source) Amplifier, Effect of Internal Transistor Capacitances, Miller Effect, High Frequency: T-Model, Common Base Short Circuit Current Gain, Hybrid π-model, Common Emitter Short Circuit and resistive Current Gain, Gain Bandwidth Product, (Numerical are expected).	08 Hrs.
Unit 2: Multistage Amplifiers Need of Cascading, Parameter evaluation such as Ri , R0, Av, Ai & Bandwidth for General Multistage Amplifier, Different Types of Coupling, Analysis & Design of RC coupled, direct coupled & voltage series feedback (Two stage) amplifier. Cascade FET Ampifier.	08 Hrs.
Unit 3: Power Amplifiers Need of Power amplifier, classification of power amplifier, Power considerations, Distortion in power amplifiers: Phase, Frequency, amplitude/ harmonic / non linear distortion, amplitude distortion using Three point method. Class A single ended transformer coupled amplifier& class A Push pull amplifiers analysis and design, Class B amplifier & class B push pull amplifier analysis & design, crossover distortion, class AB Push pull amplifiers analysis and design Complementary symmetry power amplifier.	08 Hrs.
Unit 4: Feedback Amplifiers General theory of feedback, reasons for negative feedback. Types of negative feedback in transistor circuits: Voltage series, Current series, Voltage shunt, Current shunt feedback amplifiers, Darlington pair, Darlington amplifier using bootstrapping principle,(Numerical are expected) Design of Voltage series feedback amplifier	08 Hrs.
Unit 5: Wave Shaping Circuits **RC Circuits:-** Low Pass & High Pass (square & step response), High pass as a differentiator, Low pass as integrator. **Clipping circuits:-** Classification, diode clippers, transistor clippers, Transfer characteristics, Design & analysis of clipper circuits. **Clamping circuits:-** Classification, clamping operations, Clamping circuit theorem, practical clamping circuits, **Voltage multipliers:-** Doubbler, Trippler & Qudrappler circuits.	08 Hrs.
Unit 6: IC Voltage Regulators IC Voltage Regulators:- Study and design of regulators using IC's:78XX, 79XX, LM723, LM317, Switching regulator: Introduction, study of LM3524	08 Hrs.
Textbooks: l. J. Millman & C.Halkias -'Electronic devices & circuits'-IInd Edition- Tata McGraw Hill Publication 2. Allen Mottershed —'Electronic devices & circuits'-Prentice- Hall India 3. N.C. Goyal & R.K. Khetan-' A Monograph on Electronics Design Principles'-Vth Edition-Khanna Publishers 4. J. Milman & H. Taub ' Pulse Digital & Switching Waveforms' - IInd Edition- Tata McGraw Hill Publication	
References:	

1. David A. Bell —'Electronic devices & circuits'- IVth Edition- Prentice- Hall India
2. J Millman & A. Grabel-' Microelectronics'- IInd Edition- McGraw Hill International Editions
3 National Semiconductor Data Manual.
4 M.S. Roden, G.L. Carpenter ' Electronic Design- From Concept to reality'- IVth Edition- Shroff publisher & Distributors

Unit wise Measurable students Learning Outcomes:

1. **Apply** the small signal models (tools) to **analyze** the performance of feedback amplifiers built using BJT.
2. **Analyze** the performance of feedback amplifiers, wave shaping, and regulators using BJT, IC and discrete components.
3. **Analyze** and **Design** power amplifiers, feedback amplifiers and wave shaping using BJT and discrete components.
4. **Compare and Contrast** the single stage and multistage amplifiers.
5. **Evaluate** the performance of power amplifiers in terms of efficiency and harmonic distortion.
6. **Comprehend** regulation of discrete and IC voltage regulators.

Title of the Course: Linear Integrated Circuits	**L**	**T**	**P**	**Credit**
Course Code: UETC0402	03	-	-	03

Course Pre-Requisite: Transistor as an Amplifier

Course Description:

The course aims to provide knowledge of operational amplifier, some special purpose ICs like IC 555 & IC565(PLL) and their applications.

Course Objectives:

This course aims to

1. Provide knowledge of op-amp & its electrical parameters
2. Provide knowledge of op-amp configurations & frequency response
3. Study linear and non linear applications of op-amp
4. Provide basic knowledge of special purpose ICs like IC555 and IC 565

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's level	Descriptor
CO1	Discuss the op-amp's basic construction, characteristics, parameters, various configurations of op-amp	Cognitive	Comprehension
CO2	Evaluate different parameters of op-amp viz Slew rate, CMRR, frequency response	Cognitive	Evaluate
CO3	Design linear and non-linear circuits like active filters, signal generators using op-amp.	Cognitive	Create
CO4	Design the application of timer IC 555 for multivibrators	Cognitive	Create
CO5	To test the simulation of op-amp circuits	Cognitive	Analyze

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	1	3	3	3	2	-	-	-	-	-	-
CO2	3	1	3	3	3	2	-	-	-	-	-	-
CO3	2	2	3	2	3	2	-	-	-	-	-	-
CO4	2	2	3	3	3	2	-	-	-	-	-	-
CO5	1	2	3	3	3	3	-	-	-	-	-	-

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.	
Course Contents:	
Unit 1:--- Introduction to op-amp Block diagram of OP-AMP, Explanations of each block, Differential Amplifier configurations, Differential amplifier analysis (AC & DC) for dual-input balanced-output configuration using 'r' parameters, ideal parameters and practical parameters of OP-AMP and their comparison, internal circuit of IC741	6 Hrs.
Unit 2:--- Op-amp configurations & frequency response: Concept of feedback & their types, Virtual ground concept, Open loop configuration, closed loop configuration, unity gain amplifier, frequency Response of both configurations, Stability considerations, Frequency Compensation	6 Hrs.
Unit 3:--- Applications of Op-amp Summing, Scaling & Averaging Amplifiers using Op-amps, Differential amplifier using op-amp, Subtractor Circuit, Instrumentation amplifier, V to I & I to V Converter, Precision Rectifiers, Log & Anti-log Amplifiers, Study of comparator, Schmitt Trigger, Integrators & differentiators, Peak Detectors, Sample & Hold Circuits, A-D and D-A techniques	6 Hrs.
Unit 4:--- Active Filters Introduction, Analysis & Design of Butterworth filters: High Pass filter, Low Pass filter (First & Second order), Band Pass filter, Band Reject filter, All Pass Filter, Introduction to Chebyshev Filter.	6 Hrs.
Unit 5:--- Signal Generators Analysis & Design of Square wave generator, Triangular wave generator, Sawtooth wave generator. Analysis & Design of RC phase shift oscillator, RC wein bridge oscillator, Colpitts oscillator, Hartley oscillator.	6 Hrs.
Unit 6:--- Special purpose ICs IC 555 Timer: Block Diagram, Operating Principle, Multi-vibrator using IC 555. IC 565 PLL: Operating Principle, applications-Frequency synthesizer FM demodulator, AM demodulator, FSK demodulator	6 Hrs.
Textbooks: 1) Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education second and latest edition. 2) D.Roy Choudhary, Shail Jain, "Linear Integrated Circuits", New Age Int	
Reference Books: 1) Robert Coughlin, Fredric Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth edition,PE, 2006. (Ch-6) 2) David Bell, "Operational Amplifiers and Linear ICs",Third ed, Oxford University Press 3) B. Somanathan Nair, " Linear Integrated Circuits- Analysis, Design & Applications", Wiley India. 4) Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Tata McGraw Hill., Third Edition	

5) G.B.Clayton, “Operational Amplifiers”, International Edition

Unit wise Measurable students Learning Outcomes:

Upon successful completion of this course students will be able to:

1. Calculate & analyze various electrical parameters of op-amp.
2. Analyze frequency response of inverting and non-inverting amplifiers
3. Design various linear and non-linear applications of op-amp
4. Analyze frequency response of active filters.
5. Design various waveform generators
6. Analyze o/p waveforms of astable and monostable multivibrators.

Title of the Course: Electromagnetic Engineering	**L**	**T**	**P**	**Credit**
Course Code: UETC0403	03	01	-	04

Course Pre-Requisite: Student should have clear understanding of mathematics, vector algebra, complex numbers & differential equations

Course Description:

Electromagnetic Engineering is offered as the core course at the fourth semester of E&TC Engineering undergraduate programmer. It consists of 6 units. First three units constitute study of vector algebra, co-ordinate system, Electrostatics & boundary conditions. The last three units contains the study of steady magnetic fields, wave propagation and transmission lines.

This course intends to build the competency in the students to understand basics of electromagnetic engineering. This subject is useful to understand the courses like Antennas & wave propagation & Microwave Engineering. In addition, syllabus of this course is included in competitive exams like GATE.

Course Objectives:

1. Explain basic of Vector & co-ordinate systems.
2. Describe fundamentals of static electromagnetic fields
3. Define & derive different laws in electrostatic & electromagnetic fields
4. Apply different laws to derive Maxwell's equations in different forms (Point, Integral form).
5. Develop wave equations & understand concept of wave propagation in different media
6. Explain concepts of transmission lines

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Explain the fundamentals of Electrostatic and Electromagnetic fields.	Cognitive (Comprehension)	Explain
CO2	Apply Gauss' law, Ampere's Law, Biot-Savart law, Faraday's law and laws related with steady magnetic field while solving problems in Electrostatic and Electromagnetic fields.	Cognitive (Application)	Apply
CO3	Develop field equations from understanding of Maxwell's Equations.	Cognitive (Synthesis)	Develop
CO4	Extend the knowledge of basic properties of transmission lines to analyze electromagnetic wave propagation in generic transmission line geometries.	Cognitive (Comprehension)	Extend
CO5	Demonstrate mathematical skills related with differential, integral and vector calculus.	Psychomotor (Set)	Demonstrate

CO-PO Mapping:

CO	PO											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1	3	-	-	-	-	-	1	3	2	3	-	-
CO 2	3	2	2	-	2	2	1	3	2	-	-	-
CO 3	3	1	1	-	-	2	1	3	2	3	3	3
CO 4	2	1	1	-	3	3	-	3	-	-	-	-
CO 5	3	-	-	-	-	-	-	3	2	3	2	2

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

UNIT-I Co-ordinate systems: Vector Algebra, Co-ordinate systems, Curl, Divergence & Gradient, Coulomb's law, line, Surface & Volume Charge distribution, uniqueness theorem.	6 Hrs
UNIT-II Electrostatic Fields: Electric Field Intensity, Electric Field due to infinite line and surface charges, Electric Flux Density, Gauss law (differential and integral form) and its applications, Divergence Theorem, Electric Potential and gradient. Work done, Energy Density, Electric Dipole and moment	8 Hrs
UNIT-III Dielectrics & Boundary conditions: Polarisation in Dielectrics, Boundary conditions for Dielectric and Dielectric, Conductor and Dielectric, Conductor and free space, Method of Images for point and line charge,Continuity equation.	5 Hrs
UNIT IV Magnetostatic Fields: Biot savart law, Magnetic Field Intensity due to infinite and finite line, Ampere's Circuital Law in integral and differential form, Magnetic flux density, Magnetic boundary conditions, vector magnetic potential,	7 Hrs
UNIT V Wave Propagation: Maxwell's Equations in point form & Integral form for various fields, Wave equations, wave propagation through different medium, skin depth, Poynting theorem, Reflection of plane wave.	7Hrs
UNIT VI Transmission Lines: Transmission Line equations, Characteristic equation of infinite Transmission Line, Uniform terminated Transmission Line, Input impedance, Phase velocity and group velocity, Short circuited and open circuited line, Reflection coefficient VSWR, smith chart	5Hrs

Textbooks:

1. *Engineering Electromagnetics* - William .H. Hayt and J A Buck – 7th Edition – 2011.
2. *Electromagnetic with applications* - J.D. Kraus. (MGH Publications)- 4th Edition
3. *"Electromagnetic Waves and Radiating Systems"*, E. C. Jordan & K. Balman, 2nd edition, PHI.

References:

1. Electromagnetic Field Theory- Rakhesh Singh Kshetrimayum – Cengage Publishing – 2012
2. . Principles of Electromagnetics - Matthew N O. Sadiku – 4th Edition, Oxford publication 2009.
3. Fundamentals of Engineering Elecromagnetics – Sunil Bhooshan – Oxford University press. 2012.
4. Elements of Electromagnetic fields - Surinder P.Seth (Dhanpat Rai Publications)
5. Lectures on Electricity & Magnetism by Prof. Walter Levin from MIT USA

Unit wise Measurable students Learning Outcomes: Upon successful completion students will be able to

1. Demonstrate mathematical skills related with differential, integral and vector calculus.

2. To Explain fundamentals of electrostatic fields and Apply coulomb's law, Gauss's law in integral & point form while solving problems in electrostatic fields.

3. Extend the knowledge of boundary conditions.

4. Apply different laws of magnetic fields. (biot savart law, stoke's theorem, ampere's law) while solving problems in magnetic fields

5 . Develop field equations from understanding Maxwell's equations in different forms (Point, Integral form).

6. Extend the knowledge of basic properties of transmission lines to analyze electromagnetic wave propagation in generic transmission line geometries. And Solve examples based on Smith chart

Title of the Course: Analog & Digital Communication	**L**	**T**	**P**	**Credit**
Course Code: UETC0404	04	-	-	0 4

Course Pre-Requisite: Electronic devices & circuits, signals & system.

Course Description: Course deals with understanding the principles of Analog and Digital Communication, study of different types of Noise in communication system .It describes the fundamentals of baseband transmission, modulation techniques.

Course Objectives:

1 Describe & demonstrate different types of analog demodulation techniques.
2. Describe Conversion of analog to digital signals.
3.Evaluate performance of digital modulation methods
4. Describe the transmission and reception in digital communication system.
5. Describe various types of Noise in communication systems.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Taxonomy (Cognitive)	
		Level	Descriptor
CO1	**Define** different types of noise and their classification.	Cognitive(Knowledge)	Define
CO2	Explain different modulation schemes.	Cognitive (Comprehension)	Explain
CO3	Explain different Demodulation schemes.	Cognitive (Comprehension)	Explain
CO4	Understand the baseband transmission and reception.	Cognitive	Understand

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	3	3	-	2	-	-	-	-	-	1	1
CO2	-	3	3	-	2	-	-	-	-	-	3	1
CO3	-	3	3	-	2	-	-	-	-	-	3	-
CO4	-	3	3	-	2	-	-	-	-	-	3	-

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Amplitude Modulation & Demodulation: Introduction to Analog Communication System The Electromagnetic & Optical Spectrum and its usage; Radio spectrum and frequency allocation. Elements of communication systems, Need for modulation, Amplitude Modulation principles, AM envelope, frequency spectrum & BW, phase representation of AM wave, AM modulating circuits: Low level AM modulation, medium power AM modulation,	08Hrs.

AM transmitters: Block of low level DSBFC, High level DSBFC, SSB suppression techniques. TRF and Super heterodyne receiver. Technical specification of AM broadcasting.	
Unit 2:--- Angle Modulation: Introduction to frequency and phase modulation. Mathematical representation of F.M. Frequency spectrum of F.M.wave., Generation of F.M. methods. Types of FM Receivers. Case study of AM/ FM relay station.	08Hrs.
Unit 3:---Noise: Noise sources and types.	06 Hrs.
Unit 4:--- Digital transmission of analog signals: Introduction, Shannon's theorem of information, Sampling theorem ,Study of Pulse Code Modulation- Uniform & Non uniform quantization, PAM, DPCM, Delta Modulation, ADM**.**	08 Hrs.
Unit 5:--- Baseband transmission & reception: Line codes: Unipolar, Bipolar, NRZ, RZ, RZ-AMI, Manchester Baseband pulse Shaping, M-ary Signaling, ISI, eye diagram, scrambler, Unscramble. Optimum Receivers-Matched Filters, Correlation receivers	08 Hrs.
Unit 6:--- Baseband modulation techniques: ASK, FSK, PSK, DPSK, QPSK, & QAM. Coherent, Non- Coherent Detection. Constellation diagram, comparison of modulation techniques based on Baud rate, BER, Power Spectral density.	07 Hrs.
Textbooks: 1) George Kennedy, "Electronic Communications", McGraw Hill Kennedy.. 2) Wayne Tomasi 'Electronics Communication System' -Fundamentals through Advanced.- Vth Edition- Pearson Education. 3) Analog and Digital communication – J S Chitode Technical Publications, 2009	
References: 1) B.P. Lathi, "Analog and Digital Communication", OXFORD University press. 2) Simon Haykin, "An introduction to analog & digital communications", John Wiley & Sons 3) R P Singh, S D Sapre 'Communication System-Analog & Digital' IInd Edition –Tata Mc Graw Hill Publication. 4) Louis E. Frenzel, "Principals of electronic communication system", IIIrd Ed., TMH Pub.	
Unit wise Measurable students Learning Outcomes: After the completion of the course the student should beable to **1)** Describe & demonstrate different types of AM Transmitters. **2)** Describe & demonstrate different types of AM Receivers. **3)** Describe & demonstrate different types of FM Transmitters. **4)** Describe & demonstrate different types of FM Receivers. **5)** Discuss various types of Noises in Communication System. **6)** Identify different sections of Pulse Modulation techniques. **7)** Describe & demonstrate different types of digital modulation and demodulation techniques.**8)** Describe different baseband transmission & reception systems	

Title of the Course: Data Structures	**L**	**T**	**P**	**Credit**
Course Code: UETC0405	03	-	-	03

Course Pre-Requisite: Basics of C and C++ programming language

Course Description:

Explores array, stacks, queues, pointer, linked lists, graphs, trees and there algorithms including sorting, searching, iterating over data structures and recursion

Course Objectives:

1. To use & manipulate several core data structures: arrays, linked lists, stacks and queues.
2. To Understand design and implementation of basic data structures and algorithms.
3. To use various data structures effectively in different applications
4. To learn the theory of trees and graphs.5.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Identify Linear and Non Linear data structures.	Cognitive	Identify
CO2	Apply appropriate algorithm to perform operations on Linear and Non Linear data Structures.	Cognitive	Apply
CO3	Demonstrate the algorithms of data Structure using C & C++.	Psychomotor	Demonstrate
CO4	Analyze complexity issues of algorithms.	Cognitive	Analyze
CO5	Select appropriate data structure to organize digital data.	Cognitive	Select

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1	2	3	2	-	3	3	-	-	-	-	-	-
CO 2	2	3	2	-	3	3	-	-	-	-	-	-
CO 3	2	3	2	-	3	3	-	-	-	-	-	-
CO 4	2	3	2	-	3	3	-	-	-	-	-	-
CO 4	2	3	2	-	3	3	-	-	-	-	-	-
CO 5	2	3	2	-	3	3	-	-	-	-	-	-

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	**Marks**
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.	
Course Contents:	
Unit 1:--- Introduction & Overview: Basic Terminology, Introduction of Linear and Non-linear data Structures, Characteristics of an algorithm, Time and Space Complexity, Big 'O' and Ω' notation, best, average and worst cases with example.	03 Hrs.
Unit 2:--- Arrays & Pointers: Introduction of linear arrays: representation of linear array in memory, traversing linear arrays, inserting & deleting. Sorting: bubble sort & quick sort. Searching: linear search & binary search. Multidimensional arrays: matrices and sparse matrices. Pointers: pointer arrays.	07 Hrs.
Unit 3:--- Linked Lists: Introduction, linked lists & its representation in memory, traversing & searching in a linked list, Garbage collection, insertion & deletion of nodes in linked list, header linked list, two-way lists, circular linked list.	06 Hrs.
Unit 4:--- Stacks & Queues: Introduction to stacks, stack as an Abstract Data type, representation through Arrays & linked lists , Applications of stacks , stacks & recursion, Queue as an abstract data type representation, circular, double ended, priority queues	06 Hrs.
Unit 5:--- Trees: Binary Tree: Introduction, Basic terminology, representations through arrays & linked lists, traversal, reconstruction, applications & threaded binary trees. Advanced trees: AVL trees, operation. Multi-way trees: m-way search trees, B trees, operations. Heaps: construction, operation & application	08 Hrs.
Unit 6:--- Graphs: Introduction, Graph theory terminology, sequential representation of graphs: Adjacency Matrix, Path matrix, Warshall's Algorithm, Shortest path Algorithm, linked representation of graphs, operations. Traversing, Posets, Topological sorting.	06 Hrs.
Textbooks: 1. Seymour Lipschautz, " Data Structures", Tata McGraw Hill, 2002 2. ISRD group, Data structures using C, Tata McGraw Hill, 2006 .	
References: 1] Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C and C++", Pearson Education Asia, 2nd Edition, 2002, ISBN-81-7808-729-4. 2] Ellis Horowitz, S. Sahni, D. Mehta "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi 1995 ISBN 16782928	

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Unit wise Measurable students Learning Outcomes:

1. Identify Linear and Non Linear data structures and analyze basic complexity issues of algorithms
2. Perform deferent operations on Linear data Structures.
3. Understand and perform operations on deferent types of link lists.
4. Use stack & queue in deferent applications.
5. Study different types of trees.
6. Perform deferent operations on graphs.

Title of the Course: Enhancing Soft skills and Personality Development (Audit Course-II) **Course Code:**UETC0461	**L**	**T**	**P**	**Credit**
	02	--	--	-

Course Pre-Requisite: Communication Skills, Communication Skills-Practice**.**

Course Description: The course aims to cause a basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfillment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.

Course Objectives: The course aims to:

1. To develop inter personal skills and be an effective goal oriented team player.
2. To develop professionals with idealistic, practical and moral values.
3. To develop communication and problem solving skills.
4. To re-engineer attitude and understand its influence on behavior

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO 1	To develop them to present themselves confidently in job interviews	Application	Apply
CO 2	To extend the ability of critical thinking while addressing the issues at any situation	Comprehension	Demonstrate
CO 3	To prepare them with suitable language and speech patterns in a workplace	Synthesis	Design /
CO 4	To acquire team skill by working in group activities	Knowledge	Design

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	1	3	3	3	2	--	--	--	--	--	--
CO2	3	1	3	3	3	2	--	--	--	--	--	--
CO3	2	2	3	2	3	2	--	--	--	--	--	--
CO4	2	2	3	3	3	2	--	--	--	--	--	--

Unit 1: Self-Assessment; Identifying Strength & Limitations; Habits, Will-Power and Drives; Developing Self-Esteem and Building Self-Confidence, Significance of Self-Discipline	4Hrs.
Unit 2: Mind-Set: Growth and Fixed; Values and Beliefs	4 Hrs.
Unit 3: Motivation and Achieving Excellence;Self-Actualisation Need; Goal Setting, Life and Career Planning; Constructive Thinking	5 Hrs.
Unit 4: Communicating Clearly: Understanding and Overcoming barriers Active	5 Hrs.

Listening; Persuasive Speaking and Presentation Skills	
Unit 5: Conducting Meetings, Writing Minutes, Sending Memos and Notices;Netiquette:Effective E-mail Communication; Telephone Etiquette	4 Hrs.
Unit6: Essential and Vocational skills: Survival strategies, Managing time, Managing stress, Work-life balance, Applying soft-skills to workplace.	4 Hrs.

Textbooks:

1. SOFT SKILLS, 2015, Career Development Centre, Green Pearl Publications. Communication Skills by Menasha Raman and Sangeeta Sharma, Oxford University Press (OUP), 2013.
2. Business Communication by S. Kalia and S. Agarwal, Wiley, 2015.
3. An Introduction to Professional English and Soft Skills by Das et al, Cambridge University Press, 2012.

References:

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013..
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollinsE-books, 2007.
4. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-HillEducation,2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.

Title of the Course: Analog Circuits – II Lab	**L**	**T**	**P**	**Credit**
Course Code: UETC0431	-	-	02	01

Course Pre-Requisite: Analog Circuits - I

Course Description: This course has been designed to introduce students with construction, theory and characteristics of various electronics devices. Also this course will lay strong fundamental base of discrete electronics and to develop capacity to analyze, interpret and design different electronics circuits.

Course Objectives :

1. To **explain** the working of electronic circuits like amplifiers (voltage and current), power amplifiers, feedback amplifiers, wave shaping and voltage regulators using discrete components and IC
2. To **illustrate** the methods of designing the electronic circuits using discrete components.
3. To **explain** the practical ways of **measuring** AC and DC parameters of electronic circuits like amplifiers, power amplifiers, feedback amplifiers, wave shaping and voltage regulators for their performance analysis.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy level	
CO 1	**Demonstrate** the working of electronic circuits (amplifiers, power amplifiers, feedback amplifiers, wave shaping and voltage regulators) built using discrete components and IC	Cognitive	Understanding
CO 2	**Test** and **analyze** the performance of amplifiers, oscillators, wave shaping, and voltage regulators built using discrete components and IC	Cognitive	Analyzing
CO 3	**Evaluate** the performance of voltage, current, power and feedback amplifiers and voltage regulators.	Psychomotor	Evaluating
CO 4	**Design** the electronic circuits for given specifications using IC and discrete components such as BJT.	Cognitive	Creating

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	3	-
CO 3	-	-	3	2	-	-	-	-	-	-	-	-
CO 4	-	-	3	2	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	2	-	-	-	-	-	-

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	25

ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- **Aim and Objectives:** Study of Frequency response of Common Source (CS) amplifier. **Outcomes:** Student will be able to understand Frequency response of Common Source (CS) amplifier **Theoretical Background:** Frequency response of Common Source (CS) amplifier **Experimentation:** ObtainFrequency response of Common Source (CS) amplifier **Results and Discussions:** Obtain the bandwidth of CS amplifier **Conclusion:**	2 Hrs
Experiment No. 2:--- **Aim and Objectives:** Design and study of single stage RC coupled amplifier. **Outcomes:** Student will be able to design single stage RC coupled amplifier and understand the frequency response of amplifier. **Theoretical Background:** single stage RC coupled amplifier. **Experimentation:** Design and **o**btain Frequency response of single stage RC coupled amplifier. **Results and Discussions:** Obtain the bandwidth of RC coupled amplifier **Conclusion:**	2 Hrs
Experiment No. 3:--- **Aim and Objectives:** Study of square wave response of RC coupled amplifier & calculation of Sag & rise time (t_r). **Outcomes:** Student will be able to understand square wave response of RC coupled amplifier **Theoretical Background:** square wave response of RC coupled amplifier **Experimentation:** Obtain square wave response of amplifier at low and high frequency **Results and Discussions:** Compare the theoretical and practical values **Conclusion:**	2 Hrs
Experiment No. 4:--- **Aim and Objectives:** Design & study of Frequency response of two stage RC coupled amplifiers. **Outcomes:** Student will be able to design two stage RC coupled amplifier and understand the frequency response of amplifier. **Theoretical Background:** RC coupled Multistage amplifier **Experimentation:** Design and **o**btain Frequency response of two stage RC coupled amplifier. **Results and Discussions:** Obtain the bandwidth of RC coupled amplifier **Conclusion:**	2 Hrs
Experiment No. 5:--- **Aim and Objectives:** Design & study of Frequency response of two stage direct coupled amplifiers. **Outcomes:** Student will be able to design two stage direct coupled amplifier and understand frequency response of amplifier. **Theoretical Background:** Two stage direct coupled amplifiers **Experimentation:** Design and **o**btain Frequency response of two stage direct	2 Hrs

coupled amplifier **Results and Discussions:** Obtain the bandwidth of amplifier and effect of direct coupling **Conclusion:**	
Experiment No. 6:--- **Aim and Objectives:** Study of power amplifiers **Outcomes:** Student will be able to understand various power amplifiers **Theoretical Background:** Power amplifiers **Experimentation:** Analyze the performance of various power amplifiers **Results and Discussions:** Comparison between various power amplifiers **Conclusion:**	2 Hrs
Experiment No. 7:--- **Aim and Objectives:** Design and analysis of current series feedback amplifiers **Outcomes:** Student will be able to understand effect feedback on amplifier **Theoretical Background:** Current series feedback amplifiers **Experimentation:** Observe the performance of amplifier with and without feedback **Results and Discussions:** Obtain the bandwidth with and without feedback **Conclusion:**	2 Hrs
Experiment No. 8:--- **Aim and Objectives:** a Study of RC low pass filter as an integrator b. Study of frequency response of low pass filter **Outcomes:** Student will be able to understand RC low pass filter as an integrator and its frequency response **Theoretical Background:** RC low pass filter **Experimentation:** Obtain frequency response of low pass filter and integrator condition **Results and Discussions:** Compare lower cutoff frequency between practical and theoretical. **Conclusion:**	2 Hrs
Experiment No. 9:--- **Aim and Objectives:** a. Study of RC high pass filter as an differentiator b. Study of frequency response of high pass filter **Outcomes:** Student will be able to understand RC high pass filter as an differentiator and its frequency response **Theoretical Background:** RC high pass filter **Experimentation:** Obtain frequency response of high pass filter and differentiator condition **Results and Discussions:** Compare upper cutoff frequency between practical and theoretical. **Conclusion:**	2 Hrs
Experiment No. 10:--- **Aim and Objectives:** Study of different clipper circuits **Outcomes:** Student will be able to understand operation of various clipper circuits **Theoretical Background:** Clipper circuits **Experimentation:** Obtain input output transfer characteristics of different clippers circuit **Results and Discussions:** **Conclusion:**	2 Hrs
Experiment No. 11:--- **Aim and Objectives:** Study of different clamper circuits: positive, negative & bias	2 Hrs

Outcomes: Student will be able to understand operation of various clamper circuits **Theoretical Background:** Clamper circuits **Experimentation:** Obtain input output transfer characteristics of different clamper circuit **Results and Discussions:** **Conclusion:**	
Experiment No. 12:--- **Aim and Objectives:** Design of IC Voltage Regulator using LM317 or LM723 **Outcomes:** Student will be able to design Voltage Regulator using LM317 or LM723 **Theoretical Background:** Voltage Regulator using LM317 or LM723 **Experimentation:** Obtain line regulation and load regulation of IC voltage regulator **Results and Discussions:** Comparison between Practical and Theatrical analysis results **Conclusion:**	2 Hrs
Textbooks: l. J. Millman&C.Halkias -'Electronic devices & circuits'-IInd Edition- Tata McGraw Hill Publication 2. Allen Mottershed —'Electronic devices & circuits'-Prentice- Hall India 3. N.C. Goyal& R.K. Khetan-' A Monograph on Electronics Design Principles'-Vth Edition-Khanna Publishers 4. J. Milman& H. Taub ' Pulse Digital & Switching Waveforms' - IInd Edition- Tata McGraw Hill Publication	
References: 1. David A. Bell —'Electronic devices & circuits'- IVth Edition- Prentice- Hall India 2. J Millman& A. Grabel-' Microelectronics'- IInd Edition- McGraw Hill International Editions 3 National Semiconductor Data Manual. 4 M.S. Roden, G.L. Carpenter ' Electronic Design- From Concept to reality'- IVth Edition-Shroff publisher & Distributors	
Measurable Students Learning Outcomes : 1. **Compare and contrast** the amplifier circuits implemented using BJT, JFET and MOSFET. 2. **Analyze** the performance of Feedback and Power amplifiers.	

Course Name: Analog Circuit II Lab
Course Code: UETC0431
For example:-
Problem Statement:

The industrialization of the world, increase in population, slow paced city development and mismanagement of the available parking space has resulted in parking related problems. There is a dire need for a secure, intelligent, efficient and reliable system which can be used for searching the unoccupied parking facility, guidance towards the parking facility, negotiation of the parking fee, along with the proper management of the parking facility Could you come up with a solution that can help them?

Abstract of the Problem:

The problem defined above is with the intention that the students should be able to develop intelligent parking services system.

Activities/Steps/Milestones with duration to solve the problem:

- **Milestone 1 : (1 Week)**
  - Problem discussion and Team formation
  - Rubrics Plan
- **Milestone 2 : (2 Week)**
  - Critical Thinking
  - Project Specifications
- **Milestone 3 : (1 Week)**
  - Circuit diagram
  - Components Survey
- **Milestone 4 : (1 Week)**
  - In semester examination for 05 Marks (Case Study and Presentation)
- **Milestone 5 : (1 Week)**
  - Circuit Mounting and Testing on Breadboard
- **Milestone 6 : (2 Week)**
  - Circuit Mounting, Soldering and Testing on General Purpose PCB.
- **Milestone 7 : (1 Week)**
  - Results
  - Discussion Project Costing and Simulations (1 Week)
- **Milestone 8 : (1 Week)**
  - Reports
  - Presentation
- **Milestone 9 : (1 Week)**
  - In semester examination for 7.5 Marks (Reports, Product Validation and Question Answering)
- **Assessment Scheme:**

Type of Assessment	Marks
In-Semester Examination 1	5.0 (Case Study & Presentation)
In-Semester Examination 2	7.5(Report, Product Validation and Question Answering)

- **Evaluation Scheme for 25 Marks**

	Heads	Marks	
	Case Study	2.5	
	Presentation	2.5	
	Report	2.5	
	Product Validation	2.5	
	Question Answering	2.5	

Title of the Course: Linear Integrated Circuits Lab	**L**	**T**	**P**	**Credit**
Course Code:UETC0432	-	-	02	01

Course Pre-Requisite: Transistor as an Amplifier

Course Description:

The course aims to provide knowledge of operational amplifier, some special purpose ICs like IC 555 & IC565(PLL) and their applications.

Course Objectives:

This course aims to

1. Provide knowledge of op-amp & its electrical parameters
2. Provide knowledge of op-amp configurations & frequency response
3. Study linear and non linear applications of op-amp
4. Provide basic knowledge of special purpose ICs like IC555 and IC 565

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's level	Descriptor
CO1	Discuss the op-amp's basic construction, characteristics, parameters, various configurations of op-amp	Cognitive	Recall
CO2	Evaluate different parameters of op-amp viz Slew rate, CMRR, frequency response	Cognitive	Evaluate
CO3	Design linear and non-linear circuits like active filters, signal generators using op-amp.	Cognitive	Create
CO4	Design the application of timer IC 555 for multivibrators	Cognitive	Create
CO5	To test the simulation of op-amp circuits	Cognitive	Analyze

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	1	3	3	3	2	-	-	-	-	-	-
CO2	3	1	3	3	3	2	-	-	-	-	-	-
CO3	2	2	3	2	3	2	-	-	-	-	-	-
CO4	2	2	3	3	3	2	-	-	-	-	-	-
CO5	1	2	3	3	3	3	-	-	-	-	-	-

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	25
ESE-POE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination	
Course Contents:	
Experiment No. 1:--- **Aim and Objectives:** Study of datasheets of LM741, LF356, CA3140, OP177 **Outcomes:** Students will be able to define various electrical parameters of op-amp **Theoretical Background:** Definition of electrical parameters **Experimentation:** Study datasheets of various op-amp ICs to study their electrical parameters **Results and Discussions:** Comparison of electrical parameters of op-amp ICs	2 Hrs.
Experiment No. 2:--- **Aim and Objectives:** Measure op-amp parameters & compare with the standard specifications: (a) Measure input bias current, input offset current and input offset voltage. (b) Measure slew rate (LM/UA741C) (c) Measure CMRR (d) Compare the result with datasheet of corresponding Op Amp. **Outcomes:** Students will be able to evaluate various electrical parameters of op-amp **Theoretical Background:** Pin out of IC741 and Definition of electrical parameters **Experimentation:** Calculate various parameters of op-amp by following the design procedure **Results and Discussions:** Practical values of parameters **Conclusion:** op-amp parameters have been calculated and compared with their standard values. Calculated values are approximately same as that of the standard values	2 Hrs.
Experiment No. 3:--- **Aim and Objectives:** Design of inverting , non-inverting amplifier & plot their frequency response **Outcomes:** students will be able to understand the concept of inverting and non-inverting configuration of op-amp **Theoretical Background:** Inverting and non-inverting configuration of op-amp **Experimentation:** Apply DC and AC voltage to the Inverting and non-inverting configuration of op-amp. Measure the o/p voltage for i/p DC voltage. For AC voltage, increase the i/p frequency and note down the corresponding o/p voltage. **Results and Discussions:** Prepare a table of calculated and observed o/p voltage for DC i/p voltage. Plot the frequency response curve for AC i/p voltage. **Conclusion:** For inverting configuration of op-amp, i/p is inverted at the o/p and the amplitude of o/p is equal to the gain times the i/p. For non-inverting, there is no phase shift between i/p & o/p voltage.	2 Hrs.
Experiment No. 4:--- **Aim and Objectives:** Design of Summing, scaling, and averaging amplifier **Outcomes:** Students will be able design summing, scaling and averaging amplifier using op-amp **Theoretical Background:** Derivation for the o/p voltage for Summing, scaling, and averaging amplifier using inverting & non-inverting configuration **Experimentation:** Design Summing, scaling, and averaging amplifier. Apply DC	2 Hrs.

voltage to Summing, scaling, and averaging amplifier and measure the o/p voltage **Results and Discussions:** Measure o/p voltage and compare them with the theoretical values. **Conclusion:** Op-amp can be used as the summing, scaling and averaging amplifier. For summing amplifier, the o/p voltage is sum of the i/p voltages applied. In scaling amplifier, each i/p voltage is weighted by a different factor. In averaging amplifier, the o/p voltage is average of the i/p voltages applied.	
Experiment No. 5:--- **Aim and Objectives:** Design, build and test precision half & full wave rectifier **Outcomes:** Students will be able to analyze o/p waveforms of precision HWR & FWR **Theoretical Background:** Operating principle of precision HWR & FWR **Experimentation: Construct circuits for** precision HWR & FWR. Apply AC signal of less than 0.7V to the i/p terminal of rectifier. Observe the o/p waveforms **Results and Discussions:** Observe the o/p waveforms and plot it on graph paper **Conclusion:** Precision rectifiers can rectify signals below 0.7V which is not possible with diode rectifier	2 Hrs.
Experiment No. 6:--- **Aim and Objectives:** Design, build and test Schmitt trigger **Outcomes:** Students will be able to explain operation of Schmitt trigger **Theoretical Background:** Operating principle of Schmitt trigger **Experimentation:** Design the Schmitt trigger for given specifications. Observe the i/p & o/p waveforms **Results and Discussions:** Determine upper & lower threshold voltage from observed waveforms and hysteresis loop. **Conclusion:** Schmitt trigger converts sinusoidal signal into square wave. Whenever i/p sinusoidal signal crosses upper & lower threshold voltage levels the o/p is switched from +Vsat to –Vsat & -Vsat to +Vsat respectively.	2 Hrs.
Experiment No. 7:- **Aim and Objectives:** Design of Butterworth High Pass and Low Pass filters **Outcomes:** Students will be able to explain operation of Butterworth High Pass and Low Pass filters **Theoretical Background:** Operating principle of filters **Experimentation:** Design filter for given cut-off frequency and gain. Apply AC signal to the i/p of filter. Increase the i/p frequency, observe the amplitude of o/p signal for corresponding i/p frequency. **Results and Discussions:** Plot the frequency response curve of Butterworth High Pass and Low Pass filters **Conclusion:** For LPF filter the remains constant till cut-off frequency. After reaching cut-off frequency, the gain reduces at the rate of -20dB/dec. Thus LPF allows signals below cut-off frequency while rejecting the signals above cut-off frequency. Similarly for HPF the gain increases at the rate of +20dB/dec till cut-off frequency. Thereafter the gain remains constant. Thus HPF rejects low frequencies and allows signals above cut-off frequency.	2 Hrs
Experiment No. 8:- **Aim and Objectives:** Design, build and test square & triangular wave generator **Outcomes:** Students will be able to design waveform generator **Theoretical Background:** Concept of oscillator **Experimentation:** Design square and triangular wave generator for given specification	2 Hrs

Results and Discussions: Observe the o/p waveforms. Note down frequency and amplitude of the o/p waveform **Conclusion:** Waveform generators are basically oscillators which generate square & triangular wave without applying any i/p signal	
Experiment No.9:- **Aim and Objectives:** Design of astable multivibrator using IC555 **Outcomes:** Students will be able to explain operation of astable multivibrator using IC555 **Theoretical Background:** Internal circuit of IC555 timer. Pin out of IC555**.** **Experimentation:** Design astable multivibrator using IC 555 timer to generate square wave of 50% duty cycle. **Results and Discussions:** Observe the o/p waveform. Calculate the duty cycle. **Conclusion:** IC 555 can be used to generate square wave of various duty cycle.	2 Hrs
Experiment No. 10:- **Aim and Objectives:** Design and implement Wien bridge oscillator using Op-Amp **Outcomes:** Students will be able to design oscillator to generate sinusoidal signal **Theoretical Background:** Concept of oscillator **Experimentation:** Design and implement Wien bridge oscillator using Op-Amp To generate sinusoidal signal of given frequency. **Results and Discussions:** Observe the o/p. **Conclusion:** Op-amp can designed as an oscillator to generate sinusoidal signal of desired frequency.	2 Hrs
Experiment No. 11:- **Aim and Objectives: Simulation of comparator** **Outcomes:** Students will be able to test the simulation of op-amp circuits **Theoretical Background:** Operation of comparator **Experimentation:** Create a project in pspice to simulate comparator circuit. **Results and Discussions:** Observe the i/p & o/p waveform **Conclusion:** Students will be able to analyze o/p of comparator using simulation	2 Hrs
Experiment No. 12:- **Aim and Objectives: Simulation of band pass & band reject filter** **Outcomes:** Students will be able to test the simulation of op-amp circuits **Theoretical Background:** Operation of band pass & band reject filter **Experimentation:** Create a project in pspice to simulate band pass & band reject filter circuit. **Results and Discussions:** Observe the i/p & o/p waveform **Conclusion:** Students will be able to analyze o/p of comparator using simulation	2 Hrs
Textbooks: 1) Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education second and latest edition. 2) D.Roy Choudhary, Shail Jain, “Linear Integrated Circuits”, New Age Int	
References: 1) Robert Coughlin, Fredric Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, Sixth edition,PE, 2006. (Ch-6) 2) David Bell, “Operational Amplifiers and Linear ICs”,Third ed, Oxford University Press 3) B. Somanathan Nair, “ Linear Integrated Circuits- Analysis, Design & Applications”, Wiley India. 4) Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata	

McGraw Hill., Third Edition

Experiment wise Measurable students Learning Outcomes:

1) Students will be able to explain various electrical parameters of op-amp

2) Students will be able to calculate various electrical parameters of op-amp

3) Students will be able to design inverting and non-inverting amplifier using op-amp

4) Students will be able to design summing, scaling and averaging amplifier using op-amp

5) Students will be able to analyze o/p waveform of precision HWR & FWR

6) Students will be able to analyze o/p waveform of Schmitt trigger

7) Students will be able to design butterworth LPF & HPF and analyze their operation from the frequency response

8) Students will be able to design square and triangular waveform generator.

9) Students will be able to design IC555 timer as astable multivibrator to generate square wave of various duty cycles

10) Students will be able to design wien bridge oscillator using op-amp to generate sinusoidal signal.

11) Students will be able to simulate comparator circuit in PSPICE

12) Students will be able to simulate band pass and band reject filter circuits in PSPICE

Title of the Course: Analog Communication & Digital Communication Lab Course Code: UETC0433	**L**	**T**	**P**	**Credit**
	-	-	02	01

Course Pre-Requisite: Basic knowledge of working of diode, transistor, and amplifiers.

Course Description: Course deals with different types of AM and FM transmitter and receivers with their working. Also course deals with digital modulation and demodulation types.

Course Objectives:

1. Describe & demonstrate different types of modulation techniques.
2. Describe & demonstrate different types of demodulation techniques.
3. Live Demonstration at AIR station of AM or FM transmission.
4. Describe & demonstrate different types of baseband transmission and modulation techniques.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Explain different modulation schemes.	Cognitive	Explain
CO2	Explain different Demodulation schemes.	Cognitive	Explain
CO3	In AIR visit, students actually go through the live demonstration process of transmitting and receiving of signal.	Cognitive	Demonstration
CO4	Explain different types of baseband transmission and modulation techniques.	Cognitive	Explain

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	3	3	-	3	-	-	-	-	-	3	-
CO2	-	3	3	-	3	-	-	-	-	-	3	-
CO3	-	3	3	-	3	-	-	-	-	-	3	-
CO4	-	1	1	-	2	-	-	-	-	-	3	-

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE(TW)	25
ESE(POE)	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- **Aim:** Experiment on practical implementation of Amplitude Modulation. Objectives: Demonstrate AM Modulation. Outcomes: Calculation of modulation index in different cases.	02 Hrs.

Theoretical Background: Working of R.F.amplifiers, audio and power amplifier, balanced modulators. Experimentation: Results and Discussions: m= Em/Ec Conclusion: We observed that, ideal value of m=1. When m>1, we call it as over modulation. When m<1, we call it as under modulation. In AM, amplitude of the carrier signal is changed according to instantaneous value of modulating signal.	
Experiment No. 2:--- Aim: Experiment on practical implementation of calculation of modulation index by using a) AM signal and b)Trapezoidal Pattern Objectives: Demonstrate AM modulation and Demodulation using Trapezoidal pattern and AM spectrum. Outcomes: Calculation of modulation index using trapezoidal pattern and AM spectrum in different cases. Theoretical Background: Working of R.F.amplifiers, audio and power amplifier, balanced modulators. Experimentation: Results and Discussions: Using AM spectrum: m = (Vmax-Vmin) / (Vmax+Vmin) Using trapezoidal pattern: m = (A-B) / (A+B) Conclusion: We observed that, ideal value of m=1. When m>1, we call it as over modulation. When m<1, we call it as under modulation. In AM, amplitude of the carrier signal is changed according to instantaneous value of modulating signal.	02 Hrs.
Experiment No. 3:--- **Aim :** Experiment on practical implementation of Amplitude Demodulation. Objectives: Demonstrate AM Demodulation. Outcomes: Study how to extract original signal using AM diode detector. Theoretical Background: Working of diode, rectifier, filter and balanced modulators. Experimentation: Results and Discussions: To see how original signal is extracted from modulated signal. Conclusion: We observed that, amplitude of original signal is changes in proportion to change in modulating signal.	02 Hrs.
Experiment No. 4:--- **Aim:** Experiment on practical implementation of Frequency Modulation and also find the modulation index. Objectives: Demonstrate FM Modulation. Outcomes: Calculation of modulation index using Varactor diode. Theoretical Background: Working of amplifiers.mixers, balanced modulators.diode, rectifier, filter, working of varactor diode. Experimentation:	02Hrs.

Results and Discussions: Modulation index = (f2-f1) / fm Conclusion: In FM, frequency of the carrier signal is changed according to instantaneous value of modulating signal.	
Experiment No. 5:--- **Aim:** Experiment on practical implementation of Sampling and reconstruction and also observe aliasing effect by varying sampling frequency. Objectives: Demonstrate Sampling theorem. Outcomes: Observed aliasing effect and Nyquist criteria. Theoretical Background: Working of sample and hold circuit, filter. Experimentation: Results and Discussions: Nyquist criteria is satisfied to avoid aliasing. Nyquist criteria is fs>2*fm. Conclusion: Sampling theorem states that, it is possible to convert continuous signal into discrete signal and recovered back the original signal if the condition fs> 2* fm is satisfied otherwise aliasing means merging one frequency into another is occurred.	02 Hrs.
Experiment No. 6:--- **Aim:** Experiment on practical implementation of PAM system. Objectives: Demonstrate generation and detection of PAM. Outcomes: Observed ideal, natural and flat-top PAM. Theoretical Background: Working of sample and hold circuit, filter,sampling theorem. Experimentation: Results and Discussions: To produce ideal sampling, convolution between baseband signal and pulse signal is used. To produce natural sampling, BJT or FET as a switch is used. To produce flat-top sampling, sample and hold (S/H) circuit is used. Conclusion: In this, by observing ideal, natural and flat-top sampling, we can write comparison between them.	
Experiment No. 7:--- **Aim:** Experiment on practical implementation of PAM system. Objectives: Demonstrate generation and detection of PWM. Outcomes: Observed PWM using comparator. Theoretical Background: Working of sampling theorem, comparator. Experimentation: Results and Discussions: To produce PWM output, comparator is used. Saw tooth wave and pulse, both are applied to comparator circuit to produce PWM output. Conclusion: In PWM, width of the carrier signal is changed according to instantaneous value of modulating signal.	02Hrs.
Experiment No. 8:--- **Aim:** Experiment on practical implementation of Pre-emphasis and De-emphasis. Objectives: Demonstrate working of LPF and HPF in FM.	02 Hrs

Outcomes: Observed that to artificially boost high frequency component, we use HPF at FM transmitter side and getting back signal to original value, we use LPF at FM receiver side. Theoretical Background: Working of LPF, HPF and use of Semi Log graph paper. Experimentation: Results and Discussions: To artificially boost high frequency component, we use HPF at FM transmitter side and getting back signal to original value, we use LPF at FM receiver side. Conclusion: Pre-emphasis and De-emphasis are used to improve signal to noise ratio(SNR).	
Experiment No. 9:--- **Aim:** Visit to Music Studio/ AIR/Doordarshan Kendra. Objectives: Demonstrate live working AM or FM system. Outcomes: To get live demonstration of working of all parts of AM or FM transmitter and recording studio. Experimentation: Results and Discussions: To get all the technical details like height of antenna, carrier and modulating signal frequency, power, and geographical coverage area. Conclusion: Students are getting live demo. To enhance their knowledge**.**	**02Hrs.**
Experiment No. 10:--- Aim: Study of ASK transmitter and receiver.	02Hrs.
Experiment No. 11:--- Aim: Study of FSK transmitter and receiver.	02Hrs.
Experiment No. 12:--- Aim: Study of PSK transmitter and receiver.	02Hrs.
Experiment No. 13:--- Aim: Study of QAM transmitter and receiver.	02Hrs.
Experiment No. 14:--- Aim: Study of different Data formats.	02Hrs.
Any 10 practical's out of above 14. Also any 2 practical's based on Simulation.(Self study experiments**)**	
Textbooks: 1) George Kennedy, "Electronic Communications", McGraw Hill Kennedy.. 2) Wayne Tomasi 'Electronics Communication System' -Fundamentals through Advanced.-Vth Edition- Pearson Education. 3) Analog and Digital communication – J S Chitode Technical Publications, 2009	
References: 1) B.P. Lathi, "Analog and Digital Communication", OXFORD University press. 2) Simon Haykin, "An introduction to analog & digital communications", John Wiley & Sons . 3) R P Singh, S D Sapre 'Communication System-Analog & Digital' IInd Edition –Tata Mc Graw Hill Publication. 4) Louis E. Frenzel, "Principals of electronic communication system", IIIrd Ed., TMH Pub.	
Experiment wise Measurable students Learning Outcomes:	
1) Calculation of modulation index in different cases.	
2) Calculation of modulation index using trapezoidal pattern and AM spectrum in different cases.	

3) Study how to extract original signal using AM detector.
4) Calculation of modulation index using Varactor diode.
5) Observed aliasing effect and Nyquist criteria.
6) Observed ideal, natural and flat-top PAM .
7) Observed PWM using comparator.
8) Observed that to artificially boost high frequency component, we use HPF at FM transmitter side and getting back signal to original value, we use LPF at FM receiver side.
9) To get live demonstration of working of all parts of AM or FM transmitter, recording studio.

Title of the Course: Data Structures – Lab	**L**	**T**	**P**	**Credit**
Course Code:UETC0434	**-**	**-**	**02**	**01**

Course Pre-Requisite: Basics of C and C++ programming language

Course Description:

Explores linear & nonlinear data structures and algorithms including sorting, searching, iterating over data structures and recursion

Course Objectives:

1. Develop programming skills to design simple linear and non linear data structures.
2. Strengthen the ability to identify and apply the suitable algorithm for the real world problem
3. Gain knowledge in practical applications of data structures

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO 1	Develop linear & non linear data structures	Cognitive	Develop
CO 2	Apply various searching and sorting algorithms on linear array.	Cognitive	Apply
CO 3	Demonstrate the various operations on stack and queue	Cognitive	Demonstrate
CO 4	Demonstrate Tree & Graph traversing algorithms	Cognitive	Demonstrate

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	3	2	-	3	3	-	-	-	-	-	-
CO2	2	3	2	-	3	3	-	-	-	-	-	-
CO3	2	3	2	-	3	3	-	-	-	-	-	-
CO4	2	3	2	-	3	3	-	-	-	-	-	-

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	25

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- Program to Insert & Delete the Number in a 1D Array Aim and Objectives: To Insert & Delete the Number in a 1D Array. Outcomes: Implement insertion & deletion algorithm for 1D array. Theoretical Background: Study of linear array.	02 Hrs.

Experimentation: Results and Discussions: Conclusion:	
Experiment No. 2:--- Program on Bubble Sort Aim and Objectives: To implement program on bubble sorting. Outcomes: Implement bubble sort algorithm for 1D array. Theoretical Background: Study of linear array. Experimentation: Results and Discussions: Conclusion:	02 Hrs.
Experiment No. 3:--- Program to Perform Linear search Aim and Objectives: To implement program for Linear search. Outcomes: Implement linear search algorithm for 1D array. Theoretical Background: Study of linear array. Experimentation: Results and Discussions: Conclusion:	02 Hrs.
Experiment No. 4:--- Program to Perform Binary search Aim and Objectives: To implement program for Binary search. Outcomes: Implement Binary Search algorithm for 1D array. Theoretical Background: Study of linear array. Experimentation: Results and Discussions: Conclusion:	02 Hrs.
Experiment No. 5:--- Program to Insert the Node in Link List Aim and Objectives: To implement program for Insertion of Node in Link List Outcomes: Implement algorithm for Insertion of Node in Link List Theoretical Background: Study of link list Experimentation: Results and Discussions: Conclusion:	02 Hrs.
Experiment No. 6:--- Program to Delete the Node from Link List Aim and Objectives: To implement program for Deletion of Node from Link List Outcomes: Implement algorithm for Deletion of Node from Link List Theoretical Background: Study of link list Experimentation: Results and Discussions: Conclusion:	02 Hrs.
Experiment No. 7:--- Program to Perform Operation on Stack. Aim and Objectives: To implement program for push & pop operations on stack. Outcomes: Implement algorithm for push & pop operations on stack. Theoretical Background: Study of stack. Experimentation: Results and Discussions: Conclusion:	02 Hrs.
Experiment No. 8:--- Program to Perform Operation on Queue Aim and Objectives: To implement program for insertion & deletion in queue. Outcomes: Implement algorithm for Insertion & Deletion in queue. Theoretical Background: Study of queue. Experimentation:	02 Hrs.

Results and Discussions: Conclusion:	
Experiment No. 9:--- To Study Traversing operation of Tree Aim & Objectives: Implement algorithm for deferent Traversing operations of Tree Outcomes: Understand deferent Traversing operations of Tree Theoretical Background: Trees Experimentation: Results and Discussions: Conclusion:	02 Hrs.
Experiment No. 10:--- To Study Traversing operation of Graph Aim & Objectives: Implement algorithm for deferent Traversing operations of Graph Outcomes: Understand deferent Traversing operations of Graph Theoretical Background: Graphs Experimentation: Results and Discussions: Conclusion:	02 Hrs..

Textbooks:

1. Seymour Lipschautz, " Data Structures", Tata McGraw Hill, 2002
2. ISRD group, Data structures using C, Tata McGraw Hill, 2006

References:

1] Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C and C++", Pearson Education Asia, 2nd Edition, 2002, ISBN-81-7808-729-4.
2] Ellis Horowitz, S. Sahni, D. Mehta "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi 1995 ISBN 16782928

Experiment wise Measurable students Learning Outcomes:

1. Manipulate 1D array.
2. Apply bubble sorting algo on 1D array
3. Perform Linear search algo on 1D array
4. Perform Binary search algo on 1D array
5. Insert the Node in Link List
6. Delete the Node from Link List
7. Implement stack using linear array
8. Implement queue using linear array
9. Using different traversing algo Travers Tree.
10. Using different traversing algo Travers Graph.

Title of the Course: Mini Project -I	**L**	**T**	**P**	**Credit**
Course Code: UETC0441	-	-	02	01

Course Pre-Requisite: Analog Circuits, Digital Design, Linear integrated circuits, Network Analysis.

Course Description: Course will cover all the implementation of theoretical design & its practical implementation.

Course Objectives:

1. Design working, reliable and electronic system to meet specifications.
2. Inculcate circuit designing skills and ability and to use modern design tools.
3. Enhance employability based on knowledge and understandings of electronic circuit design.
4.To create an interest in the field of electronic design as a prospective career option.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Apply the fundamental concepts and working principles of electronics devices to design electronics systems.	Cognitive	Design
CO2	Shall be able to interpret datasheets and thus select appropriate components and devices	Cognitive	Design
CO3	Select appropriate transducer and signal conditioning circuit to design prototype of Data Acquisition system.	Cognitive	Design
CO4	Design an electronic system/sub-system and validate its performance by simulating the same.	Cognitive	Draw
CO5	Shall be able to use an EDA tool for circuit schematic and simulation.	Cognitive	Draw

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	3	-	1	-	-	-	2	-	-	-
CO2	-	-	3	-	1	-	-	-	2	-	-	-
CO3	-	-	3	-	1	-	-	-	2	-	-	-
CO4	-	-	3	-	1	-	-	-	2	-	-	-

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50

ISE are based on practical performed Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Guidelines:

a) Students are expected to Design and simulate all assignments during the semester in a group. Group shall consist of **maximum of three** students. b) Institutions are requested to

provide components required for implementation and required software.

c) **For hardware based assignments:** Paper design should be functionally verified with an appropriate EDA tool (NI Multisim/Orcad/Pspice / Altium Designer suite etc.) and prepare the document which consist of :

1. Problem statement (Different for each group)
2. Specifications 3.Block Diagram
4. Component Selection
5. Design Calculations
6. Simulation results
7. Bill of Material
8. Conclusion
9. Datasheets
10. Detailed circuit diagram (separate sheet: Imperial /Half Imperial size)
11. Lauout Making, Etching, component soldering & testing.

Textbooks:

1. Measurement, Instrumentation, and Sensors Handbook‖, John G. Webster, CRC Press,1999 .
2. Printed Circuit Boards: Design, Fabrication, and Assembly‖, R. Khandpur, McGraw-Hill ,05

References:

1. Practical design of power supplies‖ , Ron Lenk, John Wiley & Sons, 2005
2. The Circuit Designer‘s Companion‖, Peter Wilson, Elsevier Ltd, 2012
3. Printed Circuits Handbook, 7th Edition, Clyde Coombs, Happy Holden, McGraw-Hill , 2016