LORDS INSTITUTE OF ENGINEERING & TECHNOLOGY

(Autonomous)

Approved by AICTE | Recognized by Government of Telangana | Affiliated to Osmania University

Accredited by NBA | Accredited with ‘A’ grade by NAAC | Accredited by NABL

II Year Course Structure and Second Year Syllabus

Department of Electronics and Communication Engineering

(With effect from the Academic Year 2024-25)

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LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(UGC Autonomous Institution)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATIONS [LR-24]
AICTE Model Curriculum (Tentative)
B.E. III-Semester (2025-2026)

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			CREDITS
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Theory Course											
1	U24MA301	BSC	M-III(Probability and Statistics)	3	0	0	3	40	60	3	3
2	U24EN301	HSMC	English for technical Communication	2	0	0	2	40	60	3	2
3	U24EC301	PCC	Electronic Devices	3	0	0	3	40	60	3	3
4	U24EC302	PCC	Signals and Systems	3	0	0	3	40	60	3	3
5**	U24EC303	PCC	Digital Electronics	3	0	0	3	40	60	3	3
6	U24EC305	PCC	Network Theory	3	0	0	3	40	60	3	3
Practical/ Laboratory Course											
7	U24EC3L1	PCC	Digital Electronics Lab	0	0	2	2	25	50	3	1
8	U24EC3L2	PCC	Electronic Devices Lab	0	0	2	2	25	50	3	1
9	U24EC3L3	PCC	Basic simulation Lab	0	0	3	3	25	50	3	1.5
Skill Development Course											
10	U24CS3L3	ESC	Programming Language - 1	-	-	3	3	25	50	3	1.5
11	U24EN3L1	HSMC	Soft Skills & Employability skill Lab	-	-	3	3	25	50	3	1.5
Bridge Courses*											
12*	U24CS3L2	ESC	C Programming Lab	-	-	2	2	50	-	3	-
13*	U24EN1L1	HSMC	Effective Communication Skills Lab	-	-	2	2	50	-	3	-
Total				17	0	13 (*17)	30 (*34)	365 (*465)	610	33 (*39)	23.5

**** Bridge Courses for Lateral Entry Admitted Students.***
*****The Students should complete Term Work (TW). TW includes Assignments, Seminars , Micro projects, Industrial Visits and any other student activities.***

L: Lecture (Hrs/Wk/Sem) T: Tutorial (Hrs/Wk/Sem P: Practical D: Drawing (Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation
SEE: Semester End Examination
BSC: Basic Science Course
ESC: Engineering Science Course
PCC: Program Core Course
HSMC: Humanities & Social Sciences Including Management Courses

Note:

1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
U24EC301	**Electronic Devices**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Physics	**3**	**0**	**0**	**0**	**40**	**60**	**3**

Course Objectives:

After completing this course, the student will be able to:

1. Concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. Applications of diodes.
3. Various configurations, characteristics of transistors – BJT, JFET & MOSFET.

Course Outcomes:

After completing this course, the student will be able to

1. Demonstrate the characteristics of various Diodes.
2. Design rectifier circuits with filters Calculate ripple factor, efficiency and percentage regulation of rectifier circuits.
3. Compare and Contrast the characteristics of BJT in various configurations.
4. Distinguish the working principles of FET & MOSFET
5. Demonstrate the properties and applications of special purpose devices.

UNIT – I

Semiconductor Diode Characteristics: PN Junction formation, Characteristics, Diode current equation, Breakdown in diodes, Diode as a circuit element, Temperature dependence of PN characteristics, Diode switching characteristics, Problems. Zener Diode, Zener as voltage regulator and its limitation, Schottky diode.

UNIT – II

Rectifiers: Half wave, Full wave and Bridge Rectifiers - their operations, performance characteristics- ripple factor calculations, and analysis, comparison of rectifiers, Filters (L, C, LC and CLC filters). comparison of filters.

UNIT – III

Bipolar Junction Transistor: Construction and Operation of NPN and PNP transistor, current components and current flow in BJT, Modes of transistor operation, Early effect, BJT input and output characteristics of CB, CE, CC configuration, determination of h- parameters, Biasing & stabilization circuits.

UNIT – IV

Field Effect Transistor: Junction Field Effect Transistor: Construction of FET, Principle of Operation -Pinch-off Voltage Vp, V-I Characteristics of JFET.FET Configurations MOSFETs: Enhancement & Depletion mode MOSFETs, V-I characteristics.

UNIT – V

Special Purpose Semi-Conductor Devices: Elementary treatment of UJT, Varactor Diode, LED, Photo Resistor, Photodiode, Solar cell, Photo transistor, OLED & applications.

Suggested Readings :

1. Millman and Halkias, "Electronic Devices and Circuits", 2nd Edition, McGraw Hill Publication, 2007.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.
3. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics",
4. 2nd Edition, McGraw Hill Publication, 2009. 2. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
5. S. Salivahanan , N Suresh Kumar , "Electronic Devices and Circuits " 4th Edition McGraw Hill Publication.2017

Course Code	Course Title						Core/Elective
U24EC302	**Signals and Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Mathematics	**3**	**0**	**0**	**0**	**40**	**60**	**3**

Course Objectives:

After completing this course, the student will be able to

1. To understand basic concepts related to continuous time signals and systems, mathematical representation of periodic signals.
2. To Understand the various domain characteristics of continuous and discrete time signals using various transform techniques.
3. Analyze the convolution, correlation operations on continuous and discrete time signals.

Course Outcomes:

After completing this course, the student will be able to:

1. Define and differentiate types of signals and systems in continuous and discrete time.
2. Apply the properties of Fourier transform for continuous time signals.
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to known inputs.
4. Interpret the process of sampling and Linear Convolution of discrete time signals using graphical representation.
5. Apply Z-transforms for discrete time signals to solve difference equations.

UNIT–I:

Classification of Signals and Systems: Classification of signals, Elementary continuous time signals and discrete time signals, Basic operations on continuous-time signals and discrete time signals. Continuous time & Discrete systems, lumped parameter & distributed –parameter systems, static & dynamic systems, causal & non-causal systems, Time- invariant & time-variant systems, stable & unstable systems.

UNIT–II:

Fourier series Analysis of Continuous-time signals: Fourier series – Existence of Fourier series, Trigonometric and Exponential Fourier series, computational formulae, symmetry conditions, complex Fourier spectrum.
Continuous-time Fourier Transform (FT): The direct and inverse FT, existence of FT, Properties of FT, FT of standard signals, The Frequency Spectrum.

UNIT–III:

Laplace Transform (LT) Analysis of signals and systems: The direct LT, Region of convergence, existence of LT, properties of LT. The inverse LT, Solution of differential equations, system transfer function. Linear Convolution & Correlation of Continuous time signals: Graphical Representation, Properties of convolution, Correlation between continuous-time signals: Auto and Cross correlation, graphical interpretation, Properties of correlation.

UNIT–IV:

Sampling: Sampling theorem, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling. Linear Convolution of discrete time signals: Graphical interpretation, properties of discrete convolution.

UNIT - V:

Z-Transforms: Introduction to Z-Transform, Region of Convergence (ROC) and its properties. S-plane and Z-plane correspondence, Properties of Z-Transform, Inverse Z-Transform, Solution to linear difference equations, linear constant coefficient systems, System transfer function. DTFT (Discrete Time Fourier Transform)

Suggested Readings:

1. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, 2ndEd., PHI.
2. Signals, Systems & Communications - B.P. Lathi, 2013, BSP.
3. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Ed.
4. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.
5. Signals and Systems – A. Anand Kumar, 3rd Ed., 2013, PHI .

Course Code	Course Title						Core/Elective
U24EC303	**Digital Electronics**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Physics	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

After completing this course, the student will be able

1. To learn the basic concepts related to Digital Electronics.
2. To acquire the operation and design of combinational circuits and concepts related to flip flops.
3. To comprehend the procedure to design Digital circuits.

Course Outcomes:

After completing this course, the student will be able to

1. Outline the fundamental concepts in number systems and Boolean algebra.
2. Implement various combinational circuits.
3. Implement various Sequential circuits like flip flops.
4. Design sequential circuits such as registers, counters using flip-flops.
5. Represent a sequential circuit using Finite State machine and apply state minimization techniques to design an FSM

UNIT – I

Basic Concepts: Number Systems, r and (r-1) Complements of a number, Subtraction using, r and (r-1) Complements, Codes – Weighted and Non-Weighted Codes and its properties, Parity check code and Hamming Code, Boolean Algebra- Basic Theorems and properties, Switching Functions- Canonical and Standard form, Fundamentals of logic gates, Implementation of NAND and NOR gate.

UNIT – II

Combinational Circuits: Implementation of logic functions using K-map. Quine Mc CLuskey Tabular Method, Adders – Half Adders and Full Adders, Subtractors - Half Subtractor and Full Subtractor, Multiplexers, Demultiplexers, Decoders. Encoders, Parity Generator, Code converters, BCD to 7-segment converter, comparators

UNIT – III

Sequential Circuits: Basic architectural distinction between Combinational and Sequential Circuits Operation of Basic Latch, Edge triggering and Level Triggering, Gated SR Latch, Clocked SR flip flop, D flip flop, T flip flop, JK flip flop, Race around condition, Master-Slave flip flop with their Truth tables, Excitation tables. and Characteristics equation, Conversion of one type of flip flop into another, Applications of Flip flops.

UNIT – IV

Applications of Sequential Circuits: Registers: - Shift registers, universal shift registers, Counters: - Types of counters, Up/Down counter, Decade counter, Mod N Counter, Johnson Counter, Ring counter

UNIT – V

Finite state Machines Capabilities of FSM, Mealy and Moore models, State diagram. State assignment, State equivalence and minimization, Design examples, Hazards in sequential circuits.ASM Charts.

TEXT BOOKS

1. R. P Jain, Modern Digital Electronics,4th ed., McGraw Hill Education (India) Private Limited, 2003
2. Anand Kumar, Switching Theory and Logic Design, 3rd ed., PHI learning Private Limited,2016.
3. Moris Mano and Michael D CIletti, Digital Design, Pearson, fourth edition,2008
4. Zvi Kohavi ,Switching and Finite Automata Theory, 3rd ed., Cambridge university press-New delhi,2011.

Course Code	Course Title						Core / Elective
U23EC305	**Network Theory**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
BEE	**3**	-	-	-	**40**	**60**	**3**

Course Objectives

After completing this course, the student will be able to

1. Understand the Concepts of Two Port networks, study about the different two port parameter representations.
2. Understand the Concepts about the image impedance on different networks, design of attenuators.
3. Understand the Concepts of equalizers, different filters and network synthesis.

Course Outcomes

After completing this course, the student will be able to

1. Interpret the given Electrical Circuit in terms of Z, Y and ABCD parameter model and solve the circuits and how they are used in real time applications.
2. Analyze the Symmetrical and Asymmetrical networks by evaluating different parameters.
3. Design different types of filters using passive elements.
4. Design of Attenuators and Equalizers networks.
5. Synthesize the RL & RC networks in Foster and Cauer Forms.

UNIT-I

Two Port networks: Z, Y, h and ABCD parameters, equivalence of two ports networks, Condition of Reciprocity and Symmetry in two port networks, Interconnection of two port networks, T-π section representation in parameter forms.

UNIT-II

Symmetrical and Asymmetrical Networks: Characteristic impedance and propagation constant of symmetrical T and π networks, Image and iterative impedances, Image transfer constant and iterative transfer constant of asymmetrical L, T and π networks.

UNIT-III

Filter Network: Low pass, high pass, band pass and band elimination filter design, constant k filters, m-derived low pass and high pass filter design, Composite filter design, Impedance matching of filters notch filters.

UNIT-IV

Attenuators and Equalizers: Design of symmetrical T, π, Bridge-T and Lattice attenuators, impedance matching networks, Inverse networks. Equalizers - Constant resistance equalizer, full series and full shunt equalizer.

UNIT-V

Network Synthesis: Hurwitz polynomials, Positive real functions, Concept of Network Synthesis, L-C Immittance functions, RC impedance functions and RL admittance functions, Cauer and Foster's forms of RL impedance and RC admittance, Properties of RC, RL Networks.

Suggested Readings:

1. S.P. Ghosh and A.K. Chakraborty, *Network Analysis and Synthesis,* McGraw Hill, 1st edition, 2009.
2. Networks, Lines and Fields – JD Ryder, PHI, 2nd Edition, 2009.
3. A.Sudhakar and Shyammohan, *Circuits Networks: Analysis Synthesis*, 4th edition, Tata
4. McGraw-Hill, 2010.
5. 4.Van Valkenburg M.E, *Introduction to Modern Network Synthesis,* Wiley Eastern 2009.

Course Code	Course Title						Core/Elective
U24EC3L1	**Digital Electronics Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives:

After completing this course, the student will be able to

1. Learn basic operation of Logic gates
2. Understand operation of Combinational Circuits
3. Understand Flip-Flops, Shift registers and Counters.

Course Outcomes:

After completing this course, the student will be able to

1. Apply the principles of Boolean algebra to verify the truth tables of basic logic gates and combinational circuits.
2. Design and implement combinational logic circuits such as adders, subtractors, multiplexers, and decoders using basic logic gates.
3. Construct and analyze sequential circuits including flip-flops, shift registers, and counters to understand their timing and functionality.
4. Evaluate the performance and correctness of digital circuits by testing and debugging various combinational and sequential designs.
5. Design and develop optimized digital subsystems such as parallel adders/subtractors and mod-N counters for specific applications.

List of Experiments:

1. To verify truth tables of Logic gates.
2. To implement

   (a) Full Adder using basic logic gates. (b) Full subtractor using basic logic gates.
3. To implement 4-bit Parallel Adder/ subtractor.
4. To implement 4-bit Comparator.
5. To realize (a) 4:1 Multiplexer using gates (b) 3-variable function (8:1 MUX)
6. To realize 1:8 Demux and 3:8 Decoder.
7. To realize the following flip-flops. (a) SR Flip-Flop (b) JK Flip-Flop(C) T Flip -Flop (D) D Flip-Flop
8. To realize the following shift registers (a) SISO (b) SIPO (c)PISO
9. To realize the Ring Counter and Johnson Counter.
10. To realize the Mod-N Counter.

Suggested Readings:

1. M. M. Mano, "*Digital logic and Computer design*", Pearson Education India, 2016.
2. A. Kumar, "*Fundamentals of Digital Circuits*", Prentice Hall India, 2016.

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>Core/Elective</td></tr>
<tr><td>U24EC3L2</td><td colspan="6">Electronic Devices Lab</td><td>Core</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4">Contact Hours per Week</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td>2</td><td>25</td><td>50</td><td>1</td></tr>
</table>

Course Objectives:

After completing this course, the student will be able to

1. Learn the V-I characteristics of diodes and special semiconductor devices.
2. Familiarize the application and performance of various diodes as rectifiers.
3. Comprehend the characteristics of transistor in various configurations.

Course Outcomes:

After completing this course, the student will be able to

1. Demonstrate the characteristic behavior of PN junction diode, Zener diode and special purpose semiconductor diodes.
2. Design various non-linear wave shaping circuits using diodes for a given specification.
3. Analyze the behavior of non-linear wave shaping circuits using diodes.
4. Examine the characteristics of BJT and FET in various configurations.
5. Evaluate and compare the significant parameters obtained from the characteristics of BJT and FET.

List of Experiments

1. To observe and draw the forward and reverse bias V-I Characteristics of PN diodes and measurement of static and dynamic resistances.
2. To plot the V-I characteristics of Zener diode, Zener breakdown voltage, static & dynamic resistance.
3. To study ripple factor and % regulation of half wave rectifiers without filters and with filters (capacitor filter).
4. To study ripple factor and % regulation of full wave rectifiers without filters and with capacitor filters.
5. To study the static characteristics of BJT in Common Base configuration.
6. To plot input and output characteristics of BJT in Common Emitter configuration and find β from the output characteristics.
7. To plot input and output characteristics of BJT in Common Collector configuration.
8. To study the behavior and switching time of a Transistor as a switch.
9. To draw the static characteristics of JFET and to find drain resistance (Rd) and transconductance (Gm).
10. To plot negative resistance region V-I Characteristics of given semi-conductor devices-UJT.

Suggested Readings:

1. Robert Diffenderfer, "*Electronic Devices Systems and Applications*", Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "*Basic Electronics, A Text - Lab Manual*", 7th Edition, TMH 2001.

Course Code	Course Title						Core/Elective
U24EC3L3	**Basic Simulation Lab**						**Core**
Pre-requisite	**Contact hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
--	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives:
After completing this course, the student will be able to:

1. To impart the knowledge to write OCTAVE/ MATLAB codes for the generation of signals.
2. To perform different operations and to verify various transforms for converting time domain signal to frequency domain signal.
3. To develop skills in locating poles and zeros and plotting Pole-Zero maps for system functions in S-plane and Z-plane.

Course Outcomes:
After completing this course, the student will be able to

1. Write OCTAVE/ MATLAB codes for the generation of signals.
2. Apply various transforms on signals to find it's Spectrum using OCTAVE/ MATLAB.
3. Correlate two signals and can remove noise using correlation.
4. Find the response of the system using convolution function in OCTAVE/ MATLAB.
5. Perform sampling of continuous time signals.

List of Experiments:

1. To perform Basic Operation on Matrices.
2. To compute the different Mathematical expressions.
3. To perform generate of Various Signals and Sequences.
4. To perform operation on Signals and Sequences.
5. To find the even and odd parts of Signals/Sequence.
6. To perform convolution for Signals and sequences.
7. To perform auto Correlation and Cross Correlation for Signals and Sequences.
8. To verify Linearity and Time Invariance Properties of a given Continuous/Discrete System.
9. To find the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
10. To locate the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.

Suggested Readings:

1. Jaydeep Chakravarthy, '*Introduction to MATLAB Programming: Toolbox and Simulink*',1/e, University Press,2014.
2. Brian R.Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg ,'*A Guide to MATLAB'*, Cambridge University Press.2008

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY

(UGC Autonomous Institution)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION & EXAMINATIONS [LR-24]

AICTE Model Curriculum (Tentative)

B.E. IV-Semester

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			CREDITS
				L	T	P/D	Contact Hours/Week	Maximum Marks		Duration in Hours	
								CIE	SEE		
Theory Course											
1	U24EC401	PCC	Analog and Digital Communication	3	0	0	3	40	60	3	3
2**	U24EC402	PCC	Analog Circuits	3	0	0	3	40	60	3	3
3	U24EC403	PCC	Control System	3	0	0	3	40	60	3	3
4	U24EC404	PCC	Pulse and Linear Integrated Circuits	3	0	0	3	40	60	3	3
5	U24MB401	HSMC	Business Economics & Financial Analysis	2	0	0	2	40	60	2	2
Practical/ Laboratory Course											
6	U24EC4L1	PCC	Analog and Digital Communication Lab	0	0	2	2	25	50	2	1
7	U24EC4L2	PCC	Analog Circuits Lab	0	0	2	2	25	50	2	1
8	U24EC4L3	PCC	Pulse and Linear Integrated Circuits Lab	0	0	2	2	25	50	2	1
9	U24ME5L3	ESC	Design Thinking Lab	-	-	2	2	25	50	-	1
10	U24EC4P1	PROJ	Micro Project	0	0	4	4	50	-	4	2
Skill Development Course											
11	U24EC4L4	PCC	Embedded C-Programming lab	-	-	3	3	25	50	3	1.5
Total				14	0	15	29	375	550	27	21.5

***** The Students should complete Term Work (TW). TW includes Assignments, Seminars, Micro projects, Industrial Visits and any other student activities.***

L: Lecture *(Hrs/Wk/Sem)* **T**: Tutorial *(Hrs/Wk/Sem)* **P**: Practical / **D**: Drawing *(Hrs/Wk/Sem)*

PCC: Program Core Course **PROJ: Project**

CIE: Continuous Internal Evaluation **SEE: Semester End Examination**

HSMC: Humanities & Social Sciences Including Management Courses

Note:

1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course code	Course title						Core/elective
U24EC401	Analog and Digital Communication						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

After completing this course, the student will be able to

1. Gain ability to analyze requirements of analog and digital communication systems.
2. Acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
3. Understand the various concepts of information theory and generation, detection of various analog and digital modulation techniques.

Course Outcomes

After completing this course, the student will be able to

1. Interpret the knowledge about AM, FM Transmitters and Receivers
2. Analyze and design the various Modulation Techniques.
3. Interpret the concept of information theory and apply source coding schemes.
4. Demonstrate various error control schemes and develop the encoding and decoding techniques to detect and correct the errors.
5. Illustrate the concepts of Digital modulation techniques and base band signal

UNIT-1: Amplitude Modulation: Introduction to communication system, Need for modulation, Amplitude Modulation, Time and frequency domain description, single tone modulation, Generation of AM waves, Detection of AM Waves, Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator, SSB, VSB

UNIT – II: Angle Modulation: Angle Modulation, Frequency Modulation and Phase modulation, Types of FM modulation: Narrow Band FM and Wide Band FM. FM Spectrum in Terms of Bessel Functions. Phasor Diagram of NBFM. Direct and Indirect (Armstrong's) methods of FM Generation. Foster–Seeley Discriminator for FM Detection.

UNIT –III: Transmitters: Classification of Transmitters, AM Transmitters, FM Transmitter, **Receivers:** Radio Receiver - Receiver Types - Tuned radio frequency receiver, Super-hetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver.

UNIT-IV:

Pulse Modulation: Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM with TDM**.**

Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non- Uniform Quantization and Companding, DPCM, DM and Adaptive DM, Noise in PCM and DM.

UNIT–V:

Digital Carrier Modulation Schemes: Optimum receiver for Binary Digital Modulation Schemes, Binary ASK, PSK, DPSK, FSK signaling schemes and their error probabilities. Introduction to MSK, Comparison of Digital Modulation Schemes, QPSK.

Suggested Readings:

1. Simon Haykin, John Wiley -*An introduction to Analog and Digital Communications*, 2nd ed.,2005.
2. Wayne Tomasi -*Electronics Communication Systems: Fundamentals through Advanced*, 5th Edition, 2009, PHI.
3. Herbert Taub, Donald L Schilling, Goutam Saha *Principles of Communication Systems* , 3rd Edition, McGraw-Hill, 2008.
4. Dennis Roddy and John Coolean *Electronic Communications* , 4th Edition, PEA, 2004
5. George Kennedy and Bernard Davis *Electronics & Communication System* , TMH 2022

Course Code	Course Title						Core/Elective
U24EC402	**Analog Circuits**						**Core**
Pre-requisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Electronic Devices	**3**	**0**	**0**	**0**	**40**	**60**	**3**

Course Objectives:
After completing this course, the student will be able to

1. Understand frequency response of Amplifiers in different frequency ranges.
2. Acquire the knowledge of various types of feedback Amplifiers and Oscillators.
3. Attain knowledge of various types of large signal amplifiers and tuned amplifiers.

Course Outcomes:
After completing this course, the student will be able to

1. Design and analyze the Single stage and Multistage RC Coupled amplifiers with BJT.
2. Interpret the effect of negative feedback on shunt and series feedback amplifiers and its stability considerations.
3. Apply the positive feedback to generate sustained oscillations and understand the operation voltage regulators.
4. Distinguish between the classes of Power Amplifiers and their design considerations.
5. Design and analyze the various Tuned Amplifiers with BJT.

UNIT–I
Small Signal Amplifiers: Classification of amplifiers, Mid-frequency, Low-frequency and high frequency analysis of single stage RC Coupled and mid frequency analysis of multistage RC coupled CE amplifier with BJT. Analysis of transformer coupled amplifier in mid frequency.

UNIT–II
Feedback Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances -Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations, Stability Considerations.

UNIT–III
Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators – Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator. Problems.

UNIT–IV
Large Signal Amplifiers: Class A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complementary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB Amplifiers.

UNIT–V
Tuned Amplifiers: General consideration, analysis and design of single tuned and double tuned amplifiers with BJT, selectivity, gain and bandwidth. Comparison of multistage Amplifiers. stability in RF amplifiers.

Suggested Readings:

1. Jacob Millman, Christos C. Halkias, and SatyabrataJit, *Electronic Devices and Circuits*, 3rd ed., McGraw Hill Education, 2010.

2. Robert L. Boylestad , Louis Nashelsky , " *Electronic Devices and Circuit Theory* " 11th Edition. Pearson, 2021.

3. David A. Bell, *Electronic Devices and Circuits*, 5th ed., Oxford University Press, 2009.
4. S Salivahanan, N Kumar, and A Vallavaraj, *Electronic Devices and Circuits*, 2nd ed., McGraw Hill Education, 2007.
5. K. Lal kishore, "*Electronic Circuit Analysis* "2nd Edition BS Publications, 2006

Course code	Course title						Core/Elective
U24EC403	Control Systems						Core
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
Linear Algebra, Laplace Transforms.	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives:

After completing this course, the student will be able to

1. To develop basic skills of utilizing mathematical tools needed to analyze and designclassical linear control systems.
2. To assess the system performance using time and frequency domain analysis and methods for improving it.
3. Acquire the knowledge of stability analysis techniques and develop the state space representation of control systems.

Course Outcomes:

After completing this course, the student will be able to:

1. Understand different mathematical models for any electromechanical LTI systems anddetermine the transfer function of an LTI system using block diagram & signal flow graph.
2. Analyze the given first and second order systems based on their performance parameters&PID controllers.
3. Analyze absolute and relative stability of an LTI system using time domain techniques.
4. Analyze the stability of an LTI system using frequency domain techniques and understandthe concepts of compensators.
5 Develop various state space models for LTI systems and to determine its Controllability and Observability.

UNIT-I

Introduction to Control Systems: Classification of control systems, Feed-Back Characteristics, Effects of feedback, Mathematical modeling of Electrical and Mechanical systems, Transfer function, Transfer function of Potentiometer, Synchro, AC Servo motor, DC Servo motor, Block diagram reduction techniques, Signal flow graph, Mason's gain formula.

UNIT-II

Time Domain Analysis: Standard test signals, Time response of first order systems, Transient response of second order system for unit step input, Time domain specifications, Steady state response, Steady state errors and error constants, Effects of P, PD, PI and PID controllers.

UNIT-III

Stability Analysis in S-Domain: The concept of stability, Routh's stability Criterion, Absolute stability and relative stability, Limitations of Routh's stability.

Root Locus Technique: The root locus concept, Construction of root loci, Effects of adding poles and zeros on the root loci.

UNIT-IV

Frequency Response Analysis: Introduction to frequency response, Frequency domain specifications, Bodeplot, Stability analysis from Bode plots, Determination of transfer function from the Bode Diagram, Polar Plots, Nyquist Plots, Stability Analysis, Gain margin and phase margin. Concept of Lag, Lead and Lag-Lead Compensators

UNIT-V

State Space Analysis: Concepts of state, State variables and state model, Derivation of state models of linear time invariant systems, State transition matrix, Solution of state equation, Concepts of Controllability and Observability. Discrete-time systems, Difference Equations, State-space models of linear discrete-time systems.

Suggested Readings:

1. I.J. Nagrath, M. Gopal *Control System Engineering*, New Age International (P) Ltd. Publishers, 5thEdition, 2017.
2. A. Anand Kumar, *Control Systems*, 2nd Edition, PHI publications, 2014.
3. B.C. Kuo,*Automatic Control Systems*, John Wiley and son's Publishers, 9th edition, 2009.
4. K. Ogata,*Modern Control Systems*, 5th Edition. PHI publication, 2010.
5. N.C Jagan, *Control Systems*, 2nd Edition, BS Publications, 2008.

Course Code	Course Title						Core/Elective
U24EC404	**Pulse and Linear Integrated Circuits**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Electronics Devices	**3**	**0**	**0**	**0**	**40**	**60**	**3**

Course Objectives

After completing this course, the student will be able to

1. Learn the behaviour of Wave Shaping Circuits
2. Analyse and Designing of Multivibrators
3. Understand the Functionality & applications of OP-AMPs.

Course Outcomes

After completing this course, the student will be able to

1. Construct different linear networks and analyse their response to different input signals
2. Analyse and Design Multivibrators and Sweep Circuits using Transistors
3. To understand the basic concepts of Operational Amplifier and Differential Amplifier.
4. Develop skills to design simple circuits using OP-AMP and simple filter circuits.
5. Learn about various techniques to develop A/D and D/A converters

UNIT-I

Wave Shaping circuits: High pass, low pass RC circuits, their responses for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and Integrator, Diode clippers, Transistor clippers ,Clipping at two independent levels, Clamping operation, Clamping circuit theorem.

UNIT-II

Multivibrators & Time Base Generators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors. General features of a time base signal, methods of generating voltage time base waveform.

UNIT-III

Operational amplifiers: Differential Amplifier-Configurations and Modes of Operations Constant Current Bias, Current Mirror. OP-AMP Block diagram, Ideal OP-AMP characteristics, OP-AMP and its features, OP-AMP Parameters and Measurements, Input and Output Offset voltages and currents, Slew rate, CMRR, PSRR.

UNIT-IV

OPAMP Applications: Inverting and Non-Inverting Amplifiers, Integrator and Differentiator, Summing Amplifier, Precision Rectifier, Voltage to Current Converter and Current to Voltage Converter, Logarithmic amplifier , Antilogarithmic amplifier.

Active filters: Low pass, High pass, Band pass and Band stop

UNIT-V

Data Converters: Digital-to-Analog Converters (DAC): Weighted Resistor, R-2R ladder and Inverted R-2R ladder.Analog-to-Digital Converters (ADC): Flash, Dual Slope, Successive Approximation, DAC/ADC Specifications.

Suggested Readings:

1. J. Millman and H. Taub. *"Pulse, Digital and Switching Waveforms*" McGraw-Hill 1991
2. D. Roy Choudhry, Shail Jain, "*Linear Integrated Circuits*", New Age International Pvt. Ltd., 2000
3. Ramakant A. Gayakwad *Op-Amps and Linear Integrated Circuits*, 3rd Edition.
4. A. Anand Kumar, " *Pulse And Digital Circuits*" Second Edition, PHI Learning Pvt. Ltd., 12-Feb-2008
5. Denton J. Daibey, *Operational Amplifiers & Linear Integrated Circuits: Theory & Applications*, TMH

Course Code	Course Title						Core/Elective
U24EC4L1	**Communication Lab**						**Core**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**		**2**	**25**	**50**	**1**

Course Objective:

After completing this course, the student will be able to

1. To Understand AM, FM, PAM, PWM and multiplexing techniques.
2. To analyze the digital modulation (i.e. ASK, FSK, QPSK) generation.
3. To understand the pulse modulation, PCM, Delta and Digital modulation techniques

Course Outcomes:

After completing this course, the student will be able to

1. Demonstrate and simulate modulation and demodulation of AM and FM.
2. Construct the need for pre-emphasis and de-emphasis at the transmitter and receiver respectively.
3. Demonstrate the generation of PAM, PWM circuits.
4. Determine the generation and detection of baseband transmission PCM, DM, and ADM
5. Generate of ASK, FSK, DPSK and QPSK

List of Experiments:

1. To study and analyze analog modulation and demodulation techniques.
2. To understand the process of frequency modulation and demodulation.
3. To study the effect of pre-emphasis and de-emphasis in communication systems.
4. To implement and analyze time division multiplexing and demultiplexing.
5. To perform and observe PAM and PWM modulation and demodulation techniques**.**
6. To study pulse code modulation and demodulation process.
7. To understand adaptive delta modulation and demodulation.
8. To implement and analyze ASK and FSK modulation and demodulation.
9. To study and analyze DPSK modulation and demodulation techniques.
10. To understand QPSK modulation and demodulation process.

Suggested Readings:

1. Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, Basic Electronics, A text–Lab Manual*, 7th Edition, TMH 2001.

2. D. Krishna Reddy,*Communication Systems Laboratory Manual*, 2nd Edition, Scitech Publications,2020.

Course Code	Course Title					Core/ Elective
U24EC4L2	**Analog Circuits Lab**					**Core**
Pre-Requisites	Contact Hours per Week			CIE	SEE	Credits
	L	T	P/D			
Electronic Devices	**0**	**0**	**2**	**25**	**50**	**1**

Course Objectives

After completing this course, the student will be able to

1. Acquire the knowledge and analyze two stage RC coupled BJT amplifiers.
2. Learn the various types of feedback amplifiers and oscillators.
3. Understand RF tuned amplifier and various power amplifiers.

Course Outcomes

After completing this course, the student will be able to

1. Evaluate gain and bandwidth of BJT Amplifiers.
2. Design and implement Input and Output impedance of Feedback amplifiers.
3. Determine the frequency of oscillator circuits.
4. Demonstrate the efficiency of Power amplifiers.
5. Determine the frequency response of RF amplifiers.

List of Experiments:

1. To obtain the voltage gain for Two Stage RC Coupled CE BJT amplifier and draw the frequency response curve.
2. To study the effect of Voltage Series feedback on Gain of the amplifier.
3. To obtain the frequency response characteristics of Voltage Shunt amplifier with and without feedback and calculate its bandwidth.
4. To calculate the input impedance, output Impedance and voltage gain of Current series amplifier with and without feedback
5. To calculate the frequency of RC Phase Shift Oscillator and to measure the phase angles of different RC sections.
6. To study and calculate the frequency of oscillations of Hartley Oscillator & Colpitts Oscillator. Compare the obtained frequency with theoretical frequency.
7. To observe the input and output waveforms of Class A Power amplifier and measure its Gain and frequency. Also calculate its efficiency.
8. To observe the input and output waveforms of Class B Power amplifier and measure its Gain and frequency. Also calculate its efficiency.
9. To study RF Tuned Amplifier and calculate its Gain and Bandwidth.
10. Using Simulator perform any two experiments.

Suggested Readings:

1. Donald A. Neamen, *Electronic Circuits- Analysis and Design,* 3rdEdition,McGraw Hill Education,2007.

2. Robert L.Boylested, Louis Nashelsky, *Electronic Devices and Circuit theory*, 11thEdition, Pearson Education,2012.

Course Code	Course Title	Core/Elective
U24EC4L3	**Pulse and Linear Integrated Circuits Lab**	**Core**

Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ED Lab	**-**	**-**	**-**	**2**	**25**	**50**	**2**

Course Objectives

After completing this course, the student will be able to

1. Implement high pass and low pass circuit, clipping and clamping circuits and study it's performance
2. Understand operational concepts of Bistable, Monostable and Astable Multivibrators.
3. Study the applications of Op-Amps and build circuits using Op-Amp and study it's performance

Course Outcomes

After completing this course, the student will be able to

1. Design and analyse linear and non-linear wave shaping circuits.
2. Design and analyse clipping and clamping circuits
3. Design and analyse multivibrator circuits and Sweep circuits.
4. Design and analyse Schmitt trigger circuit.
5. Design and analyse Inverting and Non-inverting OPAMP

List of Experiments:

1. To study the Low Pass and High Pass RC Circuits at different RC time constant and find the rise time.
2. To design clipper circuit and understand the Clipping Circuit.
3. To design clamper circuit and understand the Clamping Circuit.
4. To design a Collector Coupled Bistable Multivibrators and its output waveform.
5. To design a Collector Coupled Monstable Multivibrators and its output waveform.
6. To design a Collector Coupled Astable Multivibrators and its output waveform.
7. To study the operation and output characteristics of the Schmitt Trigger Circuit.
8. To Measure the OP-AMP Parameters
9. To design Inverting and Non-inverting OP-AMP Voltage follower.
10. To design and verify the function of Integrator and Differentiator using OPAMP.
11.

Suggested Readings:

1. Robert Boylestad and Louis Nashelsky. *Electronic Devices and Circuit Theory* :5th Edition Prentice-Hall of India Private Limited. New Delhi. 1995.
2. David A. Bell. *Laboratory Manual for Electronic Devices and Circuits* 4th Edition. Prentice-Hall of India Private Limited. New Delhi. 2004.

Course Code	Course Title						-
U24EC4P1	**Micro Project**						**Project**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**4**	**50**	**-**	**2**

Course Objectives:

After completing this course, the student will be able to

1. To familiarize tools and techniques of systematic literature survey and documentation.
2. To expose the students to industry practices and team work.
3. To encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes:

After completing this course, the student will be able to

1. Identify and define a problem statement from the requirements raised from literature survey /need analysis
2. Build and Test electronic circuits/prototype for developing real life small electronic applications.
3. Work in teams, write comprehensive report and effective presentation of the project work
4. Rapid prototyping which will lead them towards entrepreneurship.
5. Make students evaluate different solutions based on technical feasibility.

The department will appoint a project coordinator who will coordinate the following:

1. Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)

1. Grouping of students (max 3 in a group)
2. Allotment of project guides

Guidelines:

The micro-project is a team activity having 3-4 students in a team. This is electronic circuit building and testing for developing real life small electronic applications. The micro project may be a complete hardware or hardware with small programming aspect. It should encompass electronics components, devices, analog or digital ICs, micro controller etc. Micro Project should cater to a small system required in laboratory or real-life application. Based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of Micro-project.

Each group will be required to:
1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 20 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.
At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.
The seminar presentation should include the following components of the project:
1. Problem definition and specification
2. Literature survey
3. Broad knowledge of available techniques to solve a particular problem.
4. Planning of the work, preparation of bar (activity) charts

5. Presentation- oral and written.

Course Code	Course Title						Core/Elective
U24EC4L4	Embedded-C Programming Lab						Core
Pre-requisite	Contact Hours per Week				CIE	SEE	Credits
Microprocessors and Microcontrollers	**L**	**T**	**D**	**P**			
	-	-	-	4	50	50	2

Course Objectives:

After completing this course, the student will be able to

1. Familiarize with the usage of IDE tools and execution of programs using Microcontroller.
2. Know about the usage of various devices like LCD, Temperature sensor, Buzzer,
3. Acquire the knowledge about the usage of Stepper Motor by interfacing them to Microcontroller.

Course Outcomes:

After completing this course, the student will be able to

1. Illustrate the usage of IDE tools and programming
2. Implement use various on chip like LCD, Temperature sensor, Buzzer using Microcontroller.
3. Analyze the devices like DC Motor by interfacing them to Microcontroller
4. Design the digital logic circuits in various modeling styles using Embedded C.
5. Implement basic gates at transistor level.

List of Experiments:

Interfacing Programs using Embedded C on ARM Microcontroller Kit/Keil IDE/Proteus Simulator.

1. Program to implement logic gates by interfacing of Switch LED with AT89C52.
2. Program to interface 8-Bit LED and switch interface
3. Program to implement PORT toggling with delay.
4. Program to display message in a 2line x16 characters LCD display.
5. Program to interface DC motor.
6. Program to interface LM35.
7. Program to interface 7-Segment LED.
8. Program to interface Buzzer.
9. Program to produce show the Time delay.
10. Transmission from kit and reception from PC using serial port.

Suggested Readings:

1. Kenneth J. Ayala – *The 8051 Microcontroller*, 3rd Edition, Cengage Learning ISBN: 978-1401861582
2. Subrata Ghoshal – *8051 Microcontroller: Internals, Instructions, Programming & Interfacing*, Pearson ISBN: 978-8131703104