LORDS INSTITUTE OF ENGINEERING & TECHNOLOGY

(Autonomous)

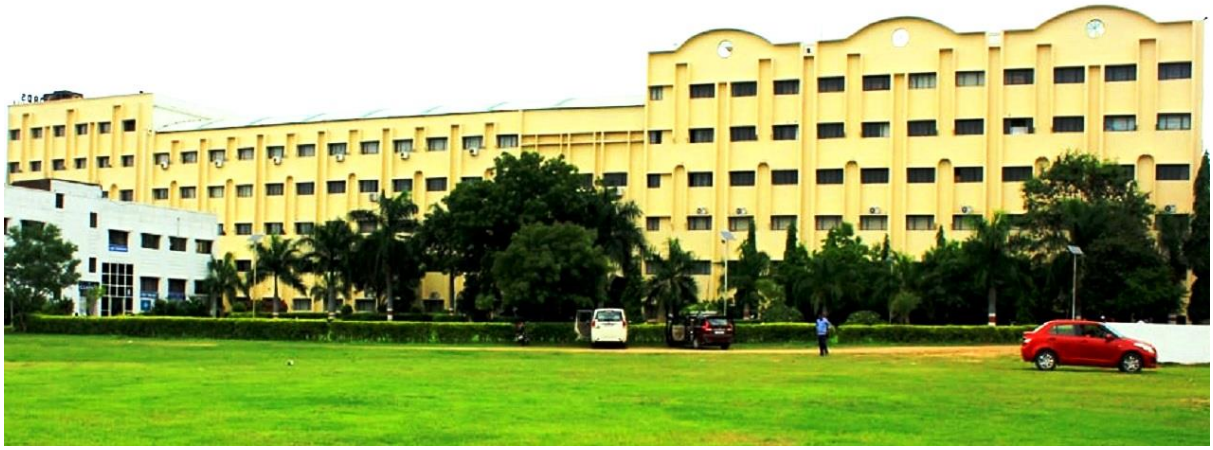
Approved by AICTE | Recognized by Government of Telangana | Affiliated to Osmania University

Accredited by NBA | Accredited with 'A' grade by NAAC | Accredited by NABL

Four Year Course Structure and First Year Syllabus

Department of Electronics and Communication Engineering

(With effect from the Academic Year 2024-25)



Sy. No:32, Himayat Sagar, Near TSPA Junction, Hyderabad-500 091, Telangana, India.
Ph: +91 6309012442/46, Fax: +91 40-6625 3642,
Website: www.lords.ac.in, Email: principal@lords.ac.in

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATIONS [LR-24]
AICTE Model Curriculum
B.E. V-Semester (2026-2027)

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	U24EC501	PCC	Electromagnetic Theory and Transmission Lines	3	0	0	3	40	60	3	3
2	U24EC502	PCC	Microprocessors & Microcontrollers	3	0	0	3	40	60	3	3
3**	U24EC503	PCC	Digital Signal Processing	3	0	0	3	40	60	3	3
4	U24EC504	PCC	Electronic Measurement and Instrumentation	3	0	0	3	40	60	3	3
5	--	PEC	Professional Elective – I	3	0	0	3	40	60	3	3
Practical/ Laboratory Course											
6	U24EC5L1	PCC	Microprocessors & Microcontrollers Lab	0	0	2	2	25	50	2	1
7	U24EC5L2	PCC	Digital Signal Processing Lab	0	0	2	2	25	50	2	1
Skill Development Course											
8	U24MA5L1	BSC	Aptitude and Reasoning	-	-	4	4	50	50	4	2
9	U24EC5P1	PROJ	Summer Internship (During Summer Vacations after IV Sem)	-	-	-	-	50	-	-	1
Total				**15**	**0**	**8**	**23**	**350**	**450**	**23**	**20**

** ***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

PCC: Program Core Course **PEC**: Professional Electives **BSC**: Basic Science Course

OEC: Open Electives

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
U24EC501	ELECTROMAGNETIC THEORY AND TRANSMISSION LINES						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Physics	3	0	0	0	40	60	3

Course Objectives:

The objectives of this course is to

1. Explain the principles of vector analysis, electrostatics, magnetostatics and Maxwell's equations.
2. Apply electromagnetic wave equations to analyze wave propagation in conducting and dielectric media.
3. Analyze transmission line characteristics, Smith Chart applications, and impedance matching techniques for RF systems.

Course Outcomes:

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

1. Explain the concepts of vector calculus, electrostatics, and capacitance calculations.
2. Apply magnetostatic laws to determine magnetic field intensity, inductance, and boundary conditions
3. Analyze electromagnetic field behavior using Maxwell's equations and boundary conditions.
4. Analyze transmission line parameters and characteristics for different transmission media..
5. Evaluate impedance matching techniques using Smith Charts and stub matching methods

UNIT I

Electrostatics:

Review of Coordinate Systems, Vector Calculus, Coulomb's Law, Electric Field Intensity –Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Poisson's and Laplace's Equations, Illustrative Problems.

UNIT II

Magneto statics:

Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields , Faraday's Law.

UNIT III

Electromagnetic Wave

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves Equation, Wave Propagation in Lossless and Conducting Media. Conductors & Dielectrics Characterization, Wave Propagation in Good Conductors and Good Dielectrics. Polarization. Reflection and Refraction of Plane Waves Normal and Oblique Incidences, Poynting Vector and Poynting Theorem,

UNIT IV

Transmission Lines - I:

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation, Attenuation and Phase Constant, Infinite Line Concepts, Losslessness Transmission line, Distortion less, Types of Loading.

UNIT V

Transmission Lines-II:

Input Impedance of loss less transmission line, SC and OC Lines, Reflection Coefficient, VSWR. Lines of Different length λ/8, λ/4, λ/2, Lines – Impedance matching devices. Significance of Z min and Z max , Smith Chart Configuration and Applications, Single and Double Stub Matching.

Suggested Readings

1. Umesh Sinha,Stya -*Transmission Lines and Networks*- Prakashan,2001(Tech India publications),New Delhi
2. G.S.N Raju -*Electromagnetic field theory* and Transmission lines, Pearson Edition 2005.
3. Matthew N.O. Sadiku -*Elements of Electromagnetic*, Oxford Univ. Press, 4th ed., 2008.
4. E.C. Jordan and K.G. Balmain ,Electromagnetic Waves and Radiating Systems, PHI, 2nd Edition, 2000.
5. John D. Ryder ,*Networks, Lines and Fields*, PHI, 2nd ed.,1999.

Course Code	Course Title						Core / Elective
U24EC502	MICROPROCESSORS AND MICROCONTROLLERS						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Digital Electronics	L	T	D	P			
	3	0	0	0	40	60	3

Course Objectives:

The objectives of this course is to

1. Comprehend the architecture of microprocessors.
2. Familiarize the basic concept and architecture of microcontrollers.
3. Provide the knowledge about interfacing techniques of bus & memory and serial communication techniques.

Course Outcomes:

On completion of this course, students are able to:

1. Illustrate the internal architecture, organization and assembly language programming of 8086processors.
2. Demonstrate the internal architecture, organization and assembly language programming of 8051controllers.
3. Implement the interfacing techniques to 8051 based systems.
4. Apply the Serial Communication and Bus Interface concept.
5. Interpret the internal architecture of ARM processors and basic concepts of ARM processors.

UNIT-I:

8086Architecture: Introduction to Microprocessors, Functional diagram, Register Organization, Memory Segmentation, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Simple Programs involving Logical, Branch Instructions, Sorting, and String Manipulations.

UNIT-II

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instructionsetof8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming 8051TimersandCounters

UNIT–III

I/O And Memory Interface: LCD, Seven Segment Display, Keyboard, External Memory RAM, ROM Interface, ADC, DACInterface to 8051.

UNIT–IV

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

UNIT–V

ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set–Data processing, Branch instructions load store instructions, Program status register instructions

Suggested Readings:

1. A.K. Rayand K.M. Bhurchandani -*Advanced Microprocessors and Peripherals*, TMH, 2nd Edition 2006.
2. K. UmaRao, Andhe Pallavi-*The 8051Microcontrollers, Architecture and Programming and Applications*, Pearson, 2009.
3. Andrew NSLOSS, Dominic SYMES -*ARM System Developers guide*, Chris WRIGHT, Elsevier, 2012
4. Kenneth. J.Ayala, Cengage -*The 8051 Microcontroller*, Learning, 3rd Ed, 2004.
5. D.V. Hall -Microprocessors and Interfacing, TMGH, 2nd Edition2006.

Course Code	Course Title						Core/Elective
U24EC503	DIGITAL SIGNAL PROCESSING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Signals & System	3	0	0	0	40	60	3

Course Objectives:

The objectives of this course is to

1. Elaborate the fast computation of DFT and appreciate the FFT processing.
2. Realise the designs and structures of digital (IIR and FIR) filters and analyze for a given specifications.
3. Acquaint in Multi-rate signal processing techniques and finite word length effects.

Course Outcomes:

On completion of this course, students are able to

1. Evaluate the DFT &FFT for given sequence reducing computational complexity of DFT.
2. Analyze the performance characteristics of digital filters using various transformation techniques.
3. Design the digital filters and their realization.
4. Apply different sampling rates using interpolation and decimation.
5. Compare the Architecture of DSP processor with Microprocessors.

UNIT– I

Introduction to DFT & FFT : Discrete Fourier transform (DFT) definition; Properties of DFT; Linear and circular convolution using DFT; **Fast-Fourier-transform (FFT):** Direct computation of DFT; Need for efficient computation of the DFT (FFT algorithms); Radix-2 FFT algorithm for the computation of DFT and IDFT using decimation-in-time and decimation-in-frequency algorithms.

UNIT-II

Finite impulse-response Filters (FIR) : Characteristics of FIR Digital Filters, Linear phase filters, Windowing techniques for design of Linear phase FIR filters- Rectangular, Triangular or Bartlett, Hamming, Hanning, Comparison between FIR and IIR

UNIT-III

Infinite Impulse- response Filters (IIR): Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters-Impulse Invariant Techniques, Bilinear Transformation **Method.**

UNIT–IV

Realization of Filters: Realization IIR and FIR filters using direct form-I and direct form-II .Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters.

Multi rate Digital Signal Processing: Introduction-Decimation by factor D and interpolation by a factor I- Sampling Rate conversion by a Rational factor I/D, Applications of multi rate DSP.

UNIT-V

Introduction to DSP Processors: Difference between DSP and the microprocessors architecture-their comparison and need for ASP, RISC and CPU- general Purpose DSP processors: TMS 320C67XX processors, architecture, addressing modes-instruction set.

Suggested Readings:

1. Dr. P. Ramesh Babu ,*Digital Signal Processing*,4th Edition Revised version,Scitech Publications,2017.
2. Dr. S. Salivahanan -*Digital Signal Processing*, 4th Edition, McGraw Hill Education,2019.
3. Alan V. Oppenheim and Ronald W. Schafer -*Digital Signal Processing*,2/e,PHI,2010.
4. John G. Praokis and Dimtris G. Melonakos -*Digital Signal Processing: Principles, Algorithms and Application*. 4/e, PHI, 2007.
5. Richard GLyons ,*Understanding Digital Signal Processing* , 3/e, Prentice Hall.

Course Code	Course Title						Core / Elective
U24EC504	ELECTRONIC MEASUREMENT AND INSTRUMENTATION						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Electronic Devicesand Circuits	3	0	0	0	40	60	3

Course Objectives:

The objectives of this course is to impart knowledge of

1. Understand the different standards of measurements.
2. Study different types of transducers, sensors and their measuring techniques.
3. Learn about various types of biomedical instrumentation equipment.

Course Outcomes:

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

1. Describe characteristic of an instrument and state different Standards of measurements
2. Identify and explain different types of Transducers
3. Draw and Interpret types of transducers.
4. Design and analyse the digital voltmeters and prioritize the instruments.
5. Identify and classify types of biomedical instruments.

UNIT-I

Electronic Measurement Fundamentals: Accuracy, Precision, Resolution and Sensitivity. Errors and their types. Standards of measurement, classification of standards, IEEE standards.

UNIT-II

Transducers: Classification, factors for selection of a transducer, transducers for measurement of velocity, acceleration. Passive electrical transducers- Strain gauges and strain measurement, LVDT and displacement measurement, capacitive transducer and thickness measurement. Active electrical transducers: Piezo electric, photo conductive, photo voltaic and photo emissive transducers

UNIT-III

Electronic Sensors: Characteristics of sound, pressure, power and loudness measurement. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermo couples.

UNIT-IV

Measuring instruments: Block diagram, specification and design considerations of different types of DVMs. Spectrum analysers. The IEEE488 or GPIB Interface and protocol. Delayed time base oscilloscope and Digital storage oscilloscope. Introduction to virtual instrumentation, SCADA. Data acquisition system block diagram.

UNIT-V

Biomedical Instrumentation: Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders – ECG, EEG, EMG, X- ray machines and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems.

Suggested Readings:

1. A.K. Shawney, Dhanpat Rai & Co. Jan, 2021.
2. H. S. Kalsi ,*Electronic Instrumentation*:– TMH, 2nd Edition 2004.
3. A.D. Helbincs, W. D.Cooper ,*Modern Electronic Instrumentation and Measurement Techniques*, PHI 5th Edition 2003.
4. David A. Bell ,*Electronic Instrumentation and Measurements* , Oxford Univ. Press, 1997.
5. Khandpur. R.S., "*Handbook of Bio- Medical Instrumentation*", TMH, 2003.

Course Code	Course Title						Core / Elective
U24EC5L1	MICROPROCESSORS AND MICROCONTROLLERS LAB						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Digital Electronics	0	0	0	3	25	50	1.5

Course Objectives:

The objectives of this course is to

1. Familiarize the architecture of microprocessors and microcontrollers.
2. Illustrate the knowledge about interfacing techniques of bus & memory.
3. Realize the concepts of 8051 & LPC2148 architecture.

Course Outcomes:

On completion of this course, students are able to:

1. Summarize the internal architecture, organization and assembly language programming of 8086 processors.
2. Verify the internal architecture of 8051.
3. Interpret the organization and assembly language programming of 8051controllers.
4. Demonstrate the interfacing techniques to 8086.
5. Utilize the interfacing techniques to 8051 & LPC2148.

List of Experiments -

1. Assembly Language Programs to Perform Arithmetic, Logical, on 8 Bit and 16-BitData using 8086 Processor Kits or Assembler.
2. Assembly Language Programs to Perform String Operations on 8 Bit and 16-Bit Data using 8086 Processor Kits or Assembler.
3. Assembly Language Programs to Perform Bit level Swap and Branch Operations using 8086 Processor Kits or Assembler.
4. Assembly Language Programs to Perform Arithmetic, Data Operations on 16bit Data using 8051 Microcontroller Keil IDE
5. Assembly Language Programs to Perform Logical Operations, Rotate, and Swap Instructions using 8051 Microcontroller Keil IDE.
6. Assembly Language Programs to Perform Branch Instructions using 8051 Microcontroller Keil IDE.
7. Time delay Generation Using Timers of 8051 using 8051 Microcontroller Keil IDE.
8. Perform Interfacing of 7 Segment Display to 8051.
9. Perform Interfacing of LCD Display using LPC2148
10. Perform Interfacing of Buzzer using LPC2148

Note - Perform all the programs using MASM/MSDOSBOX/KEIL/Equivalent Software

Course Code	Course Title						Core/Elective
U24EC5L2	DIGITAL SIGNAL PROCESSING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Basic Simulation Lab	L	T	D	P			
	0	0	0	3	25	50	1.5

Course Objectives:

The objectives of this course is to

1. Familiarize the concepts and algorithms of DFT, IDFT, FFT, and IFFT.
2. Design and analyze FIR and IIR filters for given system specifications.
3. Evaluate multirate signal processing techniques and implement digital filters on DSP platforms.

Course Outcomes:

On completion of this course, students are able to:

1. Explain the concepts of Fourier transforms, convolution, and digital filtering.
2. Implement DFT, FFT, linear convolution, and circular convolution for discrete-time signal processing.
3. Design FIR and IIR filters using windowing and approximation methods.
4. Analyze decimation, interpolation, and sampling rate conversion techniques in multirate systems.
5. Evaluate signal properties through power spectrum analysis using DSP tools.

List of Experiments -

1. To Perform DFT and FFT algorithm.
2. To Perform Linear convolution.
3. To Perform Circular Convolutions.
4. To Perform FIR filters design using different window functions.
5. To Perform IIR filters design using Butterworth.
6. To Perform IIR filters design using Chebyshev.
7. To Perform Decimation process.
8. To Perform Interpolation process.
9. To Determine Perform Power Spectrum of a given signal
10. To implement sampling rate conversion.

Note - Perform all the programs using SCI LAB Simulator/Equivalent Software

Course Code	Course Title						Core / Elective
U24EC5P1	SUMMER INTERNSHIP						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	-	50	-	1

Course Objectives:

The objective of the course is to:

1. Provide exposure to industrial work environments and professional practices.
2. Apply engineering knowledge and technical skills to solve real-world problem.
3. Develop teamwork, technical documentation, and presentation skills through internship projects.

Course Outcomes :

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

1. Explain the work environment, safety procedures, and project objectives of the internship organization
2. Apply technical and research skills to plan and execute assigned internship tasks.
3. Analyze project requirements, technical data, and outcomes using appropriate engineering methods.
4. Evaluate project results and recommend suitable solutions for practical engineering problems.
5. Develop professional technical reports and deliver effective presentations on internship work.

Guidelines:

Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organizations /Computer Industry/Software Companies/R&D Organization for a period of 4 weeks. This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co- ordinate (person from industry). The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship

1. Overview of company/project
2. Safety training
3. Discussions with project teams
4. Background research, review of documents, white papers, and scientific papers
5. Planning, designing, and reviewing the planned work
6. Executing the plans
7. Documenting progress, experiments, and other technical documentation
8. Further team discussions to discuss results
9. Final report writing and presentation.

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and

2. Present the work through a seminar talk (to be organized by the Department)

Note: Students have to undergo summer internship of 4 weeks at the end of semester IV and credits will be awarded after evaluation in V semester.

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATIONS [LR-24]
AICTE Model Curriculum
B.E. VI-Semester (2026-2027)

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	U24EC601	PCC	Antennas and Wave Propagation	3	0	0	3	40	60	3	3
2	U24EC602	PCC	VLSI Design	3	0	0	3	40	60	3	3
3	U24EC603	PCC	Embedded Systems	2	0	0	2	40	60	2	2
5	--	PEC	Professional Elective – II	3	0	0	3	40	60	3	3
6	--	OEC	Open Elective – I	3	0	0	3	40	60	3	3
Practical/ Laboratory Course											
7	U24EC6L1	PCC	Embedded Systems and IOT lab	0	0	2	2	25	50	2	1
8	U24EC6L2	PCC	ECAD Lab	0	0	2	2	25	50	2	1
9	U24EC6P1	PROJ	Mini Project	0	0	6	6	50	50	6	3
Total				**15**	**0**	**12**	**27**	**300**	**450**	**27**	**21**

** ***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
PCC: Program Core Course
PEC: Professional Electives
PROJ: Project Work

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
U24EC601	ANTENNAS AND WAVE PROPAGATION						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Electromagnetic Waves &Transmission Lines	3	0	0	0	40	60	3

Course Objectives:

The objectives of this course is to

1. Illustrate the basic principles of antennas and antenna parameters.
2. Elaborate the operation and characteristics of various antennas and antenna arrays.
3. Demonstrate the different modes of radio wave propagation and their applications.

Course Outcomes:

On completion of this course, students are able to:

1. Explain the basic principles, terminology, and parameters of antennas.
2. Explain the various modes of radio wave propagation and their applications.
3. Apply design principles to analyze wire antennas and their performance characteristics.
4. Analyze the characteristics of non-resonant antennas and smart antennas for different frequency ranges.
5. Evaluate antenna arrays and antenna measurement techniques to determine antenna performance parameters.

UNIT–I

Antenna Fundamentals: Introduction, principle of radiation, radiation pattern, beam area, radiation intensity, beam efficiency, directivity, gain, resolution, antenna apertures, effective length and effective area, Friis transmission equation, fields from oscillating dipole, antenna field zones, antenna polarization, front–to-back ratio, antenna theorems and parameters.

UNIT– II

Thin Linear Wire Antennas: Introduction, current distributions, half-wave dipole and quarter wave monopole, helical antennas-types, helical geometry, helix modes-characteristics of monofilar helical antenna radiating in normal and axial mode,

UNIT-III

Non-Resonant Antennas: Comparison between resonant and non-resonant antennas, Rhombic Antenna, Yagi-Uda Antenna, Folded dipole antennas. Horn antenna: Radiation from Horns and design considerations, Reflector antenna: Parabolic Reflector and Cassegrain Antennas, Micro Strip Antennas-Basic characteristics, Design of Rectangular Patch Antennas

UNIT-IV

Antenna Arrays: Array of point sources, the two-element array with equal and unequal amplitudes, different phases, the linear n-element array with uniform distribution, Broadside, and End fire arrays, Principle of Pattern Multiplication, Binomial array.

Antenna Measurements: Introduction, Basic Concepts-Source of Errors, Measurement setup directional patterns, gain, VSWR (absolute and comparison methods)

UNIT-V

Wave Propagation: Ground, Space and Surface waves, Troposphere refraction and reflection, Duct propagation, Sky wave propagation, Regular and irregular variations in ionosphere Line of sight propagation.

Suggested Readings

1. K D Prasad -*Antenna and wave propagation* , 2nd edition, Satya Prakashan, 2007
2. J. D. Kraus, R. J. Marhefka, and Ahmad S. Khan -*Antennas and Wave Propagation*, McGraw-Hill, 4th Edition, 2010.
3. A. Balanis -*Antenna Theory: Analysis and Design, Constantine*, 3rd Edition, John Wiley, 2005.
4. Edward C. Jordan and Keith G. Balmain -*Electromagnetic Waves and Radiating Systems*, 2nd Edition, PHI, 1968.
5. Robert E. Collin -*Antennas and Radiowave Propagation*, McGraw-Hill, 1985.

Course Code	Course Title						Core/Elective
U24EC602	VLSI DESIGN						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Electronic Circuit Analysis &Pulse and Linear ICs	3	0	0	0	40	60	3

Course Objective:

The objectives of this course is to impart knowledge of

1. To learn the basics of IC fabrication and MOS/ BiCMOS devices.
2. To understand CMOS design rules and layout of logic circuits.
3. To design simple digital circuits and learn programmable logic devices and CMOS testing.

Course Outcomes:

On completion of this course, students are able to:

1. Explain the IC fabrication process and MOS transistor characteristics.
2. Explain faults and testing concepts in digital systems.
3. Analyze logic circuit layouts and parasitic effects
4. Analyze the operation of dynamic CMOS, pseudo-NMOS, SRAM, and DRAM circuits.
5. Design digital building blocks and programmable logic circuits using PLA, PAL, FPGA, and CPLD.

UNIT-I

Introduction: Introduction to IC Technology and Fabrication – MOS, PMOS, NMOS, CMOS & Bi- CMOS. Basic Electrical Properties: Electrical Characteristics of MOSFETs, Threshold voltage, NMOS-FET Current Voltage equations, trans-conductance and drain characteristics of MOS-FET, RC model of a FET, MOS capacitances, gate-source and gate- drain capacitances, Latch-up and its prevention, scaling concept of MOSFETs.

UNIT-II

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling,Crosstalk.

UNIT-III

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

UNIT –IV

Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters. Array Subsystems: SRAM, DRAM, ROM.

UNIT – V

Programmable Logic Devices: Design Approach – PLA, PAL, Standard Cells FPGAs, and CPLDs, Floor planning and routing. CMOS Testing: CMOS Testing, Test Principles, Design Strategies for test,Chip level Test Techniques

.

Suggested Readings:

1. Kamran Eshraghian, Eshraghian Dougles and A.Pucknell, *Essentials of VLSI circuits and systems* –PHI, New Edition.
2. K. Lal Kishore -*VLSI Design*, V. S. V. Prabhakar, I.K International, 2009.
3. John. P. Uyemura -*CMOS logic circuit Design* , Springer, 2007.
4. Wayne Wolf -*Modern VLSI Design* , Pearson Education, 3rd Edition, 1997.
5. Neil H. E Weste, David Harris, Ayan Banerjee -*CMOS VLSI Design – A Circuits and Systems Perspective*, , 3rd Ed, Pearson, 2009.

Course Code	Course Title						Core/Elective
U24EC603	Embedded Systems						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Microprocessors and Microcontrollers	3	0	0	0	40	60	3

Course Objectives:

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

1. To understand the architecture of 8051 microcontrollers.
2. To understand the various applications of Embedded Systems using the concepts of Interfacing.
3. To familiarize with the design principles of SOC.

Course Outcomes:

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

1. Study and analysis of embedded systems.
2. Design and develop embedded systems (hardware, software and firmware).
3. Analyze, real time systems using RTOS and develop applications.
4. Apply knowledge to interface various sensors and its applications in embedded systems.
5. Elaborate the principles of SOC design.

UNIT-I

Embedded Computing Introduction: General Computing system v/s Embedded Computing System, History of Embedded Systems Classification Of Embedded System, Characteristics of Embedded Systems, operational requirements of embedded systems and non-operational requirements of embedded system, Major applications areas of Embedded systems.

UNIT-II

Typical Embedded Systems: Core of the embedded systems, Microprocessors v/s Microcontrollers, memory concepts, Applications: Interfacing with Push buttons and switches, Interrupts controllers, Serial Data Communication, Bus protocols: I2Cbus and CAN bus. External communication Interface: Zigbee, GPRS, Bluetooth, RFID

UNIT-III

Embedded Firmware Design and Development: Embedded Firmware Design Approaches, OS based, super loop based, Assembly language based, High level language based approaches, IDE concepts, sample programs on Embedded C.

UNIT-IV

Introduction to Real-Time Operating Systems: Tasks and task states, tasks and data, semaphores, and shared data; message queues, mail boxes and pipes, timer functions, events, memory management, interrupt routines in an RTOS environment. Basic Design Using Real Time Operating System.

UNIT-V

Introduction to the System Approach System Architecture: Components of the system, Hardware &Software, Processor Architectures, Memory and Addressing. System level inter connection, An approach for SOC Design, System Architecture and Complexity.

Suggested Readings:

1. Shibu K V ,*Introduction to Embedded Systems* , 5th edition, Mc Graw Hill Education.
2. Raj Kamal ,*Embedded Systems*, Second Edition, Mc Graw Hill Education
3. C Muhammad Ali Mazidi Janice Gillespie Mazidi, Rolin D. McKinlay,*The 8051Microcontroller and Embedded Systems using Assembly and C*,Pearson Education,2nd Edition,2005.
4. D. Patranabis, *Sensors and Transducers*, PHI Learning Private Limited.
5. David E. Simon *An Embedded Software Primer*", Pearson Education

Course Code	Course Title						Core/Elective
U24EC6L1	Embedded Systems and IoT lab						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Microcontrollers	0	0	0	3	25	50	1.5

Course Objectives:

The objectives of this course is to impart knowledge of

1. To program Arduino to control lights, motors, and other devices.
2. To learn Arduino's architecture, including inputs and connectors for add-on devices.
3. To add third-party components such as Sensors, LEDs Switches, LCDs, Buzzers, to extend Arduino's functionality.

Course Outcomes:

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

1. Execute basic and advanced Embedded C language programs.
2. Learn the ways to interface I/O devices with processor for task sharing.
3. Recall the basics of co-processor and its ways to handle Multiple Interfacings.
4. Recognize the functionality of micro controller, latest version processors and its applications.
5. Acquire design thinking capability to design a component with realistic constraints to solve real world engineering problems.

List of Experiments:

1. Switch/Pushbutton and LED Interfacing with Arduino to perform GPIO Operation.
2. LCD Interfacing with Arduino to print a character/string.
3. DC-Motor Interfacing with Arduino.
4. LDR Interfacing with Arduino.
5. Humidity Sensor Interfacing with Arduino.
6. Ultrasonic Sensor Interfacing with Arduino.
7. MQ2 Interfacing with Arduino.
8. Relay & Buzzer Interfacing with Arduino.
9. Bluetooth Interfacing with Arduino for Serial Communication.
10. IOT Module ESP8266 Interfacing with Arduino for IOT Communication.

Note – All the experiments should be performed on Arduino UNO Boards.

Course Code	Course Title						Core/Elective
U24EC6L2	ECAD Lab						Core
	Contact Hours per Week				CIE	SEE	Credits
Prerequisite	L	T	D	P			
VLSI design	0	0	0	3	25	50	1.5

Course Objectives:

The objectives of this course is to

1. Provide exposure to the students to understand Hardware design basics using CAD tools.
2. Interpret Transistor-Level CMOS Logic Design using both Verilog and VHDL.
3. Illustrate VLSI Fabrication and experience CMOS Physical Design using backend tools

Course Outcomes:

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

1. Demonstrate Xilinx Software and FPGA development Boards to write Verilog code for logic gates and digital circuits.
2. Write Verilog code for basic logic gates, complex logic gates, combinational circuits, and sequential circuits using switch level, gate level, data flow and behavioral modeling.
3. Develop test bench code using Verilog and verify the simulation results.
4. Demonstrate the FPGA implementation of digital circuits and generate the synthesis report.
5. Simplify the layouts of basic logic gates using Xilinx Software.

List of Experiments:

1. Realize all the logic gates
2. Design of 8-to-3 encoder (without and with priority) and 2-to-4 decoder
3. Design 2-to-4 decoder.
4. Design of 8-to-1 multiplexer.
5. Design of 1-to-8 de-multiplexer.
6. Design of 4 bit binary to gray code converter
7. Design of 4 bit comparator
8. Design of Full adder using behavioral modeling style
9. Design of flip flops: SR, D, JK.
10. Design of 4-bit binary, BCD counters.

Note - All the experiments have to be implemented using XILINX Software and FPGA development Boards.

Course Code	Course Title					Core / Elective
U24EC6P1	Mini Project					PROJ
Prerequisite	Contact Hours Per Week			CIE	SEE	Credits
	L	T	P			
Micro project	0	0	6	50	50	3

Course Objectives:

The objectives of this course is to impart knowledge of

1. Familiarize tools and techniques of systematic literature survey and documentation.
2. Expose the students to industry practices and team work.
3. Encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes:

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

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

1. As part of the curriculum in the VI- semester of the programme each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Four students will be allotted to one faculty supervisor for mentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Mini projects shall have inter-disciplinary/ industry relevance.
5. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling
6. All the investigations should be clearly stated and documented with the reasons/explanations.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and reference.
8. The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
9. The preliminary results (if available) of the problem may also be discussed in the report.
10. The work has to be presented in front of the PRC committee which consists of one Supervisor and a minimum of two faculty members from the respective Department of the Institute.

(An Autonomous Institution)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATIONS [LR-24]
(W. e. f Academic Year 2024-25)
PROFESSIONAL ELECTIVE COURSES

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	U24EC505	PEC 1	Principles and Architecture of Artificial Intelligence	3	0	0	3	40	60	3	3
	U24EC506		Data Communication and Computer Networks	3	0	0	3	40	60	3	3
	U24EC507		Sensors and Actuators	3	0	0	3	40	60	3	3
	U24EC508		Digital IC Design	3	0	0	3	40	60	3	3
2	U24EC604	PEC 2	Wireless Communication	3	0	0	3	40	60	3	3
	U24EC605		Digital Image Processing	3	0	0	3	40	60	3	3
	U24EC606		Advanced Micro Controllers	3	0	0	3	40	60	3	3
	U24EC607		Digital System Design through Verilog	3	0	0	3	40	60	3	3
3	U24EC703	PEC 3	Radar Communication	3	0	0	3	40	60	3	3
	U24EC704		Digital Signal Processor Architectures	3	0	0	3	40	60	3	3
	U24EC705		Introduction to IOT	3	0	0	3	40	60	3	3
	U24EC706		Low power VLSI Design	3	0	0	3	40	60	3	3
4	U24EC707	PEC 4	Multirate Signal Processing	3	0	0	3	40	60	3	3
	U24EC708		IOT Protocols and its applications	3	0	0	3	40	60	3	3
	U24EC709		Global System for Mobile Communication	3	0	0	3	40	60	3	3
	U24EC710		System on Chip Design	3	0	0	3	40	60	3	3
5	U24EC801	PEC 5	5G Communication	3	0	0	3	40	60	3	3
	U24EC802		Analog and Mixed Signal Design	3	0	0	3	40	60	3	3
	U24EC803		Satellite Communication	3	0	0	3	40	60	3	3
	U24EC804		CPLD and FPGA Architecture	3	0	0	3	40	60	3	3

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATIONS [LR-24]
(W. e. f Academic Year 2024-25)

OPEN ELECTIVE COURSES

S. No.	Course Code	Category	Course Title
01	U24EE508	OEC 1	Non-Conventional Energy Systems
	U24EE509		Energy Conservation and Management
	U24CS508		Fundamentals Of Database Management System
	U24IT506		Data Structures
	U24ME509		Basics of Mechanical Engineering
	U24ME510		Modern Manufacturing Processes
	U24CE510		Disaster Preparedness and Management
	U24CE511		Civil Engineering Principles and Practices
	U24EC608		Principles of Electronics Communication
	U24EC609		Introduction to Internet of Things
	U24MB501		Business Communication
	U24MB502		Managerial Science and Theory
	U24SH501		History of Science & Technology
	U24SH502		Economic Policies in India

S. No.	Course Code	Category	Course Title
01	U24EE608	OEC 2	Fundamental of Power Electronics
	U24EE609		Electrical Installation and Safety
	U24CS607		Introduction To Programming In Java
	U24IT606		Operating Systems
	U24ME608		Basics Of 3-D Printing
	U24ME609		Optimization Methods for Engineers
	U24CE609		Construction Materials
	U24CE610		Engineering Geology
	U24EC711		Principles of Data Communication and Computer Networks
	U24EC6712		Introduction to Micro Processors & Micro Controllers
	U24MB602		Total Quality Management
	U24MB603		Innovation Management
	U24SH601		Indian Music System
	U24SH602		Introduction to Art and Aesthetics

S. No.	Course Code	Category	Course Title
01	U24EE711	OEC 3	Introduction to Electrical Vehicles
	U24EE712		Design estimation and Costing of Electrical Systems
	U24CS711		Data Sciences
	U24IT705		Basics of Artificial Intelligence
	U24ME711		Renewable Energy Resources
	U24ME712		Cooling of Electronic Components
	U24CE711		Environmental Systems
	U24CE712		Urban Transportation System
	U24EC805		Embedded Systems
	U24EC806		Fundamentals of Wireless Communication
	U24MB702		Supply Chain Management
	U24MB703		Start Up Management
	U24SH701		Display Devices
	U24SH702		Comparative Study of Literature