CURRICULUM

FOR THE YEAR 2019-23

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

V and VI SEMESTER B.E.

POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING
(Autonomous Engineering college Affiliated to VTU Belagavi)
KALABURAGI-585102

About the institution

The Hyderabad Karnataka Education (HKE) society founded by Late ShriMahadevappa Rampure, a great visionary and educationist. The HKE Society runs 46 educational institutions. Poojya Doddappa Appa College of Engineering, Gulbarga is the first institution established by the society in1958.The college is celebrating its golden jubilee year, setting new standards in the field of education and achieving greater heights.

About the department

Department of Electronics & Communication Engineering was established in 1967 & is the pride of Karnataka. With an initial intake of 30 students the department has grown steadily and the present intake is 120 students for the UG programme. The graduates from this Department are playing a vital role in the IT revolution and are instrumental in placing Karnataka on the Global IT Landscape. These professionals have found placement in major industries and multinational corporations. Many of them are successful entrepreneurs.

The department also offers Post Graduate programs in 'Communication Systems' with an intake of 18. Active engagement of faculty in research has led to recognition of department as a Research center by the VTU.

The faculty strength of the department is 28, including 4 Professors, 4 Associate Professors, 20 Assistant Professors. The faculty always strives for imparting better knowledge to the students and works as a team in all departmental activities.

Students graduated from the department are well placed in India and abroad. Quite a few of them have pursued higher studies both in India and abroad. Some of them have qualified for Indian Engineering and Defense Services. Students of the department have bagged university ranks including the First rank on several occasions.
The department has state-of-the-art laboratories in the areas of Communication, DSP, Microwave, Microcontroller, Embedded system, VLSI design etc.

Vision of the Institute

To be an institute of excellence in technical education and research to serve the needs of industry and society at local and global levels.

Mission of the Institute

1. To provide a high-quality educational experience for students with values and ethics that enables them to become leaders in their chosen profession.
2. To explore, create and develop innovations in engineering and science through research and developmental activities.
3. To provide beneficial service to national and multinational industries and communities through educational, technical and professional activities.

Department of Electronics and Communication Engineering

Vision of the Department

To be a premier department in Electronics and Communication Engineering field by providing quality education through teaching, learning, research and innovations to serve the industry and society.

Mission of the Department

M1 Develop an environment for better teaching and learning in collaboration with industry, premier institutes and alumni.

M2 Produce competent engineers to meet the requirements of the industry and the society.

M3 Encourage students to pursue higher education, research work and to take up administrative responsibilities through leadership.

Program Educational Objectives

1. The graduates possess emergent technical skills to perform design and developmental activities in various areas of Electronics and Communication Engineering like Signal Processing, VLSI, Embedded Systems, Communication Systems and other engineering specializations.
2. The graduates indulge into entrepreneurial, higher learning/research activities to be in pace with the continuous developing environment.
3. The graduates exhibit effective communication skills, leadership and team work qualities in industry, research and development organizations maintaining ethical standards.

Program Outcomes:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data,and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability toengage in independent and life-long learning in the broadest context of technological change.

PSO-Program Specific Outcomes:

1. Apply the concepts of Electronics & Communication Engineering in various areas like Signal processing, VLSI, Embedded systems, Communication Systems, Digital & Analog Devices and other engineering specializations.

2. Solve complex Electronics and Communication Engineering problems with modern hardware and software tools, along with analytical skills to arrive at cost effective and appropriate solutions.

3. Possess social and environmental awareness along with ethical responsibility to adapt with the emerging technologies in Electronics and Communication Engineering for sustainable real-world applications to have a successful career.

Scheme of Teaching and Examination of V Semester B.E in Electronics and Communication Engineering

	Course	Hours / Week				Maximum Marks			
		Lecture	Tutorial	Practical	Duration	CIE	SEE	Total Marks	Credits
Code									
19EC51	Linear Control Systems	03	02	--	05	50	50	100	4
19EC52	Digital Signal Processing	04	--	--	04	50	50	100	4
19EC53	Information Theory and Coding	04	--	--	04	50	50	100	4
19EC54	Digital Communication	04	--	--	04	50	50	100	4
19EC55	Embedded Microcontrollers	03	--	--	03	50	50	100	3
18HU01	Recruitment Process Training-1	02	--	--	02	50	50	100	1
19ECL51	Digital Signal Processing Lab	--	--	02	02	50	50	100	1
19ECL52	Digital Communication Lab	--	--	02	02	50	50	100	1
19ECL53	Embedded Microcontrollers Lab	--	--	02	02	50	50	100	1
		20	02	06	28	450	450	900	23

Scheme of Teaching and Examination of VI Semester B.E in Electronics and Communication Engineering

	Course	Hours / Week				Maximum Marks			
		Lecture	Tutorial	Practical	Duration	CIE	SEE	Total Marks	Credits
Code									
19EC61	Entrepreneurship Management and Accounting	03	--	--	03	50	50	100	3
19EC62	Antenna and Wave Propagation	04	--	--	04	50	50	100	4
19EC63	Digital design using Verilog HDL	03	--	--	03	50	50	100	3
19EC64	Data Structures using C++	03	--	--	03	50	50	100	3
19EC65x	Elective-1	03	--		03	50	50	100	3
19HU02	Recruitment Process Training-2	02	--	--	02	50	50	100	1
19ECL61	Digital design using Verilog HDL Lab	--	--	02	02	50	50	100	1
19ECL62	Data Structures using C++ Lab	--	--	02	02	50	50	100	1
19ECL63	Mini-project	--	--	02	02	50	50	100	1
		18	--	06	24	450	450	900	20

LINEAR CONTROL SYSTEMS			
Subject Code	19EC51	CIE	50
Number of Lecture Hours/Week	3+2Hours (Theory)	SEE	50
Total Number ofLecture Hours	52	SEE Hours	03
CREDITS –3:2:0:4			

Modules	Teaching Hours
Module -1	
Basic concepts: Open-loop and Closed-loop control systems. **Mathematical Models of Physical Systems:** Differential equations of physical systems, transfer functions, Block diagram algebra, Signal flow graphs.	**10 Hours**
Module -2	
Time Response Analysis: Standard test signals, Time response of first and second order systems, Effect of adding a zero to a system, Time response specifications, Steady state errors and error constants. Performance indices.	**10 Hours**
Module -3	
Concept of stability and algebraic criteria: The concept of stability, Necessary conditions for stabililty, Hurwitz and Routh stability criterions, Relative stability analysis. **The Root Locus Technique:** The Root Locus concept, Construction of Root Loci.	**11 Hours**
Module -4	
Frequency response analysis: Correlation between time and frequency response, Bode plots – General procedure for constructing Bode plots, All pass and minimum phase systems.Polar plots, Stability in frequency domain – Nyquist stability criteria, Assessment of relative stability using Nyquist criteria.	**11 Hours**
Module -5	
State Variable Analysis and Design: Concept of state, state variables and state models, State model for Linear continuous time systems, State variables and linear discrete-time systems, Diagonalization, Solution of state equations, Controllability and Observability.	**10 Hours**

Course objectives: This course will enable students to:

- To teach the fundamental concepts of Control systems and mathematical modeling of the system
- To study the concept of time response and frequency response of the system
- To teach the basics of stability analysis of the system

Question paper pattern:

The question paper will have ten questions.
Each full question consists of 20marks.
There will be 2 full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. I J Nagrath and M Gopal, Control systems and Engineering, New Age Publishers 6th Edition-2017.
2. K Ogata, Modern Control Engineering, PHI 3rd Edition-2001.

Reference Books:

1. Kuo B C, Control Engineering.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EC51	**CO1**	Analyze physical systems using differential equations, block diagrams and signal flow graphs.
	CO2	Analyze time response of first and second order systems.
	CO3	Construct the root locus and analyze the stability of the system in time domain.
	CO4	Construct Bode plot, Polar plot and analyze the stability in the frequency domain.
	CO5	Obtain state models for linear systems and determine for observability and controllability.

19EC51: Linear Control Systems

		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Analyze physical systems using differential equations, block diagrams and signal flow graphs.	3	3	2					1		1		1	3	2	2
CO2	Analyze time response of first and second order systems.	3	3	2					1		1		1	3	2	2
CO3	Construct the root locus and analyze the stability of the system in time domain.	3	3	2		2			1		1		1	3	2	2
CO4	Construct Bode plot, Polar plot and analyze the stability in the frequency domain.	3	3	2		2			1		1		1	3	2	2
CO5	Obtain state models for linear systems and detrermine for observability and controllability	3	3	2					1		1		1	3	2	3
		3	3	2		2			1		1		1	3	2	2.2

DIGITAL SIGNAL PROCESSING			
Subject Code	19EC52	CIE	50
Number of Lecture Hours/Week	04 Hours	SEE	50
Total Number ofLecture Hours	52	SEE Hours	03
CREDITS –4:0:0:4			

Course objectives:

Modules	Teaching Hours
Module -1	
Discrete Fourier Transform: Representation of periodic sequences – The Discrete Fourier Series, Properties of DFS (No derivation), Sampling the Z-transform, Fourier Representation of finite duration sequences – The Discrete Fourier Transform, Properties of DFT, Examples on DFT properties.	**11 Hours**
Module -2	
DFT Continued: Linear filtering using DFT, Filtering of long data sequences, and Frequency analysis of signals using DFT. **Computation of the Discrete Fourier Transform:** Goertzel algorithm, Decimation in Time algorithms, Decimation in Frequency algorithms, FFT algorithms for N a composite number. Chirp Z-Transform algorithm.	**10 Hours**
Module -3	
FIR Filters: Properties of FIR digital filters, Design of Linear phase FIR filters using windows and frequency sampling method, Design of FIR differentiators, Design of Hilbert Transformers.	**10 Hours**
Module -4	
IIR Filters: Design of IIR digital filters from Analog filters – Impulse Invariance, Design based on numerical solution of the differential equation, Bilinear transformation, Characteristics of commonly used Analog filters, Design examples – Analog to digital Transformation. Frequency transformations. Comparison of Digital IIR and FIR filters	**11 Hours**
Module -5	
Digital Filter Structures: Basic Network structures for IIR filters – Direct forms, Cascade form, Parallel form, transposed form, Lattice structures, Basic network structures for FIR Systems – Direct forms Cascade form, Networks for Linear phase FIR systems, Frequency sampling structure, Lattice structure.	**10 Hours**

Course objectives: This course will enable students to:

- To study the basic concepts of digital signal processing.

- To study analysis and processing of signals for different kind of applications and retrieval of information from signals.
- To study designing of digital filters and its realization.
- To study analysis of signals using the discrete Fourier transform (DFT) and Z-Transform.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. A.V.Oppenheim and R.W.Schafer, Digital Signal Processing, PHI.
2.J.G.Proakis and D.G.Manolakis, Digital Signal Processing- Principals, Algorithms and Applications, PHI.
3. Rabiner and Gold, Theory and Applications of Digital Signal Processing, PHI
4. SanjitK.Mitra, Digital Signal- A computer- Based Approach, TMH.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18EC52	**CO1**	Compute the Discrete Fourier Transform (DFT) of a sequence.
	CO2	Analyze the efficient computation of DFT using Fast Fourier Transform.
	CO3	Design FIR filters using Windows and frequency sampling Technique.
	CO4	Design digital IIR filters from Analog filters.
	CO5	Realize digital filters using network structures.

19EC52: Digital Signal Processing

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Compute the Discrete Fourier Transform (DFT) of a sequence.	3	2	2	2	2			1		1		1	3	3	2
CO2	Analyze the efficient computation of DFT using Fast Fourier Transform.	3	2	2	2	2			1		1		1	3	3	2
CO3	Design FIR filters using Windows and frequency sampling Technique.	3	2	3	2	2			1		1		1	3	3	2
CO4	Design digital IIR filters from Analog filters	3	2	3	2	2			1		1		1	3	3	2
CO5	Realize digital filters using network structures.	3	2	2	2	2			1		1		1	3	3	2
		3	2	2.4	2.4	2			1		1		1	3	3	2

INFORMATION THEORY AND CODING			
Subject Code	19EC53	CIE	50
Number of Lecture Hours/Week	4Hours (Theory)	SEE	50
Total Number of Lecture Hours	52	SEE Hours	03
CREDITS –4:0:0:4			

Modules	Teaching Hours
Module -1	
Source Coding: Introduction to information theory, information measure, entropy, Discrete memoryless source, Source information rate and source coding theorem, Huffman coding and its extension, Entropy and information rate of Markoff sources, Shannon's algorithm for source encoding.	**10 Hours**
Module -2	
Channel Capacity and Coding: Channel models, Channel capacity, Channel coding, Information capacity Theorem, The Shannon's limit, Mutual Information and their properties, estimation of channel capacity using Muroga's method,	**11 Hours**
Module -3	
Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of Block Codes, Error Detecting and Error Correcting Capabilities of Block Codes, Standard Array and Syndrome Decoding, Single Parity Check Codes, Hamming Codes, A class of single-error correcting and double-error detecting codes, Reed-Muller Code	**11 Hours**
Module -4	
Cyclic codes: Description of Cyclic codes, generator and parity Check Matrices of Cyclic codes, Encoding of cyclic codes, Syndrome computation and Error Detection, Decoding of Cyclic Codes, Bose-Chaudhuri Hocquenghem code.	**10 Hours**
Module -5	
Convolution codes: Encoding of convolution codes, Time and frequency transform domain methods, Matrix description, Graphical approaches, State transition table, State diagram, Code tree, Trellis diagram, Viterbi decoding.	**10 Hours**

Course objectives: This course will enable students to:

- To introduce the basic concepts of information theory.
- To calculate channel capacity for discrete channels.
- The course will consider the error control coding strategies.
- The course will consider different coding techniques.
- The course will introduce decoding methods for convolution codes.

Graduate Attributes (as per NBA):

• Engineering Knowledge.
• Problem Analysis.
• Design / development of solutions (partly).
• Interpretation of data.

Question paper pattern:

• The question paper will have ten questions.
• Each full question consists of 20marks.
• There will be 2 full questions (with a maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Book

1. Shu Lin, Daniel J. Costello, Jr, Error Control Coding Fundamentals and Applications, 2nd Edition, Pearson, 2011.
2. Information Theory Coding and Cryptography, Ranjan Bose, Tata Mc Graw-Hill, 2008.

Reference Books:

1. K. Sam Shanmugam, Digital and Analog Communication systems, John wiley, 2006.
2. Simon Haykin, Digital Communications, Johan Wiley, 2006.
3. A. Bruce Carlson, Paul B. Crilly, Jannet C. Rutledge, Communication Systems, Fourth Edition, Mc Graw-Hill International edition, 2002

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18EC52	**CO1**	Understand basic notion of information theory.
	CO2	Determine channel capacity.
	CO3	Analyze error control strategies.
	CO4	Analyze various coding techniques.
	CO5	Analyze decoding techniques.

19EC53: Information Theory and Coding

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Understand basic notion of information theory.	3	2										1	3		
CO2	Determine channel capacity.	3	2										1	3		
CO3	Analyze error control strategies.	3	3	3		2							1	3	2	2
CO4	Analyze various coding techniques.	3	3	3		2							1	3	2	2
CO5	Analyze decoding techniques.	3	3	3		2							1	3	2	2

Digital Communication			
Subject Code	19EC54	CIE	50
Number of Lecture Hours/Week	4 Hours (Theory)	SEE	50
Total Number ofLecture Hours	52	SEE Hours	03
CREDITS –4:0:0:4			

Modules	Teaching Hours
Module -1	
Pulse Modulation systems: Pulse amplitude modulation (PAM), Pulse width modulation(PWM) and Pulse position modulation(PPM). Bandwidth requirements, generation and reconstruction methods, Analog to digital conversion, quantization and encoding techniques, application to pulse code modulation (PCM), quantization noise in PCM, Companding in PCM systems, Time division multiplexing (TDM), examples of PAM and PCM systems. The T1 PCM system in telephony.	**11 Hours**
Module -2	
The delta modulator and its operation, quantization noise and slope overload in delta modulators. Comparison of delta modulation and PCM, Introduction to linear prediction theory with applications in delta modulation **Base band digital data transmission:** Base band digital communication systems, multilevel coding using PAM, pulse shaping and band width consideration, inter symbol interference (ISI). Nyquist condition for zero ISI, band-limited Nyquist pulses, the eye diagram. Duobinary and modified duo binary encoding,	**10 Hours**
Module-3	
Digital Modulation: PSK, DPSK and FSK. M-array data communication systems, quadrature amplitude modulation (QAM) systems, four phase PSK effects of noise in modulated digital communication Systems, optimum binary systems. Probability of error expression for binary Communications, probability of error in QAM systems, comparison of digital Modulation systems.	**10 Hours**
Module -4	
Spread Spectrum Systems: PN sequence, PN sequence generation, Properties of PN sequence, Gold code generation, Auto correlation and cross correlation of PN and Gold codes, Direct sequence Spread spectrum, Slow and fast Frequency hopping, Time hopping, Signal space dimensionality and processing gain, antijam characteristics, CDMA Applications, comparison of spread spectrum communication.	**10 Hours**
Module -5	
Detection and Estimation: Model of digital communication system, Gram-Schmidt orthogonalization procedure, **geometric** interpretation of signals, response of bank of correlators to noisy input, detection of known signals in noise, probability of error,	**11 Hours**

correlation receiver, matched filter receiver, estimation concepts and criteria, maximum likelihood estimation, wiener filter for waveform estimation.	

Course objectives: This course will enable students to:

- To teach the fundamental concepts of Control systems and mathematical modeling of the system
- To study the concept of time response and frequency response of the system
- To teach the basics of stability analysis of the system

Question paper pattern:

• The question paper will have ten questions.
• Each full question consists of 20marks.
• There will be 2 full questions (with a maximum of four sub questions) fromeach module.
• Each full question will have sub questions covering all the topics under amodule.
The students will have to answer 5 full questions, selecting one fullquestion from each module.

Reference Books:

1. Simon Haykin, Digital Communications, John Wiley and Sons.
2. H.Taub and D.L.Schilling , Principles of Communication systems, MH
3. H.P.Hsu , Analog and Digital Communications, Schuam's outline series.
4. J G Proakis, Digital communications, MH
5. B P Lathi, Modern Digital and Analog Communication, 3rd edition.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18EC54	**CO1**	Analyze different PCM techniques in terms of SNR.
	CO2	Analyze the performance of digital communication systems in terms of BER.
	CO3	Analyze different carrier modulation techniques and its BER performance.
	CO4	Analyze properties of orthogonal codes and its use in spread spectrum Communication.
	CO5	Analyze the behavior of correlation receiver in the presence of noise.

19EC54: Digital Communication

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Analyze different PCM techniques in terms of SNR	3	2	2					1		1		1	3	2	2
CO2	Analyze the performance of digital communication systems in terms of BER.	3	2	2					1		1		1	3	2	2
CO3	Analyze different carrier modulation techniques and its BER performance.	3	2	2	1				1		1		1	3	2	2
CO4	Analyze properties of orthogonal codes and its use in spread spectrum	3	2	2	1				1		1		1	3	2	2
CO5	Analyze the behavior of correlation receiver in the presence of noise.	3	3	2	2				1		1		1	3	2	2
Average		3	2.2	2	1.33				1		1		1	3	2	2

Embedded Microcontrollers

Embedded Microcontrollers			
Subject Code	19EC55	CIE	50
Number of Lecture Hours/Week	4Hours (Theory)	SEE	50
Total Number of Lecture Hours	42	SEE Hours	03
CREDITS –3:0:0:3			

Modules	Teaching Hours
Module -1	
The 8051 Microcontrollers: Micro-controllers and Embedded Processors, Overview of the 8051 Family. **8051 Programming(Assemble and C):** Inside the 8051, Introduction to 8051 Assembly Programming, Assembling and Running an 8051 Program, The Program Counter and ROM Space in the 8051, Data Types and Directives, 8051 Flag Bits and the PSW Register, 8051 Register Banks and Stack.,	**10 Hours**
Module -2	
8051 Addressing Modes and 8051 Instruction Sets. **8051 Timer and Counter Programming:** Programming 8051 Timers, Counter Programming.	**11 Hours**
Module -3	
Interrupt Programming: 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupt, Interrupt Priority in the 8051. **Real World Interfacing:** 8051 Interfacing to ADC/DAC, Sensors, Stepper motor, Keyboard and displays	**11 Hours**

Module -4	
Introduction to Embedded system Embedded system, Introduction to ARM architecture and Cortex – M processor, Cortex M architecture, Introduction to the TM4C family viz. TM4C123x launch pad I/O pins, cortex M assembly language, addressing modes and operands, parallel I/O ports, PLL, Timers, TM4C targeted applications.TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.	**10 Hours**
Module -5	
Microcontroller fundamentals for basic programming: I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).	**10 Hours**
Graduate Attributes (as per NBA): • Engineering Knowledge. • Problem Analysis. • Design / development of solutions (partly). • Interpretation of data.	
Question paper pattern: • The question paper will have ten questions. • Each full question consists of 20marks. • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: **1.** The 8051 Microcontrollers and Embedded Systems, MAZIDI and MAZIDI, Second edition, Pearson Education,1999	

2. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.

3. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition Jonathan W Valvano, Createspace publications ISBN-13: 978-1477508992

References:

1. THE 8051 Microcontroller, Kenneth Ayala, Second Edition, Thomson,2006

2. The Definitive Guide to ARM® Cortex®-M3, Second Edition, 2017 November, Joseph Yui.

3.http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded _Processors

4.http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_ Workshop

5.http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html

6..CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

Course objectives: This course will enable students to:

- Study the architecture of 8051 microcontrollers
- Study addressing modes instruction sets, timers and counters to program with 8051
- Understand interrupt programming and real world interfacing with 8051
- Study architecture of ARM Cortex M series and TM4C
- Study ARM fundamentals for basic programming

Course Code	CO #	Course Outcome (CO)
19EC55	CO1	Describe the 8051 microcontroller architecture, PSW and memory
	CO2	Analyze the working of 8051 timers and counters and program using 8051.
	CO3	Perform interrupt programming and Interface 8051 with real world I/O devices
	CO4	Describe the architecture of ARM and TM4C microcontroller and program for basic operations
	CO5	Analyze the TM4C modules and Program TM4C to interface real world modules

19EC55: Embedded Microcontrollers

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Describe the 8051 microcontroller architecture, PSW and memory	3	3										1	2		
CO2	Analyze the working of 8051 timers and counters and program using 8051.	3	3	2		3							1	2	2	2
CO3	Perform interrupt programming and Interface 8051 with real world I/O devices	3	3	3		3							1	2	2	2
CO4	Describe the architecture of ARM and TM4C microcontroller and program for basic operations	3	3	3		3							1	2	2	2
CO5	Analyze the TM4C modules and Program TM4C to interface real world modules	3	3	3		3							1	2	2	3
Average		3	3	2.75		3							1	2	2	2.25

Digital Signal Processing Lab

Subject Code	19ECL51	CIE=50
Number of Hours/Week	03 Hours (Practical)	SEE=50
Total Number ofLecture Hours	--	SEE Hours

Laboratory Experiments:

1. Introduction to MATLAB
2. Verification of sampling theorem
3. Generation of signals (Sinusoidal signals, Exponential signals etc.)
4. Operations on signals (Time shifting, time scaling and amplitude scaling)
5. Determine Z-transform and inverse Z-transform of discrete-time signals
6. Linear convolution, circular convolution.
7. Fourier representation of Discrete-time signals (DTFT, DFS), Properties of DTFT and DFS.
8. Discrete Fourier Transform(DFT), Properties of DFT
9. Linear filtering using DFT
10. DFT and IDFT using radix-2 FFT algorithm.
11. Design and implement digital IIR filters
12. Design and implement digital FIR filters

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	**CO #**	**Course Outcome (CO)**
19ECL51	**CO1**	Sample and reconstruct analog signals.
	CO2	Compute linear and circular convolution in time domain and frequency domain.
	CO3	Compute DFT of a sequence using FFT algorithms.
	CO4	Design and implement digital IIR filters.
	CO5	Design and implement digital FIR filters using windows.

19ECL51: Digital Signal Processing Lab

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Sample and reconstruct analog signals.	3	2	2	1	2	1	1	2	3	2		1	3	3	2
CO2	Compute linear and circular convolution in time domain and frequency domain.	3	2	2	1	2	1	1	2	3	2		1	3	3	2
CO3	Compute DFT of a sequence using FFT algorithms.	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO4	Design and implement digital IIR filters.	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO5	Design and implement digital FIR filters using windows.	3	2	2	2	2	1	1	2	3	2		1	3	3	2

Embedded Microcontrollers Lab			
Subject Code	19ECL52	CIE	50
Number of Hours/Week	03 Hours (Practical)	SEE	50
Total Number of Lecture Hours	--	SEE Hours	03
CREDITS –01			

Laboratory Experiments:

I. Programming 8051 using Keil µVision

1. Develop programs using data movement instructions and arithmetic instructions
2. Develop programs on logical, bit manipulation instructions
3. Develop programs on branch and loop instructions
4. Programs 8051 timers and counters to perform specific functions
5. Develop programs to perform code conversions
6. Program 8051 to execute subroutine call and interrupts
7. Program 8051 to interface with real world modules (ADC/DAC/Stepper motor/ Display/Keyboard)

II. Programming Tiva C series TM4Cxx module with CC Studio and Energia IDE

1. Interfacing and Programming GPIO ports in 'C' using Tiva(LED Blinking and Push Button)
2. Interrupt programming through GPIO
3. PWM generation using PWM module on Tiva
4. Interfacing Potentiometer with Tiva GPIO
5. Speed control of RC motor controlled by potentiometer connected to Tiva GPIO

Course objectives: This course will enable students to:

1) Learn internal organization of 8051 microcontroller.
2) Learn programming of microcontroller and Timer/Counter.
3) Learn real-world interfacing
4) Learn to program TM4C Microcontroller
5) Learn to interface various modules with Tiva GPIO

Conduct of Practical Examination:

All laboratory experiments are to be included for practical examination.
Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script forbreakup of marks.
Change of experiment is allowed only once and will be evaluated for 85% of the total marks.

Text Books:

1. The 8051 Microcontrollers and Embedded Systems, MAZIDI and MAZIDI, Second edition, Pearson Education,1999

2. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.

3. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition Jonathan W Valvano, Createspace publications ISBN-13: 978-1477508992

References :

1. Intel Reference Manual
2. www.keil.com
3. www.energia.nu
4. THE 8051 Microcontroller, Kenneth Ayala, Second Edition, Thomson,2006
5. The Definitive Guide to ARM® Cortex®-M3, Second Edition, 2017 November, Joseph Yui.
6. http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded _Processors
7. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_ Workshop
8. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html
9. CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19ECL52	**CO1**	Develop programs to perform basic operations using 8051
	CO2	Develop programs to perform timer/counters operations and interrupt operations
	CO3	Develop program to interface 8051 with real world modules
	CO4	Program GPIO ports in ‘C’ using Tiva and perform basic operations
	CO5	Interface real world modules on Tiva

Subject with code: 19ECL52: Embedded Microcontroller lab

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Program for Data transfer, Arithmetic and logic operations.	3	3	3		3				3			1	3	2	2
CO2	Program for bit manipulation operations.	3	3	3		3				3			1	3	2	2
CO3	Program timer/counters.	3	3	3		3				3			1	3	2	2
CO4	Program for real world I/O devices	3	3	3		3				3			1	3	2	2
CO5	Program PPI for real world applications.	3	3	3		3				3			1	3	2	2
Average		3	3	3		3				3			1	3	2	2

DIGITAL COMMUNICATION LAB			
Subject Code	19ECL53	CIE	50
Number of Hours/Week	03 Hours (Practical)	SEE	50
Total Number ofLecture Hours	--	SEE Hours	02
CREDITS –01			

Course objectives:

- Use the fast Fourier Transform in a variety of applications including: Signal analysis and filtering.
- Choose and design digital IIR and FIR filters.

Laboratory Experiments:

1. Signal sampling and its reconstruction
2. Time division multiplexing of signals
3. Amplitude shift keying
4. Frequency shift keying
5. Phase shift keying
6. Differential phase shift keying
7. Quadrature phase shift keying
8. PN sequence generator

Conduct of Practical Examination:

All laboratory experiments are to be included for practical examination.
Students are allowed to pick one experiment from the lot.Strictly follow the instructions as printed on the cover page of answer script forbreakup of marks.
Change of experiment is allowed only once and will be evaluated for 85% of the total marks.

Reference Books:

1. A.V.Oppenheim and R.W.Schafer, Digital Signal Processing, PHI.
2.J.G.Proakis and D.G.Manolakis, Digital Signal Processing- Principals, Algorithms and Applications, PHI.
3. Rabiner and Gold, Theory and Applications of Digital Signal Processing, PHI
4. SanjitK.Mitra, Digital Signal- A computer- Based Approach, TMH.

Course outcomes: **On completion of the course, the student will have the ability to:**		
Course Code	**CO #**	**Course Outcome (CO)**
19ECL53	**CO1**	Analyze the importance of sampling theorem in analog to digital Conversion.
	CO2	Analyze time division multiplexing in digital communication.
	CO3	Design and implement ASK, FSK and PSK modulation and demodulation.
	CO4	Design and implement DPSK and QPSK modulation and demodulation.
	CO5	Design and implement PN sequence generator.

19ECL53: Digital Communication Lab

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Analyze the importance of sampling theorem in analog to digital Conversion.	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO2	Analyze time division multiplexing in digital communication.	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO3	Design and implement ASK, FSK and PSK modulation and demodulation	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO4	Design and implement DPSK and QPSK modulation and demodulation	3	2	2	2	2	1	1	2	3	2		1	3	3	2
CO5	Design and implement PN sequence generator	3	2	2	2	2	1	1	2	3	2		1	3	3	2
Average		3	2	2	2	2	1	1	2	3	2		1	3	3	2

VI Semester

ENTREPRENEURSHIP, MANAGEMENT AND FINANCE		
Subject Code	19EC61	CIE: 50
Number ofLecture Hours/Week	3 Hrs. (Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
CREDITS- 3:0:0:3		

Course objectives:

- The Meaning, Functions, Characteristics, Types, Role and Barriers of Entrepreneurship, Government Support for Entrepreneurship
- Management – Meaning, nature, characteristics, scope, functions, role etc.
- Engineers social responsibility and ethics
- Preparation of Project and Source of Finance
- Fundamentals of Financial Accounting
- Personnel and Material Management, Inventory Control

Modules	Teaching Hours
Module-1	
ENTREPRENEUR : Meaning of Entrepreneur; Functions of an Entrepreneur; Characteristics of an entrepreneur , Types of Entrepreneur; Intrapreneurs – an emerging class ; Role of Entrepreneurs in economic development; Barriers to entrepreneurship, Government Support for Innovation and Entrepreneurship in India - Startup-India, Make-in-India, PMMY, AIM , STEP, BIRAC, Stand-up India, TREAD.	**08 Hours**
Modules-2	
MANAGEMENT: Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management, Roles of Management, Levels of Management, Henry Fayol - 14 Principles to Management, Engineers Social responsibility and Ethics.	**08 Hours**
Modules-3	
PREPARATION OF PROJECT AND SOURCE OF FINANCE: PREPARATION OF PROJECT: Meaning of project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; SOURCE OF FINANCE: Long Term Sources(Equity, Preference, Debt Capital, Debentures, loan from Financial Institutions etc) and Short Term Source(Loan from	**08 Hours**

commercial banks, Trade Credit, Customer Advances etc.	
Modules-4	
FUNDAMENTALS OF FINANCIAL ACCOUNTING: Definition, Scope and Functions of Accounting, Accounting Concepts and Conventions: Golden rules of Accounting, Final Accounts - Trading and Profit and Loss Account, Balance sheet.	**09 Hours**
Modules-5	
PERSONNEL MANAGEMENT, MATERIAL MANAGEMENT AND INVENTORY CONTROL: PERSONNEL MANAGEMENT: Functions of Personnel Management, Recruitment, Selection and Training, Wages, Salary and Incentives. MATERIAL MANAGEMENT AND INVENTORY CONTROL: Meaning, Scope and Objects of Material Management. Inventory Control- Meaning and Functions of Inventory control; Economic Order Quantity(EOQ) and various stock level (Re-order level, Minimum level, Maximum level, Average level and Danger level)	**09 Hours**

Course objectives:

- The Meaning, Functions, Characteristics, Types, Role and Barriers of Entrepreneurship, Government Support for Entrepreneurship
- Management – Meaning, nature, characteristics, scope, functions, role etc.
- Engineers social responsibility and ethics
- Preparation of Project and Source of Finance
- Fundamentals of Financial Accounting
- Personnel and Material Management, Inventory Control

Question paper pattern: The question paper will have ten questions.
Each full question consists of 20marks.
There will be 2 full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Financial Accounting -B S RAMAN- United Publishers Manglore, Maheswar S N &Maheswari S K-Vikas Publishing House.
2. Management & Entrepreneurship- K R Phaneesh- Sudha Publications, ProfManjunatha& Amit kumar G – laxmi Publication, VeerbhadrappaHavina l-New Age International Publications.
3. Principles of Management First Edition (English, G. Murugesan), Laxmi Publications – New Delhi.

4. Industrial Organization & Engineering Economics-T R Banga & S C Sharma- Khanna Publishers, Dehli.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EC61	**CO1**	Develop Entrepreneurship skills.
	CO2	Apply the concepts of management and Engineers Social responsibility & Ethics practice.
	CO3	Prepare project report & choose different Source of Finance.
	CO4	Apply Fundamentals of Financial Accounting and interpret the final accounts.
	CO5	Apply personnel management skills, Material and inventory control Techniques.

Subject with code: 19ECHU61: ENTREPRENEURSHIP, MANAGEMENT AND FINANCE

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1																
CO2																
CO3																
CO4																
CO5																

ANTENNA AND WAVE PROPOGATION		
Subject Code	19EC62	CIE: 50
Number ofLecture Hours/Week	4 Hrs. (Theory)	SEE: 50
Total Number of Lecture Hours	52	SEE Hours: 03
CREDITS- 4:0:0:4		
Modules		**Teaching Hours**
Module-1		
Introduction to Antenna: Principle of radiation, isotropic radiator, radiation resistance, radiation pattern, beam width, bandwidth, directivity, gain, effective length of an antenna, relationship between gain and radiating efficiency, power gain, Frii's transmission formula.		**10 Hours**
Module-2		
Antenna arrays: Point sources, two element arrays of equal amplitude and same phase,equal amplitude and opposite phase and unequal amplitude and any phase, broad side and end fire arrays, multiplication of patterns, Binomial arrays, Effect of earth on vertical pattern Antenna Measurement: Methods of measuring impedance, field pattern, gain and directivity.		**10 Hours**
Modules-3		
Antenna Types: Yagi-Uda antenna, folded dipole antenna, parabolic reflectors, loop antenna, log periodic antenna, Helical antenna, horn antenna, patch antenna, slot antenna, lens antenna		**11 Hours**
Modules-4		
Radio wave propagation: Introduction, Radio waves, fundamental equation for free space propagation, modes of wave propagation, structure of atmosphere Ground wave propagation: Salient features, Field strength of ground wave at a distance, Attenuation characteristics of ground wave propagation		**10 Hours**
Modules-5		
Space wave propagation: Field strength relation for surface wave, miscellaneous aspects of space wave propagation, Radio Horizon, duct propagation, Atmospheric effects on space wave propagation Ionospheric wave propagation: characteristic parameters of wave propagation, critical frequency, maximum usable frequency, Actual height and virtual height, ray path and skip distance.		**11 Hours**
Question paper pattern: The question paper will have ten questions. Each full question consists of 20marks.		

There will be 2 full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. John D Kraus, Antennas, Third Edition, McGrawHill
2. Jordan and Balmain, Electromagnetic waves and radiating systems, Second Edition, PHI
3. K D Prasad, Antenna and Wave propagation, Satyaprakashan Publishers, 2012.
4. C A Balanis, Antenna theory analysis and design, Third Edition, Wiley

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EC62	**CO1**	Analyze the various characteristic parameters of antennas.
	CO2	Analyze antenna arrays and determine gain, directivity and radiation pattern.
	CO3	Illustrate the construction and working of different types of antennas.
	CO4	Determine the effects of atmosphere on ground wave propagation.
	CO5	Determine the effects of atmosphere on space wave and ionospheric wave propagation.

19EC62: Antenna and Wave propagation

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Analyze various parameters of antennas.	3	2						1		1		1	3		
CO2	Analyze antenna arrays and determine gain, directivity and radiation pattern.	3	3	2	2				1		1		1	3	2	2
CO3	Illustrate the construction and working of different types of antennas.	3	2	2	2				1		1		1	3	2	2
CO4	Determine the effects of atmosphere on ground wave propagation.	3	2	2	2				1		1		1	3	2	3
CO5	Determine the effects of atmosphere on space wave and ionospheric wave	3	2	2	2				1		1		1	3	2	3
Average		3	2.2	2	2				1		1		1	3	2	3.3

DIGITAL DESIGN USING VERILOG HDL		
Subject Code	19EC64	CIE: 50
Number of Lecture Hours/Week	03 Hrs. (Theory)	SEE: 50
Total Number of Lecture Hours	52	SEE Hours: 03
CREDITS- 4:0:0:4		
Modules		**Teaching Hours**
Module-1		
Overview of Digital Design with VerilogHDL: EvolutionofCAD,emergenceofHDLs, typicalHDL-flow, whyVerilogHDL? trends in HDLs. **HierarchicalModelingConcepts:** Top-downandbottom-updesignmethodology, differences between modules andmoduleinstances,partsofasimulation, designblock,stimulusblock.		**10 Hours**
Modules-2		
Basic Concepts: Lexical conventions, datatypes, system tasks, compiler directives. **Modules and Ports:** Module definition, port declaration, connecting ports, hierarchical name referencing.		**10 Hours**
Modules-3		
Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. **Dataflow Modeling:** Continuous assignments, delay specification, expressions, operators, operands, operator types.		**11 Hours**
Modules-4		
Behavioural Modeling: Structured procedures, initial and always, blocking and non blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks. **Tasks and Functions:** Differences between tasks and functions, declaration, invocation, automatic tasks and functions.		**11 Hours**
Modules-5		
Useful Modeling Techniques: Procedural continuous assignments, overriding parameters, conditional compilation and execution, useful system tasks. **Logic Synthesis with Verilog:** Logic Synthesis, Impact of logic synthesis, Verilog HDL Synthesis, Synthesis design flow,		**10 Hours**

Verification of Gate-Level Netlist.	

Question paper pattern: The question paper will have ten questions.
Each full question consists of 20marks.
There will be 2 full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Course Objectives: After studying this course, students will be able to:

- Learn different Verilog HDL constructs.
- Familiarize the different levels of abstraction in Verilog.
- Understand Verilog Tasks and Directives.
- Understand timing and delay Simulation.
- Understand logic synthesis using Verilog.

Text Books:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis",PearsonEducation, Second Edition.

Reference Books:

1. Donald E. Thomas, Philip R Moorby, 'The Verilog Hardware Description Language", Springer Science+ Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)	Blooms Level
	CO1	Develop Verilog programs in gate, dataflow (RTL) and behavioral levels of Abstraction.	L1,L2,L3
	CO2	Analyse the working of modules and port declarations.	L1,L2,L3
	CO3	Develop programs to demonstrate gate level and data flow modelling.	L1,L2,L3
	CO4	Develop programs using Verilog tasks, functions and directives.	L1,L2,L3,L4
	CO5	Perform timing and delay simulation and interpret the various constructs in logic synthesis.	L1,L2,L3

19EC63: Digital design using Verilog HDL

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Identify different styles of Verilog hardware description languages (HDL).	2	3	2	2			2				2	3	2	2	3
CO2	Design digital circuits using data flow description.	2	3	3	3			2				2	3	3	2	3
CO3	Design digital circuits using behavioral description	3	3	3	3			2				3	3	3	3	3
CO4	Design digital circuits using switch level description	2	3	3	3			3				3	3	3	3	3
CO5	Implement RTL models on FPGAs and Testing and Verification	2	3	3	3			2				3	3	2	2	3
	Average	2.2	3	2.8	2.8			2.2				2.6	3	2.6	2.4	3

Data Structures and Object-Oriented Programming using C++		
Subject Code	19EC64	CIE: 50
Number ofLecture Hours/Week	03 Hrs. (Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
CREDITS- 3:0:0:3		
Modules		**Teaching Hours**
Module-1		
PRINCIPLES OF OBJECT-ORIENTED PROGRAMMING: Introduction, Tokens, Expressions, control Structures, Functions in C++, parameters, Template function, classes and objects, Template class, constructors and destructors, operators overloading and type conversions.		**09 Hours**
Modules-2		
ADVANCED OBJECT-ORIENTED PROGRAMMING: Inheritance, Extending classes, Pointers, Virtual functions and polymorphism, File Handling Templates, Exception handling, Dynamic memory allocation.		**08 Hours**
Modules-3		
DATA STRUCTURES: Data Representation, Introduction, Linear list, Array representation, Linked representation, Arrays and Matrices **STACKS:**Definition, ADT, Array representation, Linked representation, Applications.		**08 Hours**
Modules-4		
QUEUES: Definition, ADT, Array representation, Linked representation, Applications. **SKIP LIST AND HASHING:** Dictionaries, Abstract Data Type, Linear list representation, Skip list representation, Hash Table Representation		**08 Hours**
Module-5		
BINARY TREES: Trees, Binary trees, properties of binary trees, representation of binary trees, common binary tree operations, binary tree traversal, ADT and class extensions. **PRIORITY QUEUES:**Definition, Abstract Data Type, Linear list, Heaps, leftist trees. Binary Search Tree, definitions, operations and implementation.		**9Hours**
Course Objectives: After studying this course, students will be able to: • To able to understand the features of C++ • To understand the different methods of organizing large amounts of data. To learn program in C++.		

- To efficiently implement the different data structures.
- To efficiently implement solutions for specific problems.

Question paper pattern: The question paper will have ten questions.
Each full question consists of 20marks.
There will be 2 full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions,selecting one full question from each module.

Text Books:

1. E. Balagurusamy, Object Oriented Programming with C++, McGraw Hill Company Ltd., 2007.
2. SartajSahni, Data Structures, Algorithms, and Applications in C++, McGraw Hill, Second edition.

Reference Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis
2. Michael T. Goodrich, Data Structures and Algorithm Analysis in C++, Wiley student edition, 2007.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19EC64	**CO1**	Apply various C++ constructs such as classes, functions, function overloading and dynamic memory management to develop programs.
	CO2	Develop programs using constructors, destructors, Inheritance to achieve code reusability and virtual functions to achieve run time polymorphism.
	CO3	Demonstrate program illustrations with data representations and data structures.
	CO4	Efficiently implement the concepts of Stacks, queues and Hashing.
	CO5	Analyze binary trees and priority queues and demonstrate the same with application programs.

19EC64: Data structures and Object Oriented programming using C++

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Examine the procedural and object oriented paradigm with concepts of parameters, classes, functions and objects.	3	3	2		2			1		1		1	3	2	2
CO2	Analyze the concept of overloading, virtual functions and polymorphism.	3	3	2		2			1		1		1	3	2	2
CO3	Illustrate data representations and data structures.	3	3	2	2	1			1		1		1	3	2	2
CO4	Implement Stacks, queues and Hash functions.	3	3	2	2	1			1		1		1	3	2	2
CO5	Analyze binary trees and priority queues.	3	3	3	3	2			1		1		1	3	2	2
		3	3	2.2	2.3	1.8			1		1		1	3	2	2

Internet of Things		
Subject Code	19EC651	CIE: 50
Number of Lecture Hours/Week	3 Hours (Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
CREDITS- 3:0:0:3		
Modules-1		**Teaching Hours**
Introduction & Overview of Internet of things, The Internet of things today and tomorrow, Vision of internet of things,An IoT architecture outline, Functional blocks of IOT,industrial IOT, IOT enabled Smart devices in market,Application areas for IOT,Challenges in IOT.Hardware and Software tools required for IOT application development, Overview of IOT based on Texas instruments Hardware platforms and IDE's for development. **Case Study:** SimpleLink ™ Wi-Fi ® Enabled Electronic Smart Lock.		**08 Hours**
Modules-2		
Internet/Web and Networking Basics, Introduction to internet & network topologies,TCP/IP protocol, TCP/IP Layers and their relative Protocols, IP addressing(IPV4),IP Address Classification & Subnetting, Local IP , Gateway IP and DNS,TCP & UDP Communication, Access point and Station model, Wireless networks, Encryption standards and signal strength of WiFi network, Overview of MAC Address, EnergiaWiFi Library API's for Texas Instruments Boards. **Case Study:** Connected microcontrollers essential to automation in buildings		**08 Hours**
Modules-3		
Web servers and Client Communication, Introduction to a Web server and its types, Role of servers over internet, Port numbers, Socket Communication, Wi-Fi Web Client, Client server Communication model with Example, Overview of HTTP protocol, HTTP based web server, Sensor interfacing with network, basics of HTML, Client and Server class API's.		**8 Hours**
Modules-4		
Cloud Communication in IOT,IOT device to cloud storage communication Model,need of Cloud services in IOT,Different Cloud storage services available today,Cloud Data processing and frame format,Role of Smart		**8 Hours**

phones in IOT, Examples on Home automation and Smart city development,Introduction to clouds like Temboo,Blynk,Pubnub etc. Case Study : Advances in bio-inspired sensing help people lead healthier lives.	
Modules-5	
IOT Platform and Application development, Remote Monitoring & Sensing, Remote Controlling,Application development using MQTT Protocol, Sensors and sensor Node and interfacing using Texas instruments Embedded target boards(TM4C12xx & CC31xx),IoT applications in home, infrastructures, Healthcare,Transport, buildings, security, Industries, and other IoT electronic equipments, Adapting IPV6 for IOT Requirement(overview).	**10 Hours**

Course objectives:

- This course imparts knowledge on, introduction to IOT, its complete architecture & internet Protocols involved to enable IOT communication over the network .
- The course also offers an introduction to Texas instrument's IoT platforms, end devices, networks and cloud services.
- Using case analysis , assignments ,Labs & projects students will acquire skills necessary to identify building blocks of an IOT application.

Question paper pattern:

• The question paper will have ten questions.
• Each full question consists of 20marks.
• There will be 2 full questions (with a maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text books:

1. Internet of Things: Converging Technologies for Smart Environments and Integrate Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers.
2. Embedded Ethernet And Internet Complete (Designing and Programming Small Devices for Networking)by Jan Axelson.
3. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach.
4. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur,AdamDunkels, Morgan Kuffmann.

References Book:

1. Internet of Things (IoT): A vision, architectural elements, and future directions JayavardhanaGubbia, Rajkumar Buyyab,∗, Slaven Marusic a, MarimuthuPalaniswami

2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

E books and online course materials:

1. http://www.ti.com/ww/en/internet_of_things/iot-overview.html.
2. http://energia.nu/reference/
3. http://www.ti.com/lit/ug/swru371b/swru371b.pdf
4. http://www.ti.com/lit/ug/swru371b/swru371b.pdf
5. http://www.ti.com/lit/ds/symlink/cc3100.pdf
6. http://www.ti.com/wireless-connectivity/simplelink-solutions/overview/overview.html.
7. https://www.hivemq.com/blog/mqtt-essentials-part2-publish-subscribe.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Identify issues and design challenges in IoT applications.
	CO2	Analyze various network topologies and relative internet protocols
	CO3	Analyze the role of web server and develop communication models
	CO4	Develop applications to illustrate cloud communication in IOT
	CO5	Develop case studies to demonstrate IOT based applications

19EC651: Internet of Things

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Identify issues and design challenges in IoT applications.	2	3	2	2			2				2	3	2	2	3
CO2	Analyze various network topologies and relative internet protocols	2	3	3	3			2				2	3	3	2	3
CO3	Analyze the role of web server and develop communication models	3	3	3	3			2				3	3	3	3	3
CO4	Develop applications to illustrate cloud communication in IOT	2	3	3	3			3				3	3	3	3	3
CO5	Develop case studies to demonstrate IOT based applications	2	3	3	3			2				3	3	2	2	3
Average		2.2	3	2.8	2.8			2.2				2.6	3	2.6	2.4	3

Electromagnetic Interference and Electromagnetic Compatibility		
Subject Code	19EC652	CIE: 50
Number of Lecture Hours/Week	03 Hrs. (Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
CREDITS- 3:0:0:3		
Modules		**Teaching Hours**
Module-1		
Importance of EMI and EMC, Introduction to radiated and conducted emissions testing and limits, Electromagnetic field theory: Description of electromagnetic disturbances, classification based on frequency, transmission and character, Unintentional antennas: Near field vs far field, pre-compliance testing.		**08 Hours**
Module-2		
Coupling mechanisms: Current loops, choosing a PCB stack up, Differential mode and common mode noise in digital circuits: Decoupling capacitor selection, values & resonant frequencies, Decoupling capacitor placements & routing: Demonstration, Dielectrics, Vias placement, Return paths.		**08 Hours**
Modules-3		
Techniques to optimize power delivery network, Reduction techniques: Reducing internal EMI, Introduction to grounding, EMI filter circuits, Insertion loss EMI filter design, Cable radiation and interference, EM coupling wiring layout and PCB design considerations, shielding-coaxial cables, shielding of equipment, Component placement and zoning for optimal EMI performance in mixed signal circuits.		**09 Hours**
Modules-4		
Introduction to signal integrity and EMI, Impedance mismatches, Reflections, vias and manufacturing effects, Termination methods and routing topologies, Crosstalk and guarding, causes of EMI from high speed digital circuits., SMPS design for low conducted emissions, need for Shielding, Analysis using logic analyzer.		**08 Hours**
Modules-5		
Introduction to IEEE Standards used, EMI Measurement: EMI measuring instruments, basic terms, spectrum analyzers, EMC standards, EMI testing equipment, EMI in power electronics equipment: EMI from power semiconductor devices, conducted and radiated noise.		**09Hours**
Question paper pattern: The question paper will have ten questions. Each full question consists of 20marks. There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics		

under a module. The students will have to answer 5 full questions, selecting one full question from each module.
Reference Books: 1.Electromagnetic Compatibility Design Guide", Tecknit 2. Noise Reduction Techniques In Electronic System: H.W.Ott 3. EMI Control Methodology and Procedures: Donald.J. White 4. New Dimensions in Shielding, Robert B. Cowdell, IEEE transactions on ElectromagneticCompatibility, 1968 March

Course outcomes: **On completion of the course, the student will have the ability to:**		
Course Code	**CO #**	**Course Outcome (CO)**
19EC652	**CO1**	Analyze different types of electromagnetic distribution in electric and electronicdesign.
	CO2	Mitigate common mode and differential mode noise in digital circuits.
	CO3	Apply reduction techniques to reduce EMI problems and optimize power delivery.
	CO4	Analyze signal integrity against impendence mismatch, crosstalk and guarding in high speed digital circuits.
	CO5	Implement IEEE EMI standards in electric and electronic design.

19EC652: Electromagnetic Interference and Electromagnetic Compatibility

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Analyze different types of electromagnetic distribution in electric and electronic design.								1		1		1			
CO2	Mitigate common mode and differential mode noise in digital circuits.								1		1		1			
CO3	Apply reduction techniques to reduce EMI problems and optimize power delivery.								1		1		1			
CO4	Analyze signal integrity against impendence mismatch, crosstalk and guarding in high speed digital circuits.								1		1		1			
CO5	Implement IEEE EMI standards in electric and electronic design.								1		1		1			
Average									1		1		1			

JAVA PROGRAMMING		
Subject Code	**19EC653**	**CIE: 50**
Number of Lecture Hours/Week	**3 (Theory)**	**SEE: 50**
Total Number of Lecture Hours	**42**	**SEE Hours: 03**
CREDITS- 3:0:0:3		
Course Objectives: • The course introduces Java and its applications • Gives an insight into class, objects and methods. • Gives an introduction to inheritance, packages and exception handling. • Imparts knowledge regarding multithread programming.		
Modules-1		**Teaching Hours**
Introduction to JAVA: Overview of JAVA, Java applications, JDK, Compiling JavaProgram, Java Interpreter, Byte code, JVM, Simple JAVA Programs. Primitive, non-primitive data types, Type casting, Arrays and strings. **Operators & Expressions:** Arithmetic operators, Bitwise operators, Relational Operators,Logical Operators, The Assignment Operators, The? : operators, Operator precedence; Logical expression; Control statements, Selection statements, Iteration statements, Jump statements		**08 Hours**
Modules-2		
Class, objects, Methods: Classes in Java, Class fundamentals, Super classes, Constructors; Creating instances of class; Methods; Method overloading; **Inheritance:** Simple, Multiple and multilevel inheritance, overriding, overloading, usingabstract classes, using final with inheritance.		**09 Hours**
Modules-3		
Packages: Creating package, Access package, importing package; defining Interfaces, implanting interfaces. **Exception Handling:** Exception type, Multiple catch statements, uncaught exceptions, usingtry and catch block, Nested try statements, Multiple catch statements.		**08 Hours**
Modules-4		
Event Handling: Event handling mechanisms, The delegation event model, event classes, source of events, Event listener interfaces. **Multithread Programming :** Java thread model, thread priorities, Synchronization,		**08 Hours**

Messaging, thread class and runnable interface, main thread, creating a thread, multiple threads, stopping and blocking a thread, Thread life cycle, thread methods, thread exceptions	
Modules-5	
Applet Programming : The Applet Class: Applet basics, Two types of Applets; Applet Architecture; An Applet skeleton; Applet lifecycle, Simple Applet display methods; Requesting repainting; Using the Status Window; Designing the web page, The HTML APPLET tag; Adding applet to HTML File, Passing parameters to the APPLETS; getDocumentbase() and showDocument(), The AudioClip Interface; The AppletStub Interface; Output to the Console. **Managing I/O Files in JAVA:** Stream classes, byte stream classes, character stream classes,other I/O classes. I/O exceptions, Reading writing character, Reading writing bytes.	**9 Hours**

Question paper pattern:

• The question paper will have ten questions.
• Each full question consists of 20marks.
• There will be 2 full questions (with a maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions,selecting one full question from each module.

Text books:

1. Java the Complete Reference – Herbert Schildt, 7th Edition, Tata McGraw Hill, 2007.
2. Programming with Java 4th Edition – E. Balaguruswamy, Tata McGraw Hill.

Reference Books:

1.Introduction to Java Programming: Y. Daniel Liang, 6th Edition, Pearson Education, 2007. Wesely,2005.
2.Introduction to Java Programming: Y. Daniel Liang, 6th Edition, Pearson Education, 2007.

E books and online course materials:

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Demonstrate the object oriented programming paradigm using JAVA.
	CO2	Implement inheritance, dynamic polymorphism and packages using class and objects.
	CO3	Implement Exception handling mechanism using JAVA Programming principles.
	CO4	Implement event handling and Multithread programming techniques
	CO5	Implement applets and understand the IO streams

19EC653: Java Programming

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Analyze the object-oriented programming paradigm using JAVA.	3	2	2		2							1	3	3	2
CO2	llustrate inheritance, dynamic polymorphism and packages using class and objects.	3	3	3		3							1	3	3	2
CO3	Develop applications based on exception handling mechanism.	3	3	3		3							2	3	3	2
CO4	Analyze event handling and Multithread programming techniques.	3	3	3		3							2	3	3	2
CO5	Analyze applets and IO streams.	3	3	3		3							3	3	3	2
		3	2.8	2.2		2.8							2.2	3	3	2

DIGITAL SYSTEM DESIGN USING VERILOG HDL LAB		
Subject Code	19ECL61	CIE: 50
Number ofLecture Hours/Week	02 Hours (Practical)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
CREDITS- 0:0:2:1		

1. Write Verilog code to realize all the basic and universal logic gates.
2. Write Verilog code to design of combinational circuits.
3. Write Verilog code to describe the function of a 1-bit full adder/Subtractor using all three modeling styles.
4. Write Verilog code for a 4-bit Adder/ subtractor using the module defined in question 3 as a component.
5. Write Verilog code to model a 8, 16 and 32 bit ALU.
6. Write Verilog code to design SR, JK, D and T flip flops and also master slave JK flip flop.
7. Write Verilog code to design a code converter.
8. Write Verilog code to design 4 bit binary, hexadecimal and BCD counter.
9. Write Verilog code to design 4 bit bidirectional shift register.
10. Design of real time applications for interfacing with external world.

Course Objectives: After studying this course, students will be able to:

- Design different combinational circuits in Verilog.
- Design flip flops in Verilog.
- Design registers in Verilog.
- Design of real time applications for interfacing with external world.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and will be evaluated for 85% of the total marks.

Course outcomes: **On completion of the course, the student will have the ability to:**		
Course Code	**CO #**	**Course Outcome (CO)**
19ECL61	**CO1**	Realize the fundamental digital logic circuits using various Verilog HDL descriptions and implement on FPGA.
	CO2	Design and develop combinational logic circuits using Verilog HDL and implement on FPGA.
	CO3	Analyze and verify using Verilog various flip flops and implement on FPGA.
	CO4	Develop and design counters and shift registers to implement on FPGA using Verilog.
	CO5	Develop Verilog HDL descriptions for real time applications.

19ECL61: DIGITAL SYSTEM DESIGN USING VERILOG HDL LAB

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Realize digital logic gates using various verilog HDL descriptions and implement on FPGA.	3		2						2			3	2		
CO2	Design combinational logic circuits using Verilog HDL and implement on FPGA.	3	3	3	2	2				2			3	3	2	
CO3	Analyze and implement various flip flops using verilog and test on FPGA.	3	3	3	2	2				2			3	3	2	
CO4	Design counters and shift registers and implement on FPGA using verilog.	3	2	3	3	3				2			3	3	3	3
CO5	Implement Verilog HDL descriptions for real time applications.	3	3	3	2	3				3			3	3	3	3
Average		3	3	2.8	2.25	2.5				2.2			3	2.8	2.5	3

DATA STRUCTURES USING C++ LAB		
Subject Code	19ECL62	CIE: 50
Number of Lecture Hours/Week	02 Hours (Practical)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
CREDITS- 0:0:2:1		

1. Develop C++ program that uses a function to perform the following
   i. Create a node
   ii. Implement a singly/doubly/circularly linked list of Integers
   iii. C++ program for traversal of a linked list
   iv. Find nth node in linked list
   v. Insert/Delete elements in linked list. Display the contents of the list after Insertion/deletion
2. Develop C++ programs to perform the following with stacks
   i. Implement stack using linked list
   ii. Implement stack using two queues
   iii. Implement simple stack operations to find min elements
   iv. Add/ delete elements (push and pop) from stack
   v. Solve the tower of Hanoi problem using recursion
   vi. Convert a given infix expression into postfix expression using stack.
3. Develop C++ programs to perform the following on Queues
   i. Array implementation of queue
   ii. Implement queue using linked list
   iii. Implement queue using two stacks
   iv. Implement circular queue
   v. Implement doubly ended queue
   vi. Implement double ended queue ADT using an array using a singly/doubly linked list.
   vii. find front and rear in a linked queue
4. Write a C++ program that uses function template to perform the following,
   i. Build a binary tree
   ii. Traverse the tree in inorder/ preorder/ postorder
   iii. Program to implement insertion/deletion from binary tree.
   iv. Program to check binary tree is complete or not
   v. program to find height of tree
5. Develop and implement an expression tree for a given valid postfix expression and evaluate the expression tree.
6. Write a C++ program that uses function template to perform the following,
   i. Implement heap
   ii. Implement Min/Max Heap/Binary heap

iii. Search for a key element in a list of sorted elements using binary search.

Course Objectives: This course enables the students to

• Develop and implement Linear data structures and their applications such as stacks, queues using static memory allocation.

• Develop and implement Linear data structures such as linked lists using dynamic memory allocation.

• Explore the applications of linked lists, develop and implement them.

• Develop and implement Non-Linear data structures such as trees and their applications.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and will be evaluated for 85% of the total marks.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19ECL62	**CO1**	Apply the knowledge of linked lists to design and develop solutions to given problems.
	CO2	Design and develop Linear data structures like Linked Lists using dynamic memory allocation technique.
	CO3	Apply the knowledge of linked lists to design and develop solutions to given problems.
	CO4	Design and develop Linear data structures like Stack, Queue using memory allocation techniques and explore their applications.
	CO5	Apply the knowledge of dynamic memory allocation technique to develop and implement non-linear data structures like Trees, Heaps and their applications.

19ECL62: Data structure using C++ Lab

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Develop program and Implement singly and doubly linked list.	2	2	2										2	2	1
CO2	CO2: Write program to implement various stack operations.	2	2	2										2	2	1
CO3	CO3: Write program to create binary search tree and implement operations on binary tree	2	2	2										2	2	
CO4	Implement searching and sorting algorithms.	3	2	3										2	2	
CO5	Develop program to perform hashing operations and tree traversal.	2	2	2										2	2	
	Average	2.2	2	2.2										2	2	1

MINI PROJECT			
Subject Code	196ECL63	CIE	50
Number of Hours/Week	02 Hours	SEE	50
Total Number of Lecture Hours	--	SEE Hours	03
CREDITS –01			

Course objectives: This course will enable students to:

- Improve the practical skills
- Collect the information of project
- Analyze and select appropriate method
- Plan and implement project
- Document and present the project

Each batch comprising of two to four students shall identify mini project related to the curriculum of study.

Students are supposed to carry out the following during the semester

1. Selecting the project which is having some functionality.
2. Collect the information about project
3. Develop, test and implement project
4. Document the work.

Each group shall submit a project report at the end of sixth semester. The project report should contain Literature survey, Design, Engineering documentation and Test results. Innovative design concepts, Reliability considerations, Its usefulness in practice taken care of in the project shall be given due weightage.

Guidelines for Evaluation:

1. Attendance and regularity,
2. Understanding and involvement.
3. Level of completion, Originality and Functionality.
4. Project report.

Graduate Attributes (as per NBA):

• Engineering Knowledge.
• Problem Analysis.
• Design / development of solutions (partly).
• Interpretation of data.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot

with code: 19ECL63:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PS 2
mplement the layout/schematic Design) .	3	3	2	1	3				3		3	1	2	2
Testing of the individual modules.	2	2			2				3			1	2	2
Record the results and analyze.	2	3			2		2		3			1	2	2
Perform the review									3	3				
Demonstration of the work done Viva Voce)	1	1		1	2	3	3	3	3	3	3	1	2	2