Date: 28th March 2023

To,
The Director,
K K Wagh Institute of Engineering Education and Research, Nashik

Subject: SYBTech E&TC (2022 pattern) Course Syllabus

As per the guidelines received from Dean, Academics and ETT Committee, we have finalized the syllabus for SYBTech (Electronics and Telecommunication). The same was presented in the BoS E&TC Meeting held on 23rd March 2023. The BoS members have accepted and approved the same.

Please find the copy of the same herewith for further processing.

Thanking you,

Prof. Dr D M Chandwadkar
Professor and HoD E&TC
Chairman, BoS E&TC
K K Wagh IEER, Nashik

K. K. Wagh Institute of Engineering Education and Research, Nasik
(Autonomous w. e. f. A.Y.2022-23)
Course Structure: Semester – III S. Y. B. Tech (E&TC)

Course Code	Course Type	Title of Course	Teaching Scheme Hrs./week			Assessment Scheme of Marks							Credits			
			TH	TU	PR	In Sem	End Sem	CCE	TU/ TW	PR	OR	Total	TH	TU	PR / OR	Total
SMH22401	BSC	Applied Mathematics –III	3	1	-	20	60	20	25	-	-	125	3	1	-	4
ET222002	DCC	Embedded Systems	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222003	DCC	Digital System Design using HDL	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222004	ESC	Electrical Circuits and Machines	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222005	DCC	Electronic Circuits	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222006	LHSM	UHV-II	1	-	-	-	-	-	25	-	-	25	1	-	-	1
ET222007	DCC	Lab work in Electrical and Electronic Circuits	-	-	2+2	-	-	-	25	50	-	75	-	-	2	2
ET222008	DCC	Lab work in Digital System Design using HDL	-	-	2	-	-	-	25	25	-	50	-	-	1	1
ET222009	ESC	Lab work in Embedded Systems	-	-	2	-	-	-	25	25	-	50	-	-	1	1
ET222010	PSI	Electronic Workshop	-	-	2	-	-	-	25#	-	-	25	-	-	1	1
		Total	**16**	**1**	**10**	**100**	**300**	**100**	**150**	**100**	-	**750**	**16**	**1**	**5**	**22**

Assessment of 25 marks will be done considering consistent progress of work throughout the semester.

K . K. Wagh Institute of Engineering Education and Research, Nasik
(Autonomous w. e. f. A.Y.2022-23)
Course Structure: Semester – IV S. Y. B. Tech (E&TC)

Course Code	Course Type	Title of Course	Teaching Scheme Hrs./week			Assessment Scheme of Marks						Credits			
			TH	TU	PR	In Sem	End Sem	CCE	TU/ TW	PR	OR	Total	TH	TU	PR /OR	Total
ET222011	DCC	Digital Signal Processing	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222012	DCC	Communication Engineering	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222013	DCC	VLSI Design and Technology	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222014	DCC	Control Systems	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222015	LHSM	Industrial Management	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222016	AC	Professional Communication and Aptitude Technics/ Foreign Language 1	1	-	-	-	-	-		-	-	-	-	-	-	-
ET222017	DCC	Lab work in DSP and CS	-	-	2+2	-	-	-	25	50	-	75	-	-	2	2
ET222018	DCC	Lab work in VLSI	-	-	2	-	-	-	25	25	-	50	-	-	1	1
ET222019	DCC	Lab work in Communication	-	-	2	-	-	-	25	25	-	50	-	-	1	1
ET222020	PSI	PBL	-	-	2	-	-	-	25 #	-	-	25	-	-	1	1
		Total	**16**	**-**	**10**	**100**	**300**	**100**	**100**	**100**	-	**700**	**15**	**-**	**5**	**20**

Assessment of 25 marks will be done considering consistent progress of work throughout the semester and Project Presentation at end of semester.

S. Y. B. Tech.(E&TC)
Pattern 2022 Semester: III
SMH222401: Name of Subject: Applied Mathematics-III

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week **Tutorial:01 hr/week**	**03** **01**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks** **TW: 25 Marks**

Prerequisite: - Differential and Integral calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Vector algebra and Algebra of complex numbers.

Course Objectives:
To make the students familiarize with concepts and techniques in Ordinary differential equations, Laplace transform, Fourier transform & Z-Transform, Vector Calculus and functions of a Complex Variable. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines

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

	Course Outcomes	Bloom's Level
CO1	Understand basic concept of L.D.E., Complex Variables, Fourier Series, Fourier Transform, Laplace Transform, Z-Transform, Vector differentiation & integration	2-Understanding
CO2	Apply concept of higher order linear differential equation to solve LDE of electrical circuits using appropriate techniques, perform contour integration in the study of electrostatics, signal and image processing.	3- Apply
CO3	Apply concept of Fourier series, Laplace transform, Fourier transform & Z-transform and its applications to continuous & discrete systems, signal & image processing and communication systems, apply vector calculus to electro- magnetic fields & wave theory.	3- Apply
CO4	Analyzing of electrical circuits and control systems by modeling and solving higher order LDE, Analyze Complex functions, conformal mappings,	4- Analyze
CO5	Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems. Analyze the vector fields and apply to electro- magnetic fields & wave theory	4 -Analyze

COURSE CONTENTS

Unit I	**Linear Differential Equations (LDE) and Applications**	**(08 hrs +2hrsTutorial)**	**COs Mapped - CO1, CO2, CO4,**

LDE of nth order with constant coefficients, Complementary Function, Particular Integral, General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's DE, Simultaneous and Symmetric simultaneous DE. Modeling of Electrical circuits			
Unit II	**Complex Variables**	**(08 hrs+ 2hrsTutorial)**	**COs Mapped - CO1, CO2,CO4**
Functions of a Complex variable, Analytic functions, Cauchy-Riemann equations, Conformal mapping, Bilinear transformation, Cauchy's integral theorem, Cauchy's integral formula and Residue theorem			
Unit III	**Fourier Series & Fourier Transform (FT)**	**(08 hrs+ 2hrsTutorial)**	**COs Mapped - CO1, CO3, CO5**
Fourier Series: Definition, Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Harmonic analysis, Parseval's identity and Applications to problems in Engineering. **Fourier Transform (FT):** Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses.			
Unit IV	**Laplace Transform (LT) & Z -Transform (ZT)**	**(08 hrs+ 2hrsTutorial)**	**COs Mapped -CO1, CO3,**
Laplace Transform: Definition of LT, Inverse LT, Properties & theorems, LT of standard functions,. Applications of LT for solving Linear differential equations. **Z -Transform (ZT):** Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations			
Unit V	**Vector Calculus**	**(08 hrs+ 2hrsTutorial)**	**COs Mapped CO1,CO3, CO5**
Vector Differentiation: Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities. **Vector Integration:** Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic field.			
Text Books			
1. B.V. Ramana, " Higher Engineering Mathematics", Tata McGraw-Hill. 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi. 3. Advanced Engineering Mathematics,7e, by peter V.O'Neil(Thomson Learning)			
Reference Books			
1. Erwin Kreyszig ,"Advanced Engineering Mathematics" ,Wiley Eastern Ltd. 2. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics" (Volumes I and II), Pune Vidyarthi Griha Prakashan, Pune. 3. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).			

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: III
ET222002: Name of Subject: Embedded Systems

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week **Practical (ET222009) : 02 hrs/week**	**03** **01**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks** **Practical Exam (ET222009): 25 Marks** **TW (ET222009): 25 Marks**

Prerequisite Courses, if any: -Digital Electronics

Companion course, if any: Lab work in Embedded Systems

Course Objectives:

1. To learn design metrics of embedded system
2. To study features and architecture of 8 bit microcontroller
3. To learn peripherals of 8 bit microcontroller
4. To study software used in embedded system
5. To learn case studies of different embedded system

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

	Course Outcomes	Bloom's Level
CO1	Understand design metrics embedded system	2-Understand
CO2	Study architecture 8 bit microcontrollers	2-Understand
CO3	Interface different devices to 8 bit microcontroller	3-Apply
CO4	Apply software used in embedded system	3-Apply
CO5	Select hardware and software of embedded system	4-Analyse
CO6	Carry out experiments as an individual and in a team, comprehend and write a laboratory record and draw conclusions at a technical level.	5-Evaluate

COURSE CONTENTS

Unit I	**Embedded System Overview**	**(06 hrs)**	COs Mapped - CO1

Embedded System Introduction, Hardware and software architectures of ES, Design metrics(technical and techno- economical), Embedded Product Development life cycles, Development tool chain insights (GNU), guidelines for Selection of hardware and memory architecture programming

Unit II	**8-bit Microcontroller used in embedded system**	(07 hrs)	COs Mapped - CO2

8051 Architecture, Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing,

Assembly Language Instructions: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions (Jump), Bit manipulation instructions, simple assembly language programs

Unit III	**I/O port interfacing**	(08 hrs)	COs Mapped – CO3

Interfacing basic concepts(sourcing and sinking, specification and isolation),Interfacing of simple switch and LED to I/O ports to switch on/off LED with respect to switch status, Interrupt structure of 8051,serial communication in 8051.

Timers and Counters

Mode 1 and Mode 2 of timer, simple program using timer 1, simple program using timer 2.(Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode-2 on a port pin.)

Unit IV	**Software aspects of embedded systems**	(07 hrs)	COs Mapped - CO3, CO4

Programming Embedded C, OS used in embedded system

Real time OS:

Usage of Shared resources and related issues**,** Concept of RTOS, Types of RTOS, differences from GPOS, real time scheduling algorithms, commercial RTOS.

Unit V	**Case studies of embedded system:**	(06 hrs)	COs Mapped – CO3, CO4, CO5

Stepper motor control in half step mode, Stepper motor control in full step mode, DC motor control

Robotic Arm, Data acquisition system(DAS),Vending machine controller, Waveform generator

Text Books

1. Mahumad Ali Mazadi, —The 8051 microcontroller & embedded systems‖ 2nd Edition ,PHI
2. Frank Vahid and Tony Givargis, — Embedded System Design – A Unified hardware/ Software introduction 3rd edition, Wiley
3. Shibu K.V. "Introduction Embedded System", McGraw Hill

Reference Books

4. Dr. K.V.K.K. Prasad "Embedded Real-Time System:" Dreamtech
5. D. E. Simon "An embedded software primer" Pearson

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Three Assignments on unit-1, Unit-2, Unit-3 & 4	10
2	Unit Test (Unit- 1,2,3, 4 and 5)	05
3	LearniCo Test on Each Unit	05
	Total	**20**

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: III
ET222003: Name of Subject: Digital System Design using HDL

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week Practical (ET222008): 02 hrs/week	03 01	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks Practical Exam (ET222008): 25 Marks TW (ET222008): 25 Marks

Prerequisite Courses, if any: -Fundamentals of Electronics Engineering

Companion course, if any: Lab work in Digital System Design using HDL

Course Objectives: To make the students understand
1. To analyze logic processes and implement logical operations using combinational logic circuits.
2. The principles of logic design and use of simple memory devices, flip-flops, and sequential circuits.
3.Concepts of sequential circuits and to analyze sequential systems in terms of state machines
4.System design approach using VHDL program and statements
5. To understand VHDL program structure and be able to write VHDL programs in different modeling styles.

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

	Course Outcomes	Bloom's Level
CO1	Design and implement combinational logic circuits.	3-Apply
CO2	Design and implement sequential circuits	3-Apply
CO3	Design sequential circuits using Mealy, Moore state machines.	3-Apply
CO4	Understand structure of VHDL program and statements.	2-Understand
CO5	Design and test digital logic circuits using VHDL.	3-Apply

COURSE CONTENTS

Unit I	**Combinational Logic Design**	**(08 hrs)**	**COs Mapped - CO1, CO2, CO3**

Standard representation of logic function (SOP, POS), Minimization of logic functions for min terms, Minimization of logic functions for max terms, Design examples: half adder, full adder, subtractor using adder Codes and code converters-BCD, Gray, XS-3, 7 Segment ,ALU design (using 7487) ,Digital Comparator, Parity checker, parity generator Multiplexer and Demultiplexer Quine McCluskey method (only for advanced learners)

Unit II	**Sequential Logic Design**	**(07 hrs)**	**COs Mapped - CO1, CO2, CO3**

Flip flops-1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops. Conversion of flip flops.
Application of Flip flops: Registers, Shift registers, Counter part1: Counters (ring counters, twisted ring counters), Counter part 2: Ripple counters, up/down counters Counter part 3: Synchronous counters, Modulo counter Issues in sequential design: Lock out, Clock Skew, Clock jitter. Effect on synchronous designs.

Unit III	**State Machines**	**(07 hrs)**	**COs Mapped - CO1, CO2**

Introduction to state machines, Mealy and Moore machine, State machine design, State diagram, state table, State reduction, State assignment, Design of Sequence detector, Design of Sequence generator, ASM chart and realization for sequential circuits

Unit IV	**Introduction to HDL**	**(08 hrs)**	**COs Mapped - CO1, CO2, CO5**

Introduction to Logic Families TTL and CMOS, VLSI Design Flow, Types of Design Entry- Schematic, State flow, HDL-Verilog and VHDL, Basic elements of VHDL-Entity, Architecture, VHDL Objects-constants, variables, signals, VHDL Data types- scalar, compound, VHDL Operators- Logical, relational, arithmetic, shift
VHDL Statements- Concurrent Statements-Process, Block, Sequential statements (If, case, loop, Exit, Assert, Wait, Null etc.)

Unit V	**VHDL Modeling styles**	**(06 hrs)**	**COs Mapped - CO1, CO2, CO5**

Modelling styles-Dataflow Modelling, Behavioural Modelling and Structural Modelling, Full adder program using Dataflow, Behavioural and Structural Modelling, Test Bench, Simulation, Synthesis
VHDL code for counter and its test bench, VHDL code for ALU and its test bench, VHDL code for Shift register and its test bench

Text Books

1. R.P. Jain, “Modern Digital Electronics”, Tata McGraw Hill Publication, 3 rd Edition
2. M. Morris Mano, “Digital Logic and Computer Design”, Prentice Hall of India, 4 th Edition
3. Douglas Perry, "VHDL", TMH, 4th Edition, 2002
4. Stephen Brown & Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", TMH.
5. Nazeih M.Botros, "HDL Programming (VHDL and Verilog)", Dreamtech Press (Available through John Wiley – India and Thomson Learning), 2006 Edition

Reference Books

1. Anand Kumar, “Fundamentals of Digital Circuits”, Prentice Hall of India, 1st Edition
2. J. F. Wakerly, “Digital Design- Principles and Practices,” Pearson, 3rd Edition.

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Three Assignments on unit-1, Unit-2, Unit-3 , Unit-4 & 5	05
2	Simulation of circuits using any open source simulation software	10
3	LearniCo Test on Each Unit	05
	Total	**20**

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: III
ET222004: Name of Subject: Electrical Circuits and Machines

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week Practical (ET222007): 04 hrs/week	03 01	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks Practical (ET222007): 50 Marks TW (ET222007): 25 Marks

Prerequisite Courses, if any: Fundamentals of Electrical Engineering

Companion course, if any: Lab work in Electrical and Electronics Circuits

Course Objectives:

1. To analyze simple DC and AC circuits with circuit simplification techniques.
2. To formulate and analyze driven and source free RL and RC circuits.
3. To formulate & determine network parameters for a given network.
4. To understand the constructional details, characteristics, features and application areas of various types of electric motors.

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

	Course Outcomes	Bloom's Level
CO1	Analyze the simple DC and AC circuit with circuit simplification techniques.	4-Analysis
CO2	Formulate and analyze driven and source free RL and RC circuits.	3-Apply, 2-Understand
CO3	Formulate & determine network parameters for given network and analyze the given network using Laplace Transform to find the network transfer function.	4-Analysis
CO4	Explain construction, working and applications of DC Machines / Single Phase & Three Phase AC Motors.	2-Understand
CO5	Explain construction, working and applications of special purpose motors & understand motors used in electrical vehicles.	3-Apply
CO6	Analyze and select a suitable motor for different applications.	4-Analysis

COURSE CONTENTS

Unit I	Basic Circuit analysis & Simplification Techniques	**(06 hrs)**	**COs Mapped - CO**
Network Analysis: Mesh Analysis of only simple AC circuits, Super mesh, Node and Super node analysis of DC circuits. Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer. (Analysis of simple DC circuits using all above techniques)			
Unit II	Transient Analysis of Basic RL, RC and RLC Circuits	**(08 hrs)**	**COs Mapped - CO**

Initial conditions, Driven RL and RC circuits, source free RL and RC circuits, properties of exponential response, Natural and Forced response of RL and RC circuits. Introduction to driven & Source free series RLC circuit. Over damped and Under damped series RLC circuit.

Unit III	Two Port Network Parameters and Functions	**(07 hrs)**	**COs Mapped – CO**

Terminal characteristics of network, Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters. Application of Laplace Transforms to circuit analysis, network functions for one port and two port networks, Interconnection of Two-Port Networks

Unit IV	DC Machines	**(06 hrs)**	**COs Mapped – CO**

DC generator : Construction, working principle, derivation of emf equation
DC Motor: Working principle, derivation of Torque equation, types, voltage equation & speed equation.
Basic characteristics & different methods of speed control of DC Shunt and Series motor, Power flow diagram of DC motor,
Need of starter, three point starters for DC shunt motor, applications of DC Motors.
Three phase Induction motors: Construction, working principle, types, concept of slip and torque equation, Torque-slip characteristics, Power flow diagram with numerical.
Single phase Induction motor: Construction, working principle, types and applications
Necessity of starters: speed control using V/f method, Applications.

Unit V	Special Purpose Motors	**(07 hrs)**	**COs Mapped – CO**

- Permanent Magnet DC motors (PMDC): Construction, Working and applications.
- BLDC Motor: Types, Construction, working principle and applications.
- Stepper Motor: Types, Construction, working principle, different modes of operation, applications.

Text Books

1. Ravish R Singh, “Network Analysis & Synthesis”, McGraw-Hill Education.
2. B.L. Theraja, A.K. Theraja, “Electrical Technology”, Vol II, AC & DC Machines, S. Chand

Reference Books

1. Electronic Devices and Circuits , David A. Bell, Oxford press
2. I.J Nagarath and D.P Kothari, “Electrical Machines”,Tata McGraw-Hill Publication 4th Edition.
3. William H. Hayt, Jack E. Kimmerly and Steven M. Durbin, “Electrical Circuit Analysis”, Tata McGraw Hill publication, 7th Edition.
4. V K Mehta and Rohit Mehta, “Principles of Electrical Machines”, S Chand Publications.
5. A K Babu, “Electric & Hybrid Vehicle”, Khanna Publishing.

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Five Assignments on unit-1, Unit-2, Unit-3, Unit-4 and Unit-5	10
3	Performance in Unit Tests	10
	Total	**20**

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: III
ET222005: Name of Subject: Electronic Circuits

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week Practical (ET222007) : 04 hrs/week	03 01	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks Practical (ET222007): 50 Marks TW (ET222007): 25 Marks

Prerequisite Courses, if any: Fundamentals of Electronics Engineering

Companion course, if any: Lab work in Electrical and Electronics Circuits

Course Objectives:

1. To make the students acquainted with semiconductor devices- MOSFET and Op-amp, their characteristics and operations.
2. To make them able to analyze and assess the performance of various circuits and applications.

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

	Course Outcomes	Bloom's Level
CO1	Analyze DC and AC circuits of MOSFET.	4-Analysis
CO2	Apply and explain the concepts of both positive and negative feedbacks in electronic circuits and their applications.	3-Apply, 2-Understand
CO3	Analyze and design the applications of op-amp for performing various operations.	6-Design 4-Analysis
CO4	Design and analyze the application of op-amp as an Active Filter.	6-Design 4-Analysis
CO5	Understand and compare the principles of various data conversion techniques. Also Analyze and assess the performance of linear and switching regulators, with their variants, towards applications in regulated power supplies.	3-Apply

COURSE CONTENTS

Unit I	**Basic MOSFET Applications**	**(06 hrs)**	**COs Mapped - CO1**
Introduction, E-MOSFET Common source circuit, DC Circuit analysis, Load line and modes of operation, MOSFET Applications: Switch, Digital logic gate, MOSFET CS small signal amplifier, Small signal equivalent circuit, parameters and analysis			
Unit II	**Feedback amplifiers and oscillators**	**(08 hrs)**	**COs Mapped - CO2**

Basic feedback concepts, Ideal feedback topologies, Voltage Amplifier and Transconductance amplifier, Current amplifier and Trans résistance amplifier, FET feedback amplifier, Stability of feedback circuits, Barkhausen criteria LC and RC oscillator, Hartley and Colpitts oscillators, Crystal Oscillator			
Unit III	**Applications and design of operational amplifier circuits**	**(07 hrs)**	**COs Mapped – CO3**
Introduction to operational amplifier, Summing averaging and scaling amplifier, Ideal and practical integrator, Ideal and practical differentiator, Difference amplifier, Instrumentation amplifier, Square and triangular wave generator, Zero crossing detector (ZCD)			
Unit IV	**Active filters**	**(06 hrs)**	**COs Mapped – CO4**
Introduction to filters, First and second order LPF: Design and applications, First and second order HPF: Design and applications, First and second order BPF: Design and applications, Wide and narrow band Butterworth filter: Design and applications, Notch and All pass filter: Design and applications			
Unit V	**Data converters and voltage regulators**	**(07 hrs)**	**COs Mapped – CO5**
Voltage to Current, Current to Voltage converters. , DAC: Resistor weighted and R-2R ladder DAC, SAR, Flash and dual slope , ADC Types / Techniques, Characteristics, block diagrams, Circuits, Specifications, Merits, Demerits, Comparisons, PLL: Block Diagram, Characteristics, phase detectors, Details of PLL IC 565 applications, Typical circuits, Block diagram of linear voltage regulator, IC 317 and IC337, Features and specifications, typical circuits, current boosting, Low Dropout Regulator (LDO). SMPS: Block diagram, Types, features and specifications, typical circuits buck and boost converter, PWM Generator ICs (IC 3524 or equivalent)			

Text Books

1. Electronic Circuit Analysis and Design, Donald Neaman, Tata McGraw Hill, 3rd Edition.
2. Op Amps and Linear Integrated Circuits, Ramakant A. Gaikwad, Pearson Education
3. Linear Integrated Circuits, Salivahanan and Kanchana Bhaskaran, Tata McGraw Hill.

Reference Books

1. Electronic Devices and Circuits , David A. Bell, Oxford press
2. Operational Amplifiers, George Clayton and Steve Winder, 5th Edition.
3. Linear Integrated Circuits, Bali , Tata McGraw-Hill, New Delhi
4. Electronic Devices and Circuits, David A. Bell, Oxford press.

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Five Assignments on unit-1, Unit-2, Unit-3, Unit-4 and Unit-5	10
3	Performance in Unit Tests	10
	Total	**20**

K.K. Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

S. Y. B. Tech. E&TC
Pattern 2022 Semester: III
ET222006: Name of Subject: UHV-2

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory : 01 hrs/week	**01**	**TW: 25 Marks**

Prerequisite Courses: NA

Course Objectives:

• To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

• To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

• To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

Course Methodology

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. The course is in the form of 28 lectures (discussions) and 14 practice sessions.
3. It is free from any dogma or value prescriptions.
4. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
6. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Course Outcomes: At the end of the course, the students will be able to

	Course Outcomes	**Bloom's Level**
CO1	**Evaluate** the significance of value inputs in formal education and start applying them in their life and profession	Evaluate-5
CO2	**Distinguish** between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	Distinguish-4
CO3	**Analyze** the value of harmonious relationship based on trust and respect in their life and profession	Analyze-4

CO4	**Examine** the role of a human being in ensuring harmony in society and nature.	Examine-4
CO5	**Apply** the understanding of ethical conduct to formulate the strategy for ethical life and profession.	Apply-3

COURSE CONTENTS

Unit 1: Introduction-Basic Human Aspiration, its fulfilment through All-encompassing Resolution
The basic human aspirations and their fulfilment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution

Unit 2: Right Understanding (Knowing)- Knower, Known & the Process
The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).

Unit 3: Understanding Human Being
Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self

Unit 4: Understanding Nature and Existence
A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self-awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).

Unit 5: Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living
Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence

Text Book

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course inHuman Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi.

Reference Books

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.

8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press
10. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Mode of Evaluation

Based on participation of student in classroom discussions/Self-assessment/Peer assessment/Assignments/ Seminar/Continuous Assessment Test/Semester End Exam
Socially relevant project/Group Activities/Assignments may be given importance in this course

Guidelines for Term work Assessment		
Sr. No.	**Components for Term work Assessment**	**Marks Allotted**
1	Assignments	20
2	Attendance (Above 95 % : 05 Marks, below 75% : 0 Marks)	5

S. Y. B. Tech. (E&TC) Pattern 2022 Semester: III ET222007: Name of Subject: Lab work in Electrical and Electronic Circuits		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 04 hrs/week	**02**	**PR: 50 Marks** **TW: 25 Marks**
Prerequisite Courses, if any: - Fundamentals of Electronics Engineering		
Companion course, if any: - Electronic circuits, Electrical circuits and machines		

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

	Course Outcomes	Bloom's Level (Cognitive domain)	Bloom's Level (Psychomotor domain)
CO1	Design, build and test the applications of op-amp for performing various operations.	6-Design	6-Adaptation
CO2	Implement and test the circuits for amplifier and voltage regulator applications.	3-Apply	4-Mechanism
CO3	Carry out experiments as an individual and in a team, comprehend and write a laboratory record and draw conclusions at a technical level.	5-Evaluate	3-Guided Response
CO4	Analyze simple AC/DC circuits, driven and source free RL and RC circuits.	4-Analyze	3-Guided Response
CO5	Formulate & determine network parameters for given network and analyze the given network using Laplace Transform to find the network transfer function.	5-Evaluate	4-Mechanism
CO6	Analyze characteristics of various types of motors and speed control techniques.	4-Analyze	1-Perception

List of Laboratory Experiments / Assignments

Sr. No.	Laboratory Experiments / Assignments (Group A)	CO Mapped
1	An amplifier to amplify audio signals is to be designed. Suggest the suitable FET amplifier configuration for the same. Also design and implement the circuit.	CO2, CO3
2	Design and simulate a circuit to generate audio frequency signals to be used in musical instruments.	CO1, CO3
3	The op-amp amplifier is to be operated at very high frequency. Suggest suitable op-amp for the same. Which parameter is important for this application? Measure that parameter for IC 741.	CO1, CO3

4	A radio signal is having high frequency noise. How will you design the circuit which will remove the high frequency noise having frequency greater than fa? Also build & test the circuit using Op-amp.	CO1, CO3
5	Most biomedical sensors generate tiny signals, such as blood pressure sensors, ultrasound transducers, polarized and non-polarized electrodes. Suggest and design a suitable amplifier using op-amp for this medical application. For example, in electrocardiography machines, or ECGs, which monitor the changes in the heart's dipole electric field. Also simulate the designed circuit.	CO1, CO3
6	Design, build & test a Square wave generator using op-amp. Suggest suitable circuit to produce triangular waveforms from square waveform.	CO1, CO3
7	An industrial motor requires the DC supply from 0V to 5 V. Design, implement and test the circuit for this application.	CO2, CO3
	List of Laboratory Experiments / Assignments (Group B)	
1	Determine the following using KVL, KCL, node, loop analysis and circuit simplification techniques: 1. Currents through various given branches. 2. Voltages across the given branches. 3. Power absorbed or delivered by a given component. (Analysis of simple DC circuits using all above techniques & Analysis of simple AC circuits using Mesh and Nodal analysis is expected) Verifying the results using appropriate simulator is expected: https://www.falstad.com/circuit/ OR https://www.tinkercad.com/dashboard?type=circuits&collection=designs OR http://vlab.amrita.edu/?sub=1&brch=75 OR any other equivalent	CO4
2	Formulate differential equation for RL and RC circuits and solve for current and voltages by determining initial conditions for driven and source free conditions.	CO4
3	Carry out the transient analysis and determine the voltage, current expressions for a given network involving RL, RC, RLC. (One problem statement on each combination, source free and driven RL, RC, series RLC network) Verifying the results using appropriate simulator is expected: https://www.falstad.com/circuit/ OR https://www.tinkercad.com/dashboard?type=circuits&collection=designs OR http://vlab.amrita.edu/?sub=1&brch=75 OR any other equivalent	CO4

4	Determine the Z, Y, h, ABCD parameters for a given network. Verifying the results using appropriate simulator is expected: https://www.falstad.com/circuit/ OR https://www.tinkercad.com/dashboard?type=circuits&collection=designs	CO5
5	Analyze the given network using Laplace Transform and find the network transfer function.	CO5
6	To study speed control of DC shunt motor using armature voltage and field current control method. Measure RPM and plot graph of speed versus armature voltage and field current. Virtual Lab Link: http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/index.php	CO6
7	To study No-load test and blocked rotor test on 3-phase induction motor. Virtual Lab Link: http://vem-iitg.vlabs.ac.in/	CO6
8	Torque- speed characteristic of 3 phase induction motor	CO6
9	To Study BLDC Motor Drive	CO6
10	To study operating modes of stepper motor.	CO6

Guidelines for Laboratory Conduction

1. Teacher will brief the given experiment to students, its procedure, observations calculation, and outcome of this experiment.
2. Apparatus and equipment required for the allotted experiment will be provided by the lab assistants using SOP.
3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistants.
4. After performing the experiment students will check their readings, calculations.
5. After checking they have to write the conclusion of the final result.

Guidelines for Student's Lab Journal

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.

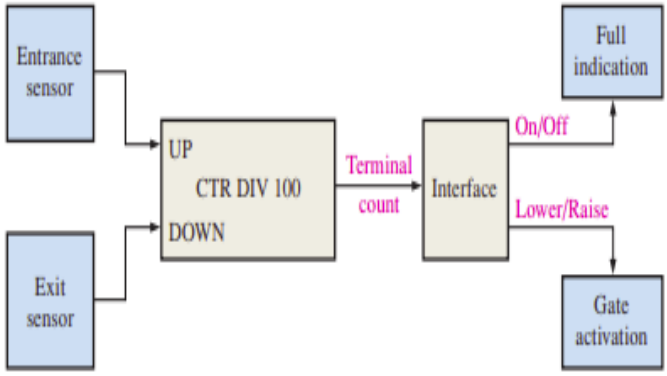
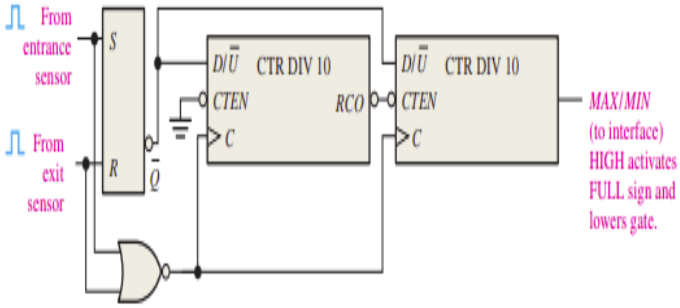
Guidelines for Teamwork Assessment

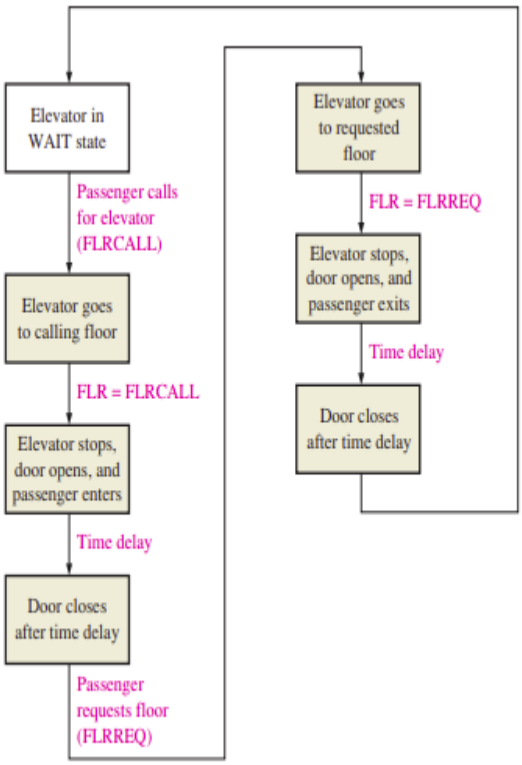
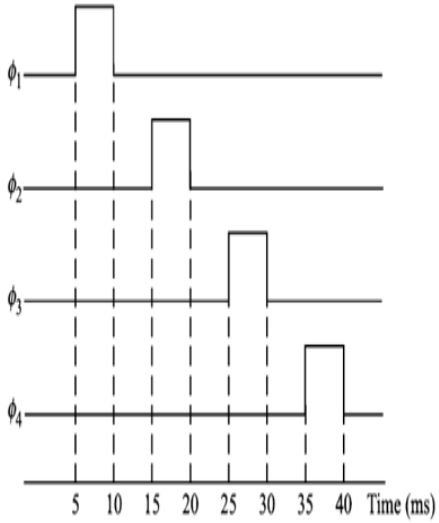
Each experiment from the lab journal is assessed for thirty marks based on three rubrics. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks

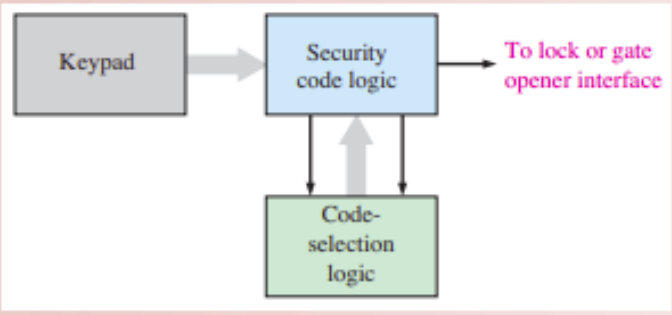
S. Y. B. Tech. (E&TC) Pattern 2022 Semester: III ET222008: Name of Subject: Lab work in Digital System Design using HDL		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 02 hrs/week	**01**	**Practical : 25 Marks** **TW: 25 Marks**
Prerequisite Courses, if any: -Fundamentals of Electronics Engineering		
Companion course, if any: Digital System Design using HDL		
Course Outcomes: On completion of the course, students will be able to–		

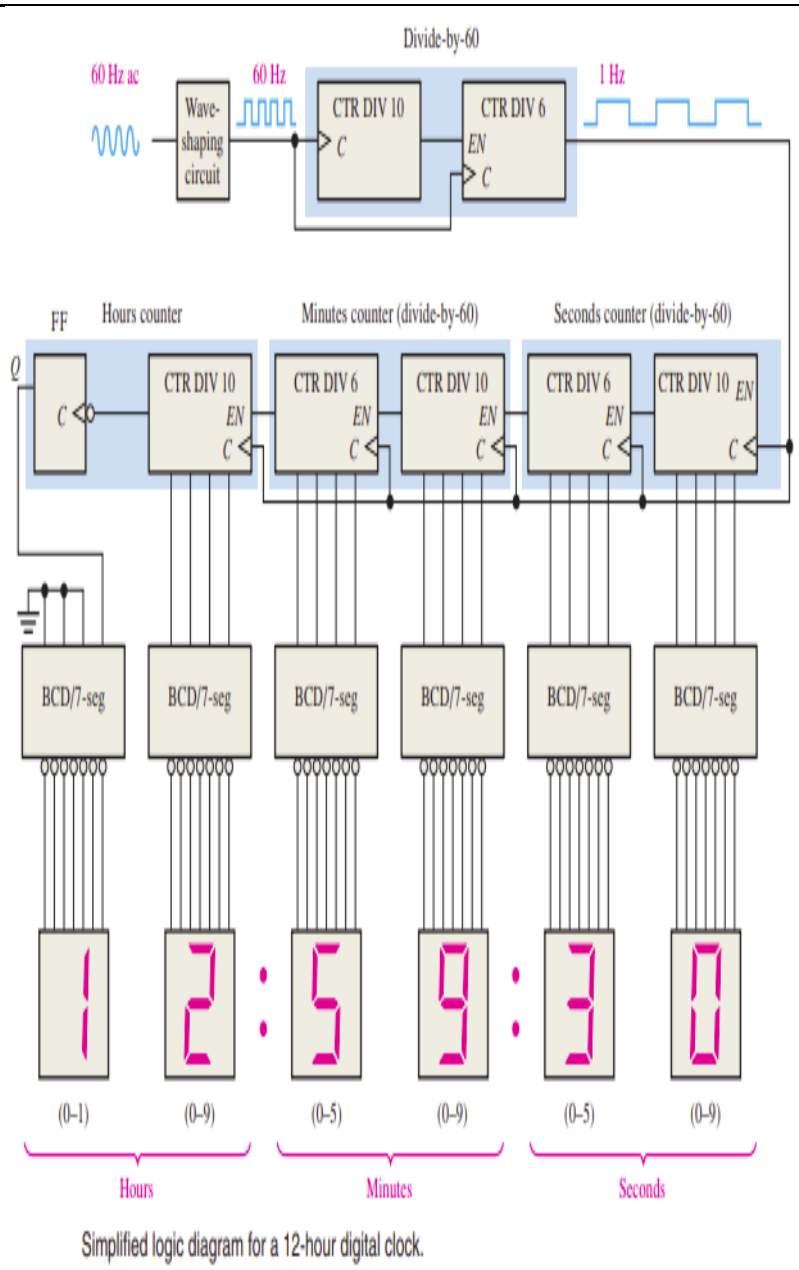
	Course Outcomes	Bloom's Level (Cognitive domain)	Bloom's Level (Psychomotor domain)
CO1	Design and implement and test combinational logic circuits.	3-Apply	4-Mechanism
CO2	Design and implement and test sequential circuits.	3-Apply	4-Mechanism
CO3	Write and simulate VHDL codes to implement digital circuits	3-Apply	4-Mechanism

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	A staircase light is controlled by Two switches, one at the top of the stairs and another at the bottom of the stairs. (a) Make a truth table for this system (b) Write the logic equation in SOP form (c) Realize the circuit using AND-OR gates (d) Realize the circuit using NAND gates only.	**1**
2	Automobile parking control: The problem is to devise a means of monitoring available spaces in a one-hundred space parking garage and provide for an indication of a full condition by illuminating a display sign and lowering a gate bar at the entrance. A general block diagram of this system is shown in Figure below:	**3**

	 Functional block diagram for parking garage control. A logic diagram of the up/down counter is shown in Figure below. It consists of two cascaded up/down decade counters.  Logic diagram for modulus-100 up/down counter for automobile parking control Analyse and implement using HDL code.	
3	Solve the problem with multiple methods for data processing circuits which can be used to compare two 2-bit numbers, A1A0 & B1B0 to generate two outputs, A>B and A=B	**1**
4	Design elevator control using VHDL: This Applied Logic describes the operation and implementation of a service elevator controller for a seven-story building. The controller consists of logic that controls the elevator operation, a counter that determines the floor at which the elevator is located at any given time, and a floor number display. For simplicity, there is only one floor call and one floor request for each elevator cycle. A cycle occurs when the elevator is called to a given floor to pick up a passenger and the passenger is delivered to a requested floor. The elevator sequence for one cycle is shown in Figure	**3**

	 One cycle of the elevator operation.	
5	Design sequence Generator to provide necessary signal to drive stepper motor 	**2**
6	Develop a security system that provides coded access to a secured area.	**1,2**

	 Block diagram of the security system. Once a 4-digit security code is stored in the system, access is achieved by entering the correct code on a keypad. A block diagram for the security system is shown in Figure above. The system consists of the security code logic, the code-selection logic, and the keypad. The keypad is a standard numeric keypad.	
7	Realize the diagram explained here with suitable software: A common example of a counter application is in timekeeping systems. Figure below is a simplified logic diagram of a digital clock that displays seconds, minutes, and hours. First, a 60 Hz sinusoidal ac voltage is converted to a 60 Hz pulse waveform and divided down to a 1 Hz pulse waveform by a divide-by-60 counter formed by a divide-by-10 counter followed by a divide-by-6 counter. Both the seconds and minutes counts are also produced by divide-by-60 counters. These counters count from 0 to 59 and then recycle to 0; synchronous decade counters are used in this particular implementation. Notice that the divide-by-6 portion is formed with a decade counter with a truncated sequence achieved by using the decoder count 6 to asynchronously clear the counter. The terminal count, 59, is also decoded to enable the next counter in the chain.	**1,2**

	 Simplified logic diagram for a 12-hour digital clock.	
8	Simulate all types of Flip-Flops using VHDL	**3**
9	Simulate Shift Register (Left and Right shift) using VHDL	**3**
10	Write HDL code to implement traffic light controller shown in the figure below: Note: Timing Requirements: The control logic establishes the sequencing of the lights for a traffic signal at the intersection of a busy main street and an occasionally used side street. The following are the timing requirements: u The green light for the main street will stay on for a minimum of 25 s or as long as there is no vehicle on the side street. u The green light for the side street will stay on until there is no vehicle on the side street up to a maximum of 25 s. u The yellow caution light will stay on for 4 s between changes from	**3**

green to red on both the main street and the side street.

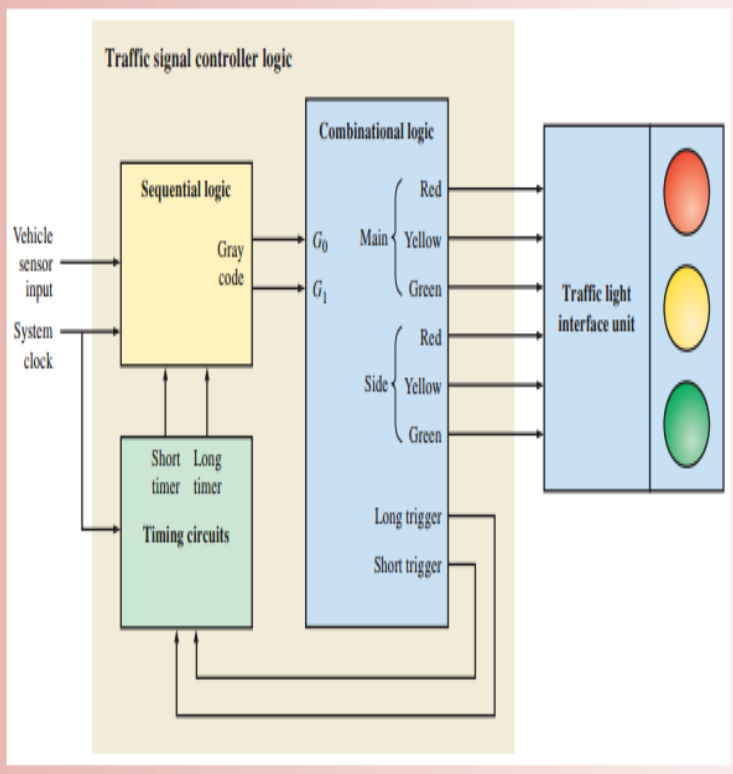


FIGURE 6-64 Block diagram of the traffic signal controller.

Guidelines for Laboratory Conduction

1. Teacher will brief the given experiment to students, its procedure, observations calculation, and outcome of this experiment.
2. Apparatus and equipment required for the allotted experiment will be provided by the lab assistants using SOP.
3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistants.
4. After performing the experiment students will check their readings, calculations from the teacher.
5. After checking they have to write the conclusion of the final result.

Guidelines for Student's Lab Journal

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.

Guidelines for Term work Assessment

1. Each experiment from lab journal is assessed for thirty marks based on three rubrics.
2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech. (E&TC) Pattern 2022 Semester: III ET222009: Name of Subject: Lab work in Embedded Systems		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 02 hrs/week	**01**	**PR: 25 Marks** **TW: 25 Marks**
Prerequisite Courses, if any: -Digital Electronics		
Companion course, if any: Embedded Systems		

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

	Course Outcomes	Bloom's Level (Cognitive domain)	Bloom's Level (Psychomotor domain)
CO1	Interface different devices to microcontroller 8051	3-Apply	3-Guided Response
CO2	Write, compile and execute program in assembly language and embedded C of 8051	3-Apply	6-Adaptation
CO3	Interface ADC and DAC with 8051 for different application	3-Apply	3-Guided Response

List of Laboratory Experiments / Assignments

Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1	Develop a token system in the bank such that the cashier presses the key for the token number that will get displayed. Display will be such that the customer can see the display from at least 10m. Draw interfacing diagram and write a program in embedded C and assembly language.	CO1,CO2
2	Develop a system for bottle manufacturing plants for counting a bottle, available in belts. Reject the bottle if it is faulty. Display number of bottles. If count reaches 20 then start count from 01. Draw interfacing diagram and write a program in embedded C and assembly language.	CO1,CO2
3	Develop a touch screen based display system for battery operated two wheeler. All parameters can be handled through touch screen (e.g. start-stop). Draw interfacing diagram and write a program in embedded C.	CO1,CO2
4	Develop an arbitrary waveform generator for frequency 1HZ to 10 MHZ. Output voltage varies from 0 to 10V. Draw interfacing diagram and write a program in embedded C.	CO1,CO2, CO3

5	Develop an embedded system for measuring different parameters in CAR.(e.g. fuel level, tem of engine, air pressure). Draw interfacing diagram and write a program in embedded C.	CO1,CO2, CO3
6	Design a battery operated medical electronic system for measuring protein level in urine and displays your result on LCD. Draw interfacing diagram and write a program in embedded C	CO1,CO2, CO3

Guidelines for Laboratory Conduction

1. Teacher will brief the given interfacing of embedded system to students
2. Microcontroller Kits and interfacing modules will be provided in the Lab
3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistant.
4. After performing the interfacing and programming students will check their results from the teacher.
5. After checking they have to write the conclusion of the final result.

Guidelines for Student's Lab Journal

Write-up should include title, aim, interfacing diagram, algorithm, procedure, calculations, waveform, conclusion and questions, if any

Guidelines for Teamwork Assessment

Each experiment from the lab journal is assessed for thirty marks based on three rubrics.
Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks

S. Y. B. Tech. (E&TC) Pattern 2022 Semester: III ET222010: Name of Subject: Electronic Workshop		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 02 hrs/week	**01**	**TW: 25 Marks**
Prerequisite Courses, if any: - Fundamentals of Electronics Engineering		
Companion course, if any: - NA		
Course Outcomes: On completion of the course, students will be able to–		

	Course Outcomes	Bloom's Level (Cognitive domain)	Bloom's Level (Psychomotor domain)
CO1	**Identify** various active and passive electronic components and **select** proper components as per applications based on datasheet specifications.	3-Apply	1- Perception
CO2	**Use** various electronic equipment and tools for building, testing and troubleshooting of electronic circuits	5-Evaluate	6-Adaptation
CO3	**Identify** various core components of PC	3-Apply	3-Guided Response
CO4	**Use** various troubleshooting preventive maintenance tools for maintenance of PC and peripherals	5-Evaluate	4-Mechanism

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
	Group A	
1.	Use of Data sheets for Component Selection and Specification ● Find Specifications and package of following components from Datasheet. (as a guideline only): a. Diodes 1N4001 to 1N4007, IN4148, 2N5402, 2N5408,BY127 b. Zener Diode - 5V6 c. Photodiode - BPW10 d. LED - LED 55 e. Varactor diode f. Thermistor g. Trimmer h. Opto-coupler i. Relay j. Seven segment LED	**CO1**

	k. Photocell l. Transistors BC107, BC177, BC547/548, m. Transistors SL100, SK100, AC127/128, BF194, TIP122 n. IC 78XX, 79XX o. LM317 p. SMD components: Resistor, Capacitor, Inductor & Diode- q. LL4148, SM4007, Chip transistor, Chip Darlington transistor,Bridge rectifier ● Select the appropriate component for a given circuit application. ● Select specification of Surface Mount Device (SMD) components as required.	
2.	Use the following instruments to measure the parameters of any electronic circuit: Function Generator, Frequency counter, CRO, and DSO, with all safety precautions.	**CO1**
3.	Provide some exercises so that the following electronics hardware tools and materials are learned to be used by the students (as a guideline only): a. Bread board b. Copper clad laminate sheet c. Solder iron, solder-stand d. Solder-wire, flux e. Flexible wire f. Hookup wire g. Cutter h. Nose plier i. Screwdriver set j. Wire stripper k. De-solder pump l. De-solder wick m. Drilling machine	**CO2**
4.	Sketch, mount and test at least six from following electronic circuits on breadboard (Circuits given as a guideline only): a. T type attenuator b. π-type attenuator c. Forward/reverse biased PN Junction diode d. Zener diode as shunt regulator e. Opto coupler using LED & Photo diode f. Half wave Rectifier, Full wave & Bridge rectifier g. Light operated relay h. Diode clipper i. Diode clamper j. Transistorized series regulator k. +/- 5V Regulated power supply with LED indication l. Low pass filter, High pass filter m. Band pass filter, Band elimination filter n. Variable power supply using LM317.	**CO2**
5.	➢ Sketch, mount, wire, solder and test at least one electronic circuit (mentioned in Sr.No. 6 above) on a general purpose board. ➢ De-solder given circuit(s) from general purpose printed circuit board.	**CO2**

6.	a. Create PCB layout manually. b. Create schematic and layout of given electronic circuit using any Simple PCB design software.Trace circuit from given PCB layout	**CO2**
	Group B	
7.	a) Identify basic components of a personal computer. Prepare a list of various computer peripherals. (e.g. CPU, Monitor, Keyboard, Mouse, Speaker, Web cam, Printer, Scanner, microphone, speakers, modem, projector etc). b) Identify common ports, associated cables, and their connectors. Observe various connectors, ports back and front side of the computer. Write their purpose and specifications. (e.g. Power, PS/2 keyboard and mouse, Serial and parallel, USB, VGA, LAN, Audio & microphone, Firewire, HDMI, games, SATA etc.)	**CO3**
8.	Identify major components including motherboards, memory, drives, peripheral cards and devices, BIOS, and Windows operating systems. Observe the various components on the motherboard, identify it. Also observe their interconnection and arrangement inside the case. Detach and attach the cables and components in the PC case and motherboard. Carryout detailed study on all the components and devices on the given motherboard. ➢ Processor socket, Chipsets, Memory module slots, BIOS, CMOS FDD, HDD connectors ➢ Different types of expansion slots (ISA, EISA, PCI, PCI express, AGP, Express Card & PC Card (or PCMCIA) etc.) ➢ Add-on-cards (audio, graphics, I/O, TV tuner, network etc.) ➢ Cables in a computer system (IDE Ribbon cable, SATA cable etc) ➢ Connections for buttons, indicator lights etc. ➢ Observe various types of memory modules (SIMM, DIMM, SO-DIMM, RIMM, SO-RIMM). Also observe the impact of removal of memory modules from the system, start it and re-insert the memory module and restart the system.	**CO3**
9.	Observe different types of printers (dot matrix, inkjet & laser, multifunction). Install driver and interface the printers with PC/Laptop on any operating system (connect the printer to one PC directly using USB/Serial/Parallel ports as per the availability; test the functioning of the printer.) Write detailed comparative analysis of different types of printer available in the market and suggest a printer with good features and best price as per need. Justify your printer selection.	**CO3, CO4**
10.	Open at least 2 to 3 different types of keyboard and mouse and observe the internal circuits. Observe and write steps to troubleshoot, maintain and clean the diskette drives, keyboard, mouse, etc.	**CO3, CO4**
11.	Observe the interfacing, installation and working of various devices such as scanner, projector, web cam etc. Connect all these devices with the given PC, install & test them.	**CO3, CO4**
12.	How to format a PC? How to change the CMOS battery in a PC? How to install/uninstall a program?	**CO3, CO4**

Guidelines for Laboratory Conduction
1. Teacher will brief the given interfacing of embedded system to students 2. Microcontroller Kits and interfacing modules will be provided in the Lab 3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistant. 4. After performing the interfacing and programming students will check their results from the teacher. 5. After checking they have to write the conclusion of the final result.
Guidelines for Student's Lab Journal
Write-up should include title, aim, interfacing diagram, algorithm, procedure, calculations, waveform, conclusion and questions, if any
Guidelines for Teamwork Assessment
Each experiment from the lab journal is assessed for thirty marks based on three rubrics. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks

Semester IV

Course Code	Course Type	Title of Course	Teaching Scheme Hrs./week			Assessment Scheme of Marks							Credits			
			TH	TU	PR	In Sem	End Sem	CCE	TU/ TW	PR	OR	Total	TH	TU	PR /OR	Total
ET222011	DCC	Digital Signal Processing	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222012	DCC	Communication Engineering	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222013	DCC	VLSI Design and Technology	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222014	DCC	Control Systems	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222015	LHSM	Industrial Management	3	-	-	20	60	20		-	-	100	3	-	-	3
ET222016	AC	Professional Communication and Aptitude Technics/ Foreign Language 1	1	-	-	-	-	-		-	-	-	-	-	-	-
ET222017	DCC	Lab work in DSP and CS	-	-	2+2	-	-	-	25	50	-	75	-	-	2	2
ET222018	DCC	Lab work in VLSI	-	-	2	-	-	-	25	25	-	50	-	-	1	1
ET222019	DCC	Lab work in Communication	-	-	2	-	-	-	25	25	-	50	-	-	1	1
ET222020	PSI	PBL	-	-	2	-	-	-	25 #	-	-	25	-	-	1	1
		Total	**16**	**-**	**10**	**100**	**300**	**100**	**100**	**100**	**-**	**700**	**15**	**-**	**5**	**20**

Assessment of 25 marks will be done considering consistent progress of work throughout the semester and Project Presentation at end of semester.

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: IV
ET222011: Name of Subject: Digital signal processing

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week Practical (ET222017): 4 Hrs/ week	03 02	Continuous Comprehensive Evaluation: 20 Marks In Sem Exam: 20 Marks End Sem Exam: 60 Marks PR (ET222017): 50 Marks TW (ET222017): 25 Marks

Prerequisite Courses: - Engineering Mathematics III

Companion course, if any: Lab work in DSP and CS

Course Objectives:

- To understand the mathematical description of continuous and discrete time signals and systems and classify signals into different categories.
- To analyze Linear Time Invariant (LTI) systems in time and transform domains.
- To introduce students with transforms for analysis of discrete time signals and systems.
- To introduce students with transforms for analysis using Fast Fourier Transform
- To design IIR and FIR filters.

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

	Course Outcomes	Bloom's Level
CO1	**Understand** mathematical description and representation of continuous and discrete time signals and systems.	2- Understanding
CO2	**Develop** input output relationship for linear shift invariant system and **understand** the convolution operator for continuous and discrete time system	3- Apply
CO3	**Analyze** discrete time signals and systems using Discrete Fourier transforms.	4 –Analyze
CO4	**Develop** algorithms for linear filtering of signals.	3- Apply
CO5	**Design** different types of IIR and FIR digital filters	4 -Analyze

COURSE CONTENTS

Unit I	Introduction and Classification of signals	(09 hrs + 2 hrs Tutorial)	COs Mapped - CO1

Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.
Elementary signals used for testing: reasons for using standard test signals, exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc.
Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.

Unit II	**Representation of LTI systems in time domain:**	**(08 hrs+ 2hrsTutorial)**	**COs Mapped CO2**
Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible. System modeling: Input-output relation, definition of impulse response, convolution integral, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Properties of convolution. System properties in terms of impulse response, step response in terms of impulse response.			
Unit III	**Basics of DSP and Discrete Fourier Transform**	**(08 hrs+ 2hrsTutorial)**	**COs Mapped CO3**
Sampling, Basic elements of DSP and its requirements, advantages of Digital over Analog signal processing. mapping between analog frequencies to digital frequency, DTFT, Definition, Frequency domain sampling, DFT, Properties of DFT, circular convolution, linear convolution, Computation of linear convolution using circular convolution, Linear filtering using overlap add and overlap save method.			
Unit IV	**Fast Fourier Transform**	**(08 hrs+ 2hrsTutorial)**	**COs Mapped CO4,**
FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm, Comparison between finding DFT of signals using direct method and using FFT algorithm**.** In- place computation and memory requirement. Goertzel and Chirp-Z algorithm.			
Unit V	**IIR and FIR filter design**	**(09 hrs+ 2hrsTutorial)**	**COs Mapped CO5,**
Design of IIR filters from analog filters. IIR filters design by impulse invariance method, Bilinear transformation method, warping effect. Characteristics of Butterworth filters, Chebyshev filters and elliptic filters, Ideal filter requirements, Gibbs phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows..			
Text Books			
1.Simon Haykins and Barry Van Veen, “Signals and Systems”, Wiley India, 2 nd Edition. 2. John G. Proakis“Digital Signal Processing: Principles”, Pearson publication			
Reference Books			
1. A. Nagoor Kanni ``Signals and Systems”, McGraw Hill, 2. Dr. Shaila Apte, “Digital Signal Processing” Wiley India Publication			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignments: (Total 3 Assignment, Unit I and II 20 marks, Unit III and IV 20 marks and Unit V 10 marks &50 marks will be converted to 10 Marks)	15
2	Tests on each unit using LearniCo: (Each test for 15 M and total will be converted out of 10 M)	5

List of Tutorial Assignments		
Sr. No.	**Title**	**CO Mapped**
1	Examples on classification of signals.	CO1
2	Examples of operations on signals.	CO1
3	Examples on classification of systems.	CO2
4	Examples of convolution integral.	CO2,
5	Solve problems on system properties in terms of impulse response.	CO2,
6	Solve examples on DFT and IDFT	CO3,
7	Examples on circular convolution.	CO3
8	Examples on overlap add method and overlap save method	CO3
9	Examples of the DIT FFT algorithm.	CO4,
10	Examples on DIF FFT algorithm.	CO4,
11	Examples on Design of IIR filter using impulse invariance method and bilinear transformation method	CO5
12	Examples of FIR filter using windowing techniques.	CO5

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: IV
ET 232012: (Name of Subject: Communication Engineering)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week Practical (ET222019): 02 hrs/week	03 01	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks Practical Exam (ET222019) : 25 Marks TW (ET222019): 25 Marks

Prerequisite Courses, if any: - Fundamentals of Electronics Engineering

Companion course, if any: Lab work in Communication

Course Objectives:

To understand the building blocks of analog and digital communication systems.
Describe and analyze the mathematical techniques of generation, transmission and reception of amplitude modulation (AM) and frequency modulation (FM)
Evaluate the performance levels (Signal-to-Noise Ratio) of AM and FM systems in the presence of additive white noise.
Convert analog signals to digital format and describe Pulse and digital Modulation techniques.

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

	Course Outcomes	Bloom's Level
CO1	**Improve** the ability to understand the performance of a AM & FM transmitter	3-Apply
CO2	**Identify** various components and **analyze** the Performance Characteristics of AM & FM receiver	3-Apply
CO3	**Explore** different pulse modulation techniques and **design** of scramblers in digital communication.	5-Evaluate
CO4	**Analyze** the performance of a pass band digital communication system in terms of error probability and power spectra.	3-Apply
CO5	**Explain & calculate** signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.	2-Understand

COURSE CONTENTS

Unit I	AM & FM Transmission	(08 hrs)	COs Mapped - CO1, CO2,CO5

Communication System and Need For Modulation ,Baseband & Carrier communication, Generation of AM (DSBFC),Frequency Spectrum, Generation of DSBSC, SSBSC, Filter Method, Power relations, Introduction to ISB & VSB, Concept of Angle modulation, Relation between FM and PM, Narrow band & wide band FM, frequency spectrum & Eigen Values ,Bessel's Function ,Bandwidth and required FM spectra Classification of FM generation Methods, Generation of FM (Direct Method and Indirect Method)

Case study: Implementation of AM & FM transmitter using GNU radio

Unit II	AM & FM Reception	(07 hrs)	COs Mapped - CO1, CO2
Receiver Types, Block diagram of TRF AM Receivers, Super Heterodyne Receiver, Concept of Series & Parallel resonant circuits for Bandwidth & Selectivity, Performance Characteristics of receiver , Tracking, Mixers ,AM Detection, Block diagram of FM Receiver, FM detection using Phase lock loop(PLL) **Case study:** Implementation of AM & FM receiver using GNU radio			
Unit III	**Pulse modulation (Analog & Digital)**	**(07 hrs)**	**COs Mapped - CO1, CO2,CO3,CO5**
Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization. Inter-symbol interference, Equalization, Sampling theorem in time domain, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect, PAM, PWM & PPM. Pulse Code Modulation and reconstruction, Delta Modulation, Adaptive Delta Modulation **Case study:** Implementation of PCM system using GNU radio			
Unit IV	**Digital modulation techniques**	**(07 hrs)**	**COs Mapped - CO1, CO2,CO5**
Pass band transmission model, Types of Digital Modulation Techniques, Generation of BASK Generation and detection BPSK, Signal space diagram, Generation and detection BFSK, Generation and detection QPSK, Error Probability derivation and Power spectra of BPSK **Case study:** Implementation of Digital modulation techniques using GNU radio			
Unit V	**Random Process and Noise**	**(07 hrs)**	**COs Mapped - CO1, CO2**
Review of a random process, Stationary processes, Ergodic processes, Sources and types of Noise, Signal to Noise Ratio, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth, Behavior of Baseband systems and Amplitude modulated systems in presence of noise. **Case study:** Implementation of any communication system in presence of noise using GNU radio			
Text Books			
1. George Kennedy, "Electronic Communication Systems" Tata McGraw Hill 2. Dennis Roddy ,John Coolen, "Electronic Communications" , Pearson , 4th Edition			
Reference Books			
1. B P Lathi, Zhi Ding, "Modern Analog and Digital Communication System", Oxford University Press, 4th Edition 2. Louis E. Frenzel Jr. , "Principles of Electronic Communication Systems" , McGraw-Hill Education , 4th Edition 3. Taub& Schilling, "Principles of Communication Systems" , Tata McGraw Hill 4. Simon Haykin, "Communication Systems", John Wiley & Sons			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Three Assignments on unit-1, Unit-2, Unit-3, Unit-4 & Unit-5	10
2	Flipped Learning Activity on Unit-3 & 4	5
3	LearniCo Test/Quiz on Each Unit	5
	Total	**20**

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: IV
ET222013: Name of Subject: VLSI Design and Technology

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week Practical (ET222018): 02 hrs/week	03 01	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks Practical Exam (ET222018): 25 Marks TW (ET222018): 25 Marks

Prerequisite Courses, if any: - Digital System Design using HDL

Companion course, if any: Lab work in VLSI

Course Objectives:
To Understand the architecture of PLD
To implement combinational and sequential circuits
To get the knowledge about properties of CMOS circuits
To Understand the concept behind ASIC design
To Get an Idea of Testability Approach

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

	Course Outcomes	Bloom's Level
CO1	Understand the basic architecture of various PLDs	2- Understanding
CO2	Explain the role of Verilog in digital system design	2- Explain
CO3	Develop effective HDL coding for digital design and Model digital circuit with HDL, simulate, synthesis and prototype in PLDs	3,6- Design
CO4	Design CMOS circuits for specified applications and Implement subsystem using CMOS Technology	4 -Analyze
CO5	Apply knowledge of chip level issues , faults and testability in design	3- Apply

COURSE CONTENTS

Unit I	**PLD Architectures and applications**	**(06 hrs)**	**COs Mapped - CO1**

Study of Programmable Logic Devices (PROM, PAL, PLA) and comparison, Complex Programmable Devices: Various families, Features, Specifications, CPLD Architecture Applications, Field Programmable Gate Arrays: Various families, Features, Specifications, FPGA Architecture Applications, Implementing functions in PLA, PAL and FPGA, Study of latest FPGA Devices

Unit II	**Introduction to Verilog HDL**	**(08 hrs)**	**COs Mapped - CO2**

Overview of Digital Design with Verilog HDL, Hierarchical Modelling Concepts, Basic Concepts, Modules and ports, Initial and always block, Modelling Styles: Gate-Level Modelling

Unit III	**Design Elements in Verilog**	**(08 hrs)**	**COs Mapped – CO3**

Dataflow Modelling, Behavioural Modelling, Switch level Modeling. Tasks and functions, Verilog Test bench			
Unit IV	**CMOS Logic Design**	**(07 hrs)**	**COs Mapped – CO4**
CMOS Inverter and DC transfer Characteristics, Inverter with capacitive load and its effects, CMOS Logic gates (All gates) and Multiplexer , Combinational circuit design using CMOS , Sequential circuit design using CMOS Transmission gates, example of TG for combinational circuit.			
Unit V	**Digital Design Issues and Testability**	**(07 hrs)**	**COs Mapped - CO5**
Metastability and solutions, Timing considerations and Skew, Clock distribution and jitter, Supply and ground bounce, Power distribution techniques and optimization, Need of Design for Testability (DFT), DFT Guideline, Testability, Types of fault and fault models, Hazards, Test pattern generation, Sequential circuit test, Built-in Self-Test, JTAG & Boundary scan, TAP Controller.			

Text Books

1. Charles H. Roth, "Digital systems design using VHDL", PWS.
2. Wyane Wolf, "Modern VLSI Design (IP-Based Design)", 4E,Prentice Hall.
3. Steve Kilts "Advanced FPGA Design Architecture, Implementation and Optimization", Wiley.

Reference Books

1. E. Weste, David Money Harris, "CMOS VLSI Design: A Circuit & System Perspective", Pearson Publication.
2. R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", 3E, Wiley-IEEE Press
3. John F. Wakerly, "Digital Design Principles and Practices" , 3E, Prentice Hall
4. M. Morris Mano , "Digital Design", 3E , Pearson
5. Cem Unsalan, Bora Tar, "Digital System Design with FPGA: Implementation Using Verilog and VHDL", McGraw-Hill
6. VHDL Programming by Douglas.L.Perry , McGraw-Hill 4th 2002

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Three Assignments on Unit-1, Unit-2, Unit-3 Unit-4, Unit-5	10
2	Project Based Learning	5
3	LearniCo/ Quiz Test on Each Unit	5
	Total	**20**

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: IV
ET222014: Name of Subject: Control Systems

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week Practical (ET222017): 04 hrs/week	03 02	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks PR (ET222017): 50 Marks TW (ET222017): 25 Marks

Prerequisite Courses, if any: - Laplace Transform and Differential Equations

Companion course, if any: Lab work in DSP and CS

Course Objectives:
To Introduce basic sensors. To introduce elements of the control system and their modeling using various Techniques.
To get acquainted with the methods to determine stability of a system using root locus.
To Introduce and analyze the time and frequency response and stability of system using bode plot
To Introduce state variable analysis method.
To get acquainted with Concepts of actuators and controllers

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

	Course Outcomes	Bloom's Level
CO1	To Introduce basic sensors. To introduce elements of the control system and their modeling using various Techniques.	1-Knowledge
CO2	To get acquainted with the methods to determine stability of a system using root locus.	2-Understand
CO3	To Introduce and analyze the time and frequency response and stability of system using bode plot	2-Understand
CO4	To Introduce state variable analysis method.	3-Apply
CO5	To get acquainted with Concepts of actuators and controllers	3-Apply

COURSE CONTENTS

Unit I	Control system modelling	(08 hrs)	COs Mapped - CO1

Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph

Unit II	Stability Analysis	(06 hrs)	COs Mapped - CO2

Concept of pole and zero, concept of stability absolute stability, relative stability, Routh Hurwitz stability criterion, Root locus, Root locus, Application of root locus for stability analysis.

Unit III	Time and Frequency domain analysis	(08 hrs)	COs Mapped – CO3

Standard test inputs, order and type of a system, transient analysis of first and second order systems, transient analysis of first and second order systems, time domain specifications of second order system, Steady state error and static error constants. Frequency response and frequency domain specifications, correlation between time domain and frequency domain specifications, stability analysis using Bode plot

Unit IV	**State Variable Analysis**	**(07 hrs)**	**COs Mapped – CO4**

State space advantages and representation, Transfer function from State space, physical variable form, phase variable forms: controllable canonical form, observable canonical form, Solution of homogeneous state equations, state transition matrix and its properties, computation of state transition matrix by Laplace transform method only, Concepts of Controllability and Observability

Unit V	**Sensors, Actuators and Controllers**	**(07 hrs)**	**COs Mapped - CO1, CO2, CO5**

Sensor static and dynamic characteristics, Sensor selection criteria, Sensor operating principle: Temperature, displacement, optical, pressure and strain gauge, Smart sensors. Classification of actuators, Relays and solenoids, Relay circuits, Pneumatic and Hydraulic linear and rotary actuators, Control circuits for actuators. Concept of Controller, Introduction to ON-OFF and PID controller,
Concept of Zeigler-Nicholas method.

Text Books

1. N. J. Nagrath and M. Gopal, "Control System Engineering", New Age International Publishers, 5th Edition.
2. K. Ogata, "Modern Control Engineering", Prentice Hall India Learning Private Limited; 5th Edition.

Reference Books

1. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition.
2. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition.
3. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw -Hill.
4. John J. D'Azzo and Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley.
6. Process Control Instrumentation Technology, C. D. Johnson

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Five Assignments on unit-1, Unit-2, Unit-3, Unit-4 and Unit-5	10
2	Performance in Unit Tests	10
	Total	**20**

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: IV
ET222015: Name of Subject: Industrial Management

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week	03	Continuous Comprehensive Evaluation: 20 Marks In Sem Exam: 20 Marks End Sem Exam: 60 Marks

Prerequisite Courses: - NA

Course Objectives:

1. Students are exposed to know the importance of Industrial Management.
2. Get the idea about concept of Entrepreneurship
3. To provide a basis of understanding to the students with reference to working of business organization, small scale industries.

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

	Course Outcomes	Bloom's Level
CO1	Get Comprehensive theoretical knowledge about Management & organization.	2-Understanding
CO2	Explain principle role & operation of Business sectors & organizations.	2- Understanding
CO3	Recognize the need for work-study and importance of quality control.	2- Understanding
CO4	Discuss role of supply chain management, role of IT tools in SCM.	2- Understanding
CO5	Describe management information system (MIS) & government policies.	2- Understanding

COURSE CONTENTS

Unit I	Management	(06 hrs)	COs Mapped - CO1

Introduction-Thought and its Development, Scope and Functional areas of management, Management as a science, art of profession Management and Administration Roles of Management, Levels of Management, functions of Management, Contribution of F.W.Taylor, Henri Fayol, Elton Mayo, Structure of an industrial organization, Hierarchy of various job positions in Electronics & IT industries, Functions of different departments. Relationship between individual departments.

Unit II	Business sectors & organizations	(06 hrs)	COs Mapped - CO2

Private sector, Cooperative sectors, public sector, joint sector, Services sector, Various forms of business organizations – Sole Proprietorship, Partnership firms, Joint stock companies –their features, relative merits, demerits& suitability. Charter documents of Companies Decisions in setting up an Enterprise – opportunity and idea generation, Business Plan, Business size and location decisions, Challenges in business sectors,

Setting up of Business outside India : Issues in choosing location; Structure and the processes involved

Unit III	Work Study & Quality control	(06 hrs)	COs Mapped –CO3
Introduction, definition, objectives, steps in work study, Method study: definition, objectives, steps of method study, Work Measurement: purpose, types of study, stopwatch methods, steps, allowances, standard time, Calculations, work sampling, Production Planning and Control Quality control: statistical quality control, Control charts for variables and attributes, Acceptance Sampling- Single sampling, Double sampling plans, Introduction to TQM.			
Unit IV	**Supply chain management**	**(06 hrs)**	**COs Mapped – CO4**
Goals, advantages, process, Strategic sourcing, Networks, Make vs Buy, inventory management, Role of IT,ERP tools, agile and reverse supply chain, Areas & practices of Supply Chain Management for Electronic Manufacturing, supply chain challenges, Digital supply chain.			
Unit V	**Management information system (MIS) & Government policies**	**(06 hrs)**	**COs Mapped – CO5**
Types of Information Systems, Developing Secure Information Systems, Security Policies, E-commerce, On-line trading, Information Security Standard, Industrialization in India. Industrial Policy Resolutions, Science, Technology and Innovation Policy of India, Relevant Government Policies, Impact of Government policies of decisions of setting up an enterprise. Start-up India Policy; Registration process.			

Textbooks

1. Industrial Engineering & Management , O.P. Khanna, Dhanpat Rai, 4th, 2018
2. Challenges to Modern Business by Michael J Dixon
3. Starting a Business outside India By Taxmann

Reference Books

1. Management, Stephen Robbins, Pearson Education, 17th Edition, 2003
2. Management Fundamentals Concepts, Application, Skill Development, Roberts Lusier Thomson, SAGE publication, 6th, 2014
3. The Founder's Dilemmas: Anticipating and Avoiding the Pitfalls That Can Sink a Startup,' by Noam Wasserman

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignments (Total 3 Assignment, Unit I and II 20 marks, Unit III and IV 20 marks and Unit V 10 marks &50 marks will be converted to 10 Marks)	15
2	Tests on each unit using LearniCo (Each test for 15 M and total will be converted out of 10 M)	5

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: IV
ET2220016: Name of Subject: Professional Communication and Aptitude Technics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory : 01 hrs/week	AC	-

Prerequisite Courses: NA

Course Objectives:

1. To improve aptitude skills.
2. To improve communication skills.

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

	Course Outcomes	Bloom's Level
CO1	Demonstrate aptitude skills.	3-Applying
CO2	Demonstrate communication skills.	3-Applying

COURSE CONTENTS

Unit 1	Aptitude Skills	6 Hrs	COs Mapped: CO1

- Numerical Ability
- Arithmetical Ability
- Data Interpretation
- Verbal Ability
- Verbal Reasoning
- Logical Deduction
- Non-Verbal Reasoning

Unit 2	Communication Skills	6 Hrs	COs Mapped: CO2

- Listening: Listening/Reading Comprehension; Dictation; Note making
- Speaking: Using words in context; Use of formal expressions and usages; Formal presentations (organizing data and slide preparation)
- Reading: Skimming through the text; Scanning;
- Writing: Grammar; Introduction to elements of academic writing; Report Writing; Resume writing ; Project Proposal writing

OR

Successful completion of a suitable NPTEL course identified and approved by the BoS (E & TC Engg).

Text Books

1. A Modern Approach to Verbal & Non-Verbal Reasoning, Dr. R S Aggarwal
2. S. Chand's Advanced Objective General Knowledge, Dr. R S Aggarwal

Reference Books

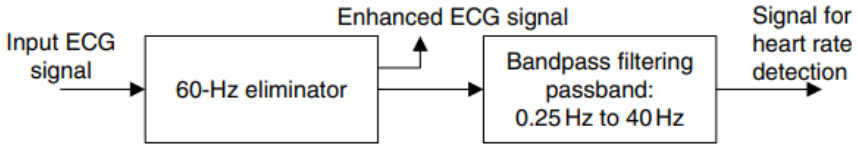
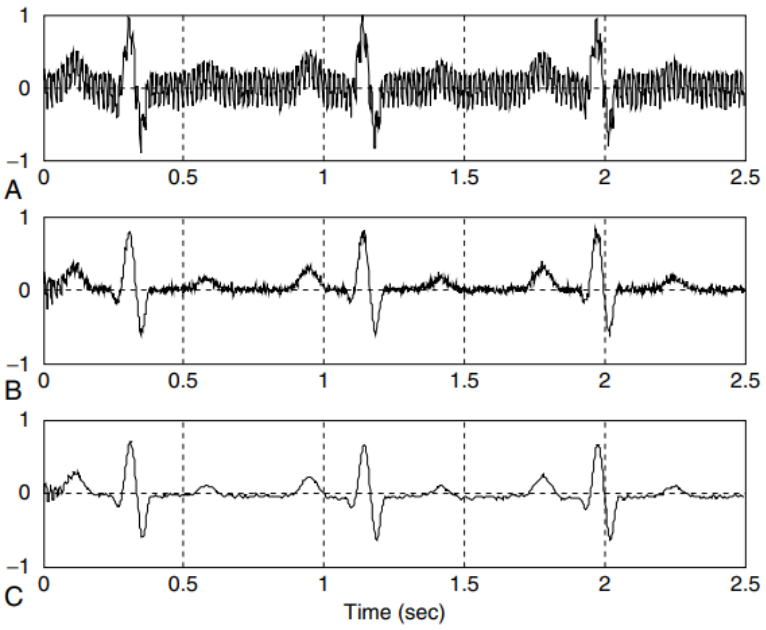
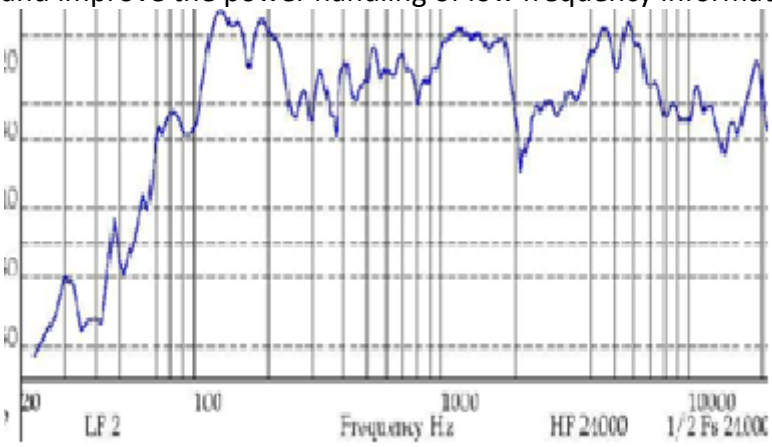
1. Quick Learning Objective General English, Dr. R S Aggarwal & Vikas Aggarwal
2. Quantitative Aptitude for Competitive Examinations, Dr. R S Aggarwal

Useful Websites
1. NPTEL Course on Technical English for Engineers by Dr. Aysha Iqbal Viswamohan, IIT Madras https://nptel.ac.in/courses/109/106/109106094/ 2. NPTEL Course on English Language for Competitive Exams by Dr. Aysha Iqbal Viswamohan, IIT Madras https://nptel.ac.in/courses/109/106/109106116/

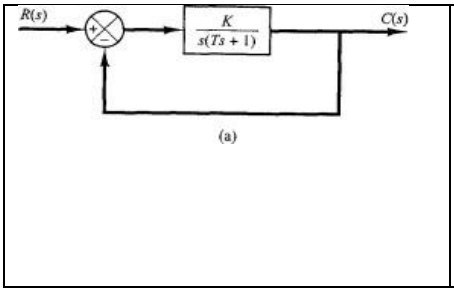
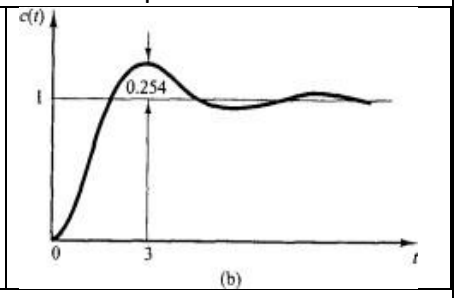
S. Y. B. Tech. (E&TC) Pattern 2022 Semester: IV ET222017: Name of Subject: Lab work in DSP and CS		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 04 hrs/week	**02**	**Practical : 50 Marks** **TW : 25 Marks**
Prerequisite Courses, if any: -Applied Mathematics-III		
Companion course, if any: DSP and Control Systems		
Course Outcomes: On completion of the course, students will be able to–		

	Course Outcomes	Bloom's Level (Cognitive domain)	Bloom's Level (Psychomotor domain)
CO1	Experiment concepts of DSP, Control system and its applications using MATLAB software.	2-Understand	1-Perception
CO2	Determine impulse response of LTI system by means of convolution.	4- Analyze	3-Guided response
CO3	Design FIR and IIR filters for real time DSP applications.	6- Create	1-Adaption
CO4	Evaluate the various parameters of transient analysis of a control system	5- Evaluate	3-Guided response
CO5	Examine the stability criteria for a control system using various techniques.	4- Analyze	4-Mechanism

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	To verify sampling theorem in MATLAB and Demonstrate the effects of aliasing arising from improper sampling	CO1
2	Find the response of LTI system for unit step signal x1(t) and exponential signal x2(t)	CO1, 2
3	Record or use the recorded music samples of different instruments (at least four) and analyze the major frequency components included in the music signal. Also try to solve this using Prat compare and comment on the results.	CO1

4	Design an appropriate filter for ECG signal enhancement and heart rate detection.  **ECG signal enhancement system.**  **Results of ECG signal processing. (a) Initial corrupted ECG data; (b) ECG data enhanced by removing 60 Hz; (c) ECG data with DC blocking and noise removal for heart rate detection.**	CO1, 3
5	**Design Loudspeaker Equalizer** The objectives of this equalization is to reduce the variations in the overall frequency response, extend the low frequency response, and improve the power handling of low frequency information  	CO1, 3

6	1) Implement a speech recognition algorithm for a voice driven system. Use voice commands to drive a digital output. When a user speaks “on”, the device will start to operate; it will stop working when a user speaks “stop”. Try the same for multiple users. Interested students can implement it on hardware.	CO1, 3
7	2) Android based Plots: Using A-JDSP App, determine the frequency response and pole-zero plot for Kaiser filter. (use a chart engine library for Android)	CO1, 3
Group B (Control System)		
1.	Represent the following systems with the help of a block diagram. 3) A traffic control system 4) Draw a block diagram of the control system in which the door automatically opens when a customer comes near it, and the door closes when he goes away from the door. 5) Consider an industrial oven, which is used for controlling the temperature of the chamber of an oven from room temperature plus 5°C to 180°C. The device used for this is a bimetallic strip. Draw a suitable block diagram. Indicate various important parameters and different components in the same. 6) Consider the system described below and draw the block diagram. State whether it is closed or open loop, with reason. The system is a bottle filling plant on a conveyor belt. Each bottle is to be filled with specified volume. Then a new bottle will replace the old bottle, Mention your assumptions specifically. 7) Identify the input and output of an automatic refrigerator. Is it an open loop or closed loop control system?	CO1
2.	For the given multi-loop feedback system, get closed loop transfer function and the corresponding pole-zero map of the system. **(Block Diagram to Transfer Function Representation)**	CO1
3.	Write a program to obtain the unit step response curve of a second order system for different zeta values.	CO4
4.	A control system is designed to keep the antenna of a tracking radar pointed at a flying target. The system must be able to follow a target traveling in a straight line with a speed of 200m/s with maximum permissible error of 0.01degree. The shortest distance from the antenna to the target is 250m. Find the value of error constant K_v in order to satisfy the requirements.	CO4

5.	When the system shown in Figure (a) is subjected to a unit- step input, the system output responds as shown in Figure (b). Determine the values of K and T from the response curve.   Write a program to determine the rise time, peak time, peak overshoot and settling time of a unity feedback system for a given open loop transfer function.	CO4
6.	Write a program for determining the stability of the system with a given characteristic equation using Routh criteria.	CO5
7.	Computation and Software simulation of root locus for given G(s)H(s). Comment on time domain specifications and stability of the system.	CO5
8.	Computation and analysis of frequency response using Bode Plot for given G(s) H(s).Comment on Gain Margin, Phase Margin and Stability of the system.	CO5
9.	Software implementation/Simulation of frequency response analysis using Nyquist Plot for given G(s) H(s). Comment on Gain Margin, Phase Margin and Stability of the system	CO5

Guidelines for Laboratory Conduction

1. Teacher will brief the given experiment to students, its procedure, observations calculation, and outcome of this experiment.
2. Apparatus and equipment required for the allotted experiment will be provided by the lab assistants using SOP.
3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistants.
4. After performing the experiment students will check their readings, calculations from the teacher.
5. After checking they have to write the conclusion of the final result.

Guidelines for Student's Lab Journal

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.

Guidelines for Term work Assessment

1. Each experiment from the lab journal is assessed for thirty marks based on three rubrics.
2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech. (E&TC) Pattern 2022 Semester: IV ET222018: Name of Subject: Lab work in VLSI		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 02 hrs/week	**01**	**Practical: 25 Marks** **TW: 25 Marks**
Prerequisite Courses, if any: -Digital System Design using HDL		
Companion course, if any: VLSI Design and Technology		
Course Outcomes: On completion of the course, students will be able to–		

	Course Outcomes	Bloom's Level (Cognitive domain)	Bloom's Level (Psychomotor domain)
CO1	Develop programs using HDL & handle the hardware proficiently by writing & simulating for combinational & sequential circuits in various modeling styles and implementation of programs in PLDs.	3- Develop	3-Guided Response 7-Origination
CO2	Design CMOS circuits for specified applications and Implement subsystems using CMOS Technology.	6- Design	3-Guided Response
CO3	Apply knowledge of chip level issues, faults and testability in design of Digital circuits.	3- Apply	3-Guided Response

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Implementation of Full Adder using all modeling styles	**C01**
2	Design a lift controller for 4 floors building Assume suitable data. Also write a test bench for it.	**C01**
3	Design a washing machine controller Assume suitable data. Also write a test bench for it. (Operation: When start is pressed, go through wash, spin, rinse, spin cycles. If "double rinse" is selected, an extra rinse and spin cycle is added. Details: Must fill the tub with water before washing or rinsing – output the signal "fill tub" to do this. A timer is provided that gives the appropriate amount of time for a wash, rinse, or spin cycle.)	**C01**

4	Design a Traffic Light Controller, assume suitable data. Also write a test bench for it. (A busy highway is intersected by a little used farm road. Detectors C sense the presence of cars waiting on the farm road , with no car on farm road, light remain green in highway direction, if vehicle on farm road, highway lights go from Green to Yellow to Red, allowing the farm road lights to become green, these stay green only as long as a farm road car is detected but never longer than a set interval, when these are met, farm lights transition from Green to Yellow to Red, allowing highway to return to green, even if farm road vehicles are waiting, highway gets at least a set interval as green)	**C01**
5	To simulate Logic Gates using CMOS	**C02**
6	To simulate Combinational/ Sequential circuit Using Conventional method and Transmission Gates(TG)	**C02**
7	To simulate CMOS combinational logic for minimum four variable inputs	**C02**
8	Simulate Stuck at fault model of given function	**C03**

Guidelines for Laboratory Conduction

1. Teacher will brief the given experiment to students, its procedure, observations calculation, and outcome of this experiment.
2. Equipment and Kits required for the allotted experiment will be provided by the lab assistants using SOP.
3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistants.
4. After performing the experiment students will check their readings, calculations from the teacher.
5. After checking they have to write the conclusion of the final result.

Guidelines for Student's Lab Journal

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.

Guidelines for Lab Assessment

1. Each experiment from the lab journal is assessed for thirty marks based on three rubrics.
2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech. (E&TC) Pattern 2022 Semester: IV ET222019: Name of Subject: Lab Work in Communication		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Practical Exam: 25 Marks** **TW: 25 Marks**
Prerequisite Courses, if any: - Fundamentals of Electronics Engineering		
Companion course, if any: Communication Engineering		
Course Outcomes: On completion of the course, students will be able to–		

	Course Outcomes	Bloom's Level (Cognitive domain)	Bloom's Level (Psychomotor domain)
CO1	**Demonstrate** the generation and detection of FM systems and compare with AM systems.	3-Apply, 4-Analyze	3-Guided Response
CO2	**Analyze** Pulse modulation and different data formats	4-Analyze	4-Mechanism
CO3	**Implement different** analog and digital modulation techniques.	3-Apply	3-Guided Response

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Discuss the type of modulation used to broadcast a single signal, such as a monophonic audio signal with maximum bandwidth of 10 KHz. Generate the modulated signal, Observe the frequency Spectrum and calculate the power required to transmit the modulated signal.	**CO1**
2	Select type of modulation to broadcasts of music in the VHF range with high SNR. Generate the modulated signal, Observe the frequency Spectrum and calculate the frequency deviation of the modulated signal.	**CO1**
3	Discuss the type of modulation used to record audio signals digitally on Compact Disc. Generate the modulated signal and determine the bits required to encode the signal.	**CO2**
4	Study of line codes (NRZ, RZ, POLAR RZ, AMI, MANCHESTER) & their spectral analysis.	**CO2**
5	Discuss the type of modulation used in various wireless standards such as CDMA. Also discuss the modulation used for telemetry, caller ID, garage door openers. Compare the performance of both modulation techniques.	**CO3**

6	Generate and compare the performance of AM and FM system using MATLAB	**CO3**
7	Implementation of AM and FM transmitter using GNU radio	**CO3**
8	Implementation of any digital modulation technique using GNU radio	**CO3**

Guidelines for Laboratory Conduction

1. Teacher will brief the given experiment to students, its procedure, observations calculation, and outcome of this experiment.
2. Equipment and kits required for the allotted experiment will be provided by the lab assistants using SOP.
3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistants.
4. After performing the experiment students will check their readings, calculations from the teacher.
5. After checking they have to write the conclusion of the final result.

Guidelines for Student's Lab Journal

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.

Guidelines for Lab Assessment

1. Each experiment from the lab journal is assessed for thirty marks based on three rubrics.
2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech. (E&TC)
Pattern 2022 Semester: IV
ET222020: Project Based Learning

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical : 02hr/week	01	TW: 25 Marks

Prerequisite Courses: -Fundamentals of electronics Engineering, Applied Mathematics-III, Communication Engineering

Companion course, if any: NA

Course Objectives:

1. To introduce the Integrated Development Environment of various simulation software.
2. To learn basic features of modeling tools and techniques
3. To implement and verify knowledge of the fundamental concepts of different electronic circuits and simulate it using suitable software (hands-on)
4. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

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

	Course Outcomes	Bloom's Level (Cognitive domain)	Bloom's Level (Psychomotor domain)
CO1	**Implement** basic electronic circuits on **suitable simulation** software	3- Apply	2-Set
CO2	**Identify** relevant tools/libraries and **Simulate** electronic circuits	2-Understand	1-Perception
CO3	**Create** a suitable solution based on the fundamentals of electronics and communication engineering by possibly the integration of previously acquired knowledge	6-Create	6-Origination
CO4	**Apply** advanced technology in proposed work and demonstrate learning in oral and written form.	3- Apply	3-Guided Response
CO5	**Develop** ability to work as an individual and as a team member	3- Apply	2-Set

COURSE CONTENTS

Group Structure:

The students plan, manage and complete a task/project/activity which addresses the stated problem.

1. Create group of 2 to 3 students in a class

Selection of Project/Problem:

Students are instructed to select a problem or project based on GNU radio/ whose solutions are obtained using MATLAB.

Effective Documentation:
In order to make our engineering graduates capable of preparing effective documentation, it is required for the students to learn effective writing skills. The PBL final report is expected to consist of the Literature Survey, Problem Statement, Aim and Objectives, System Block Diagram, System Implementation Details, Discussion and Analysis of Results, Conclusion, System Limitations and Future Scope
Evaluation & Continuous Assessment:
Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. It is recommended that all activities are required to be recorded regularly. A regular assessment of PBL work is required to be maintained at the department in the PBL log book by students. **Assessment**: The mentor is committed to assessing and evaluating student performance. Progress of PBL is monitored regularly on a weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured
Text Books
1. John Larmer, John R. Mergendoller, and Suzie Boss, “Setting the Standard for Project Based Learning”. 2. John Larmer and Suzie Boss, “Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences”.
Reference
1. https://www.mathworks.com/products/matlab.html 2. https://www.gnuradio.org/