Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Electronics Circuit Analysis and Design-I
Desired Requisites:	Engineering Physics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To **explain** the working of electronic circuits: rectifiers, Zener diode voltage regulator, amplifiers using BJT and MOSFETs and feedback amplifiers.
2	To **illustrate** the small signal models used for analysis of electronic circuits.
3	To **illustrate** the methods of designing the electronic circuits using discrete components.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	**Analyze** the performance of diode circuits.	Analyze
CO2	**Analyze** the performance of electronic circuits (amplifiers) using small signal models such as hybrid-π, r_e and h-parametermodel.	Analyze
CO3	**Evaluate** the performance of feedback amplifiers, oscillators and power amplifiers.	Evaluate
CO4	**Design** the electronic circuits (amplifiers)for given specifications using discrete components such as BJT, FET and MOSFET.	Create

Module	**Module Contents**	**Hours**
I	**Semiconductor Diode and its Applications** Types of diode, diode circuits: half-wave and full-wave rectifier, clippers and clampers; Zener diode voltage regulator.	4
II	**BJT Amplifiers** BJTs and its biasing methods considering stability factor; Basic BJT amplifier: DC and AC load line analysis, small signal hybrid- model: analysis of common emitter (CE), common collector (emitter follower) amplifier and common base (CB) amplifier.	8
III	**JFET Amplifiers** JFET (Junction Field Effect Transistor): operation, characteristics, biasing methods for JFET: self-bias, voltage divider bias; small signal equivalent circuit, JFET common source amplifier, JFET common drain amplifier.	5
IV	**MOSFET Amplifiers** Two terminal MOS structure, enhancement-mode MOSFET, ideal current-voltage characteristics, biasing in MOSFET amplifiers, small-signal equivalent circuit, common source (CS) amplifier, common drain (source follower) amplifier and common gate configuration; MOSFET as a switch.	8
V	**Feedback Amplifiers and Oscillators** Multistage amplifiers, Darlington pair, general feedback structure, amplifiers with negative feedback, properties of negative feedback, four basic feedback topologies; Oscillators: basic principle of oscillation, Phase-Shift oscillator; frequency response of amplifiers.	9

VI	**Power Amplifiers** Classification of power amplifiers: class-A, class-B, class-AB, class-C power amplifiers; transformer-coupled amplifiers, class-AB push-pull complementary output stage.	6

Text Books	
1	D. A. Negmen,"Electronic Circuit Analysis and Design", 3rd edition, Mcgraw Hill Education(India) Private limited New Delhi, 2007
2	A. S. Sedra, K. C. Smith, "Microelectronic Circuits", 5th edition, Oxford University Press, 2004.
3	Allen Mottershed," Electronic Devices and Circuits", PHI
4	

References	
1	R. Boylestad and L. Nashelsky, "*Electronic Devices and Circuit Theory*", PHI, 9th Edition, 2009.
2	Millman and Halkias, "*Electronic devices and Circuits*", Tata McGraw Hill, 1st Edition, 1991.
3	Gerald E. Williams, "*Practical Transistor Circuit Design and Analysis*", Tata McGraw Hill, New Delhi, 1st Edition, 1973.
4	

Useful Links	
1	https://nptel.ac.in/courses/108/102/108102112/
2	https://nptel.ac.in/courses/108/105/108105158/
3	
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CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3												
CO2	2	3			1									
CO3		3	3											
CO4			3		1									2

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand				
Apply				
Analyze	20	10	20	50
Evaluate			30	30
Create		10	10	20
Total	**20**	**20**	**60**	100

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Circuit Theory
Desired Requisites:	Engineering Mathematics, Basic Electrical Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

On completion of the course, students should be sufficiently familiar with the theoretical structure, formal representation, computational methods, notation, and vocabulary of linear models to be able to apply them to the analysis and design of digital and analog communications and control systems. The students will be able to perform signal analysis with reference to spectrum analysis of deterministic signals.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Work with basic fundamentals, theorems used in circuit's analysis	Understand
CO2	Carry out transient and steady state analysis of different circuits	Analyze
CO3	Do analysis and synthesis of circuit characteristics	Evaluate
CO4	Design a circuit and network	Create

Module	**Module Contents**	**Hours**
I	**Network Analysis** Review of fundamentals of circuit components, complex numbers and phasors in circuits, applications to networks, graphs and trees, node and mesh analysis, matrix representations dual and inverse networks, admittance and impedance, state variable analysis, T-II transformations, bridged-T and lattice networks, Network Theorems: Superposition, Millman, Norton, Thevenin, Maximum power transfer, AC and DC analysis.	8
II	**Transient Response of Circuits** RL and RC circuits, switching conditions, RLC circuits, Review of Laplace transform, important theorems and properties, application analysis of circuits in time domain, transfer function, Initial Conditions and Solutions to networks.	8
III	**Sinusoidal Steady State Analysis** The Sinusoidal Forcing Function, Phasor Concept, Average and Effective values of Voltage and Current, Instantaneous and Average Power, Complex Power, Steady State Analysis Using Mesh and Nodal Analysis, Application of Network Theorems to AC Circuits.	6
IV	**Resonance and Magnetically Coupled Circuits** U Series resonance, impedance and phase angle of series resonant circuit, voltage and current in series resonant circuit, effect of resistance on frequency response curve, bandwidth, selectivity and quality factor. Parallel resonance, resonant frequency for tank circuit, and variation of impedance with frequency factor of parallel resonant circuit, reactance curves. Magnetic coupled circuits: Mutual inductance, coefficient of coupling, single tuned and double tuned circuits.	6

V	**Two Port Networks** Open and short circuit parameters, transmission parameters, hybrid parameters, matrix form of input output relations, interaction of two four terminal networks, unsymmetrical networks, propagation functions, lattice networks, balanced and unbalanced networks, bisection theorem.	8
VI	**Network Functions** Concept of complex frequency network functions for one port and two port network, polesand zeros of network functions, restrictions on poles and zeros location for driving point function and transfer function. Time domain behavior from poles and zero plot, stability of active network. Characteristics of RLC and LC high pass, low pass, band pass and band stop filter.	6

Text Books	
1	Van Valkenburg, "Network Analysis", PHI publication, 3rd Edition, 1983.
2	Leonard S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 1996

References	
1	L.P. Huelsman, "Basic Circuit Theory", PHI Publication, 3rd Edition, 2009.
2	C. K. Alexander, M. N. O. Sadiku, "Electrical Circuits", Tata McGraw-Hill, 2008.
3	Ravish R Singh, "Network Analysis and Synthesis", Tata McGraw-Hill, 2013

Useful Links	
1	
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CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1												
CO2		1	2											
CO3		1		2									3	
CO4			1	2									3	

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10		10	**20**
Apply				
Analyze	10	20	30	60
Evaluate			10	10
Create			10	10
Total	**20**	**20**	**60**	100

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Digital Electronics
Desired Requisites:	Engineering Physics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To develop the fundamental concepts in digital design.
2	To make differences between combinational and sequential circuits evident to students.
3	To motivate students learn implementation of digital circuits using HDL and PLD.
4	To teach students to develop digital design using VHDL code.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Conversion** of number system and arithmetic operations	Understand
CO2	**Design** combinational and sequential digital circuits	Apply
CO3	**Analysis** the sequential circuits using state diagram	Analyze
CO4	**Classify** PAL, PLA, PLD and their architecture	Evaluate

Module	**Module Contents**	**Hours**
I	**Number system** Introduction, Revise of Decimal, Binary, Octal & Hex number system. Interconversion of number system, Arithmetic operations, Addition, Subtraction on binary, Octal, Hex, BCD numbers. Review of logic gates, NAND/NOR as universal gates, tri-state logic, Review of Boolean algebra, converting AOI to NAND/NOR.	8
II	**Combinational Circuit** Review of Digital circuits, algebraic minimization (min-terms, max- terms), K-map minimization, Realization using gates, Quine: Mc-cluskey method for logic minimization, Designs using MUX and Demux, Priority Encoder, Priority decoder, Parity Generator and Checker, Carry look ahead adder, ALU, tristate buffers, Shifter, Static and Dynamic timing Hazards, Hazard removal, Code converter.	8
III	**Sequential Circuits** Latches & Flip Flop (S-R Latch, D Latch, D FF, J-K FF, T FF, Conversion of any FF to any other FF, Switch Denouncing, Synchronous Counters, Mod-N Counter.	7
IV	**Shift Registers & parameters** Shift register, SISO, SIPO, PISO, PIPO, Bidirectional shift resistor, universal shift register,Johnson counter, universal shift resistor, Ring Counter. twisted ring counters, Setup time, hold time, timing parameters of flip flop Clock Skew, Clock jitter, Meta stability.	7

V	**State Diagram** Mealy and Moore machines, State diagram, State assignment, Clocked Synchronous State Machines Design using J-K, D, T FF (sequence detector, counters, priority resolver) , decodingcounter state , ASM Chart. **Logic Families** TTL,CMOS, and their characteristics.	6
VI	**PLD** Programmable Logic Devices, Design Using PLA & PAL, CPLD architectures, Generic, Xilnx & Altera family.	3

Text Books	
1	John F. Wakerly, *"Digital Design",* Pearson Education Publication, 4th edition, 2008.
2	Anand Kumar, "*Fundamentals of Digital Circuits*", PHI, 2nd Edition, 2009.
3	MandalS.K , "*Digital Electronics*" 1st Ediction.Mc-Graw-Hill, 2009.
4	Douglas Perry , *"VHDL-Programming by Example"* TMH, 4th Edition, 2002.

References	
1	R..P.Jain, "*Modern Digital Design",* Mc-Graw-Hill, 4th edition, 2010.
2	Morris Manno, "Digital Logic and Computer Design", Prentice-Hall India, 4th edition, 2014.
3	
4	

Useful Links	
1	www.nptel.ac.in/courses/108/105/108105113
2	www.nptel.ac.in/courses/117/106/117106086
3	
4	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1												
CO2		1	1	2										2
CO3			1	2										2
CO4	2	2												

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	20	35
Apply		5	20	25
Analyze				
Evaluate	10	10	20	40
Create				
Total	**20**	**20**	**60**	100

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Data Structure and Algorithm
Desired Requisites:	Programming basics, C programming

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	An ability to describe basic concepts of Data structures
2	To apply knowledge of engineering, information technology, mathematics, andscience
3	An ability to design a system or component, or process to meet stated specifications
4	An ability to identify, formulate and solve engineering problems

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Discuss** the basic concept of data structure	Understand
CO2	**Illustrate** programming skills with various data structures	Apply
CO3	**Apply** the knowledge in applications like RDBMS, Network data models, Hierarchical data model	Apply

Module	**Module Contents**	**Hours**
I	**Introduction** Basic Concepts: Algorithm, Pseudo code, ADT, Data Structure, Algorithmic Efficiency Recursion: Direct and Indirect recursion, analysis of recursive functions e.g. Towers of Hanoi, etc.	6
II	**Linked Lists** Concept of linked organization, Singly linked list, doubly linked list and dynamic storage management, circular linked list, Operations such as insertion, deletion, inversion, concatenation, computation of length, traversal on linked list, Representation and manipulations of polynomials using linked lists.	7
III	**Stacks and Queues** Fundamentals stack and queue as ADT, Representation and Implementation of stack and queue using sequential and linked organization, Circular queue: representation and implementation, Application of stack for expression evaluation and for expression conversion, Backtracking, Stacks and Recursion, Priority queue Doubly Ended Queue	7
IV	**Trees & Graphs** Tree: Basic terminology, binary trees and its representation, binary tree traversals (recursive and non-recursive), operations such as copy, equal on binary tree, expression trees, General Trees, Binary Search Trees, Heaps and its operations, Introduction to Multiway Trees. Graphs: Terminology and Representation of graphs using adjacency matrix, adjacency list and adjacency Multilist, Traversals Depth First and Breadth First, Minimum Spanning Tree.	8

V	**Searching & Sorting** Search: Importance of searching, Sequential, Binary, Fibonacci search algorithms. Sorting: Internal and External Sorts, Insertion, Shell, Heap, Quick sort, Mergesort, Radix sort, Two-way merge sort.	6
VI	**Hashing and Indexing Technique** Hashing: Hashing functions, overflow handling with and without chaining, open addressing: linear, quadratic, double, rehashing Files and Indexes: Indexing Techniques: hashed indexes, Tree indexing - B-trees (concept only implementation not expected), File Organizations: Sequential, Random and Linked organizations, Storage Management	6

Text Books	
1	"C The Programming language", Kernigham & Ritchie
2	"Object Oriented Programming", Lafore, Tata McGraw-Hill
3	"Fundamentals of Data structures in C++", S.Sahni and D.Mehta, Galgotia BookSource

References	
1	*"Data structures via C++"*, A. Michael Berman, Oxford University Press, 2002
2	*"Data Structures and Algorithm Analysis in C++"* M.Weiss, Pearson Education,2002.

Useful Links	
1	
2	
3	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1												1
CO2	2				2									2
CO3	3	1			2									2

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	10	30	50
Apply	10	10	30	50
Analyze				
Evaluate				
Create				
Total	**20**	**20**	**60**	100

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Sensors and Actuators
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	Understand the required sensor and actuator criteria for a mechatronic system.
2	Understand the operation of commonly employed sensors and actuators.
3	Analyze and select the most appropriate sensors or actuator for an application.
4	Construct the appropriate interface circuits for the sensors and actuators.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Explain fundamental physical and technical base of sensors and actuators.	Understand
CO2	Identify the acquired data and measured results.	Apply
CO3	Analyse the required sensors and actuators for their design.	Analyze

Module	**Module Contents**	**Hours**
I	**Instrumentation of an Engineering System** Instrumentation of an Engineering System: Role of Sensors and Actuators, Human Sensory System, Mechatronic Engineering, Control System Architectures, Instrumentation Process. Component Interconnection and Signal Conditioning: Signal Modification and Conditioning, Impedance Matching Methods, Data Acquisition Hardware, Bridge Circuits, Linearizing Devices, Signal-Modification Hardware.	4
II	**Performance Specification and Instrument Rating Parameters** Performance Specification, Time-Domain Specifications, Frequency-Domain Specifications, Linearity, Instrument Ratings, Bandwidth Analysis, Aliasing Distortion Due to Signal Sampling, Instrument Error Considerations, Estimation from Measurements, Sensing and Estimation, Least-Squares Estimation, Maximum Likelihood Estimation, Scalar Static Kalman Filter., Linear Multivariable Dynamic Kalman Filter, Kalman Filter	4
III	**Analog Sensors and Transducers** Sensors and Transducers, Sensors for Electromechanical Applications, Potentiometer, Variable-Inductance Transducers, Permanent-Magnet and Eddy Current Transducers, Variable-Capacitance Transducers., Piezoelectric Sensors, Strain Gauges, Torque Sensors, Gyroscopic Sensors, Thermo-Fluid Sensors.	4
IV	**Digital and Innovative Sensing** Innovative Sensor Technologies, Shaft Encoders, Incremental Optical Encoder, Motion Sensing by Encoder, Encoder Data Acquisition and Processing, Absolute Optical Encoders, Encoder Error, Optical Sensors, Lasers, and Cameras, Miscellaneous Sensor Technologies, Tactile Sensing, MEMS Sensors, Sensor Fusion, Wireless Sensor Networks	4

V	**Mechanical Transmission Components** Actuator–Load Matching, Mechanical Components, Lead Screw and Nut, Harmonic Drives, Continuously Variable Transmission, Load Matching for Actuators. Stepper Motors: Principle of Operation, Stepper Motor Classification, Driver and Controller, Torque Motion Characteristics, Static Position Error, Damping of Stepper Motors, Stepper Motor Models, Control of Stepper Motors, Stepper Motor Selection and Applications.	5
VI	**Continuous-Drive Actuators** Actuator Classification, Actuator Requirements, DC Motors, DC Motor Equations, Control of DC Motors, Motor Driver and Feedback Control, DC Motor Selection, Induction Motors, Induction Motor Control, Synchronous Motors, Linear Actuators, Hydraulic Actuators, Hydraulic Control Systems, Pneumatic Control Systems, Fluidics.	5

Text Books	
1	B. P. Lathi and Jeff Kennedy, "Modern Digital and Analog Communication Systems", Third edition, Oxford University Press, 1998, ISBN: 12345678
2	Straus, Joseph Nathan, "Elements of Communication", Third edition, Prentice Hall, 2011, ISBN: 12345678

References	
1	Pawlak, Andrzej M.,Sensors and actuators in mechatronics : design and applications, CRC Press, Taylor & Francis Group, 2007.
2	Renganathan S.," Transducer Engineering", Allied Publishers (P) Ltd., 2003

Useful Links	
1	Onlinecourses.nptel.ac.in/noc 21 ee32
2	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		3												
CO2			3											
CO3				3										

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	20	10	30	60
Apply		10	20	30
Analyze			10	10
Evaluate				
Create				
Total	**20**	**20**	**60**	100

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Electronic Circuit Analysis and Design-I Lab
Desired Requisites:	Engineering Physics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**LAB ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-	**Credits: 1**			

Course Objectives	
1	To explain the working of electronic circuits like rectifiers, amplifiers (voltage and current), power amplifiers and feedback amplifiers using BJT, FET and MOSFETs.
2	To **illustrate** the methods of designing the electronic circuits using discrete components.
3	To explain the practical ways of measuring AC and DC parameters of electronic circuits like amplifiers for their performance analysis.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	**Demonstrate** the working of electronic circuits: rectifiers, Zenerdiode voltage regulator, and amplifiers built using BJT, JFET and MOSFET.	Understand
CO2	Test and analyze the performance of amplifiers built using BJT, JFET and MOSFET	Analyze
CO3	Evaluate the performance of voltage, current, power and feedback amplifiers.	Evaluate
CO4	Design the electronic circuits (amplifiers) for given specifications using discrete components such as BJT, FET and MOSFET	Create

List of Experiments / Lab Activities

List of Experiments:

1. Analyze the performance of Half-wave and Full-wave Rectifiers.
2. Zener diode I-V characteristics and design a Zener diode voltage regulator.
3. Design and analysis of single stage common emitter BJT amplifier. Plot the frequency response of amplifier.
4. Design and analysis of single stage common collector (emitter follower) amplifier.
5. Analyze the performance of common source JFET amplifier.
6. Biasing methods for MOSFET and MOSFET as a switch.
7. Design and analysis of common source MOSFET amplifier.
8. Design and analysis of common drain (source follower) MOSFET amplifier.
9. Study of performance of Darlington pair.
10. Design and analysis of two stage BJT amplifier with negative feedback.
11. Design and analysis of class-A power amplifier using BJT/MOSFET.
12. Design and analysis of class-AB power amplifier.
13. Analyze the performance RC Phase-Shift Oscillator.

In case of mini-projects, drawing, presentations etc, write the relevant details of the same.

Text Books	
1	D. A. Neamen," Electronic Circuit Analysis and Design", 3rd edition, McGraw Hill Education, India Private Limited, New Delhi, 2007
2	A. S. Sedra, K. C. Smith,"Microelectronic Circuits", 5th edition , Oxford University Press, 2004
3	Allen Mottershed,"Electronic Devices and circuits", PHI
4	
References	
1	R. BOylestad and L. Nashelsky," Electronic Devices and circuit Theory", 9th Edition, PHI 2009
2	Millman and Halkias," Electronic Devices and circuits", TATA MacGraw Hill
3	Gerald E. Williams," Practical Transistor Circuit Design and Analysis", McGraw Hill, 1973
4	
Useful Links	
1	https://www.theengineeringknowledge.com/introduction-to-proteus/
2	http://www.youtube.com/watch?v=-RCApPIsuYU
3	https://www.udemy.com/course/simulation-of-electronic-circuits-by-proteus/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3									3				1
CO2		3		2										
CO3					2									
CO4			3	2										2

Assessment

There are four components of lab assessment, LA1, LA2, LA3 and LA4
IMP: LA4 is a separate head of passing. LA4 is treated as End Semester Exam and is based on all experiments/lab activities.

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 4 Marks Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Marks Submission at the end of Week 9	25

LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Marks Submission at the end of Week 14	25
LA4	Lab Performance and documentation	Lab Course faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	25

Week 1 indicates starting week of Semester.
Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

Assessment Plan based on Bloom's Taxonomy Level					
Bloom's Taxonomy Level	**LA1**	**LA2**	**LA3**	**LA4**	**Total**
Remember					
Understand	10	5			**15**
Apply					
Analyze	10	10	5	5	**30**
Evaluate			10	10	**20**
Create	5	10	10	10	**35**
Total	**25**	**25**	**25**	**25**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Simulation Tools
Desired Requisites:	Computer Programming for Electronics Engineers

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**LAB ESE**	**Total**
Tutorial	-	30	30	40	100
Practical					
Interaction	1 Hrs/Week -	**Credits: 1**			

Course Objectives	
1	To explain simulation of electronic circuit and creating its PCB layout using eSim.
2	To explain ngspice statements for describing and analyzing an electronic circuit.
3	To explain ngspice statements for modeling electronic devices.
4	To explain built in functions in SciLab or MatLab .
5	To explain statements for programming in SciLab or MatLab.
6	To explain creation of GUI and modeling of system in SciLab or MatLab

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	After the completion of the course the student should be able to	Bloom's Cognitive Descriptor
CO1	**Use** ngspice for analyzing electronic circuits and SciLab or MatLab for processing large data.	Apply
CO2	**Employ** ngspice for modeling electronic devices and SciLab or MatLab for visualizing complex equations.	Apply
CO3	**Evaluate** operating parameters of an electronic circuit using eSim and system performance using SciLab or MatLab	Evaluate

List of Experiments / Lab Activities

List of Experiments:

1. Simulating an Electronic circuit using KiCAD
2. Creating PCB layout of an Electronic circuit using KiCAD
3. DC Analysis of an Electronic circuit using ngspice
4. AC Analysis of an Electronic circuit using ngspice
5. Modeling an Electronic device using ngspice
6. Solving simultaneous equations using SciLab or MatLab
7. Plotting 2D graph using SciLab or MatLab
8. Ploting 3D graph using SciLab or MatLab
9. Creating GUI using SciLab or MatLab
10. Modeling a system in SciLab or MatLab

Text Books

1	(Online books available through internet) http://ngspice.sourceforge.net/docs.html
2	SciLab help
3	MatLab Documentation

References

1	https://spoken-tutorial.org/tutorial-search/?search_foss=eSim&search_language=English
2	https://spoken-tutorial.org/tutorial-search/?search_foss=KiCad&search_language=English
3	https://spoken-tutorial.org/tutorial-search/?search_foss=Ngspice&search_language=English
4	https://spoken-tutorial.org/tutorial-search/?search_foss=Scilab&search_language=English

Useful Links

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1					1									
CO2					1									
CO3					1									
CO4														

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	30	20	30	**80**
Analyze				
Evaluate		10	10	**20**
Create				
Total	**30**	**30**	**40**	**100**

AY 2021-22						
Course Information						
Programme		B.Tech. (Electronics Engineering)				
Class, Semester		Second Year B. Tech., Sem III				
Course Code		5EN253				
Course Name		Digital Electronics Lab				
Desired Requisites:		Engineering Physics				
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	-	**LA1**	**LA2**	**LAB ESE**	**Total**	
Tutorial	-	30	30	40	100	
Practical	2 Hrs/Week					
Interaction	-	**Credits: 1**				

Course Objectives	
1	To explain the importance of the HDL for Digital Design
2	To demonstrate the complete flow of EDA tool for implementing digital designs
3	To explain the concepts involved in simulation and synthesis of digital circuits using EDA tool
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	After the completion of the course the student should be able to	Bloom's Cognitive Descriptor
CO1	Able to write the & debug the VHDL code	Understand
CO2	Able to implement on kits	Apply

List of Experiments / Lab Activities

List of Experiments:

1. Experiment 1: Introduction to Xilinx with sample experiment
2. Experiment 2: 1 bit full adder using 1 bit half adder as a component
3. Experiment 3: 4 bit full adder using 1 bit full adder as a component
4. Experiment 4: 1 bit full adder using 8:1 multiplexer as component
5. Experiment 5: 1 bit full adder using 1:8 demux as component
6. Experiment 6: Implementation of 4:1 mux using 2:1 mux as a component
7. Experiment 7: Implementation of demultiplexer IC 74138
8. Experiment 8: 4 bit comparator
9. Experiment 9: Implementation of flip flops
10. Experiment 10: UP counter and DOWN counter
11. Experiment 11: MODN counter
12. Experiment 12: UP-DOWN counter
13. Experiment 13: Shift registers
14. Experiment 14: Universal shift register
15. Experiment 15: Parallel loading shift register
16. Experiment 16: Sequence detector
17. Experiment 17: Creation of project in Quartus-II & download

Text Books

1	John F. Wakerly, "Digital Design", Pearson Education Publication, 5th edition, 2018.
2	Anand Kumar, "Fundamentals of Digital Circuits", PHI, 2ndEdition, 2009
3	MandalS.K , "Digital Electronics" Mc-Graw-Hill, 1stEdiction., 2009
4	Douglas Perry, "VHDL-Programming by Example" TMH, 4th Edition, 2012

References

1	R..P.Jain, “Modern Digital Design”, Mc-Graw-Hill, 4th edition, 2010
2	Morris Manno, “Digital Logic and Computer Design”, Prentice-Hall India, 1st edition 1979
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Useful Links	
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CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1		2	2									1
CO2		1	1											1
CO3														
CO4														

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

Assessment Plan based on Bloom’s Taxonomy Level (Marks) (For lab Courses)

Bloom’s Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	20	10	20	**50**
Apply	10	20	20	**50**
Analyze				
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

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AY 2021-22

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Data Structures and Algorithm Lab
Desired Requisites:	Programming basics and Computer Programming for Electronics Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**LAB ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To explain debugging of a C program for AT89C51ED2 and PIC16F877A in uV4 and MPLAB IDE respectively
2	To show downloading and testing of C program for AT89C51ED2 and PIC16F877A in AT89C51ED2 and PIC16F877A development board respectively.
3	To explain development of C program for implementing given system requirements using AT89C51ED2 or PIC16F877A microcontroller
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

COs	After the completion of the course the student should be able to	Bloom's Cognitive
CO1	**Demonstrate** different data structures and need of searching and sorting techniques.	Apply
CO2	**Implement** Static and dynamic data structures stack and queue, searching and sorting algorithms.	Apply
CO3	**Examine** the complexity of data structures, searching and sorting algorithms.	Apply

List of Experiments / Lab Activities

List of Experiments:

1. Programs to revise arrays, structures and pointers
2. Programs to study different file operations opening files, closing files, writing a file, reading file
3. Program to implement algorithm and observing complexity measures
4. Program to implement singly linked list with all operations
5. Program to implement doubly linked list with all operations
6. Program to implement circular linked list with all operations
7. Program to implement Stack (Static and Dynamic)
8. Program to implement Queue (Static and Dynamic)
9. Program to implement applications of Stack (Expression evaluation and string reversing)
10. Programs to Search the data with complexity
11. Programs to Sort the data with complexity measure
12. Implementation of binary search tree

Text Books

1	Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures A pseudo code approach with C".
2	Horowitz, Sahni, "Fundamentals of Data structures in C", 2nd edition, 2008
References	
1	Yashavant Kanetkar, "Understanding pointers in C", BPB Publication, 2009
2	N. B. Venkateshwarlu, E. V. Prasad, C and Data Structures, S. Chand and Company, 2010
Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			2	2	2				2					
CO2			2	2	2				2				2	
CO3			2	2	2				2				**2**	
CO4														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	30	30	40	**100**
Analyze				
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Electronic Circuit Analysis and Design - II
Desired Requisites:	Electronic Circuit Analysis and Design-I

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To explain the importance of the course, (along with COs, POs, Course Plan etc.)
2	To illustrate the working of differential amplifier and operational amplifier.
3	To illustrate the methods used for analysis of op-amp based circuits (useful for GATE)
4	To illustrate the practical aspects of op-amp in analog signal processing.
5	To illustrate the working of and design methods of important opamp based circuits (useful for industry, mini-projects and projects)

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	**Illustrate and Apply** the understanding of various op- amp based linear and nonlinear circuits, such as amplifiers, waveform generators, active filters, PLL etc., to solve related problems.	Apply
CO2	**Analyze** the ideal opamp based circuits such as various amplifiers, filters, waveform generators, precision rectifiers, voltage regulators etc.	Analyze
CO3	**Analyze** the electronic circuits considering practicallimitations of opamp, for amplifiers and related linear circuits, applications of adder, subtractors, waveformgenerator etc.	Analyze
CO4	**Design** the circuits like Instrumentation amplifier, V-I, I-V, Precision Rectifier, Linear voltage regulator etc.	Create

Module	**Module Contents**	**Hours**
I	**Operational Amplifier** Amplifier fundamentals, differential amplifier, basic op-amp configuration, op-amp powering, feedback in op-amp circuits, ideal op-amp circuits analysis.	5
II	**Basic Opamp Circuits** Inverting and Non-inverting amplifiers, adder, subtractor, voltage to current converters, current to voltage converters, instrumentation amplifier, transducer bridge amplifier, Log/Antilog amplifier.	8
III	**Opamp Practical Limitations** Simplified op-amp internal circuit diagram, input bias current, input offset voltage, input offset error compensation, low input bias/offset voltage op-amps, open loop response, closed loop response, transient response; sources of noise, stability in op-amp circuits, frequency compensation.	6
IV	**Opamp based Filter Circuits** Opamp as Integrator and Differentiator, Advantage of active filters, First order active filter, standard second order active filters. Design of simple active filters.	5
V	**Comparator and Waveform Generators** Voltage Comparator, Schmitt triggers and applications, peak detector, sample and hold circuit, Sine wave generators, square/triangular wave generators, waveform generator ICs, V to F, F to V converter, Precision rectifier.	8

VI	**Voltage Regulator and PLL** Linear regulators and applications, three pin regulators, switching regulators, phase locked loop and applications, monolithic PLLs: NE565, CD4046.	7

Text Books	
1	Sergio Franco, "Design with op-amp and analog integrated circuits", Tata McGraw Hill, 3rd edition, 2009.
2	Ramakant Gaikwad, "Op-amp and Linear Integrated Circuits", PHI, 4th edition 2008.

References	
1	Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear IntegratedCircuits", Sixth Edition, PHI, 2001.
2	D. Roy Choudhury and S. B. Jain, "*Linear Integrated Circuits*", New Age International Publishers,

Useful Links	
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CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													3
CO2		3												3
CO3		3												3
CO4			3											3

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand				
Apply	10	10	25	45
Analyze	10	10	15	35
Evaluate				
Create			20	20
Total	**20**	**20**	**60**	100

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Signals and Systems
Desired Requisites:	Engineering Mathematics, Basic Electrical Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial		20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

On completion of the course, students should be sufficiently familiar with the theoretical structure, formal representation, computational methods, notation, and vocabulary of linear models to be able to apply them to the analysis and design of digital and analog communications and control systems. The students will be able to perform signal analysis with reference to spectrum analysis of deterministic signals.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Demonstrate the concept of signals and systems.	Understand
CO2	Examine the response of linear systems in the time domain.	Analyze
CO3	Evaluate systems in the frequency domains.	Evaluate
CO4	Use frequency domain techniques to solve input/output problems for linear time invariant systems.	Create

Module	**Module Contents**	**Hours**
I	**Introduction to Signals and Systems – Continuous and Discrete** Introduction, standard signals, signal representation, classification of signals, systems – representation, classification, Linear, Time invariant, causal, BIBO stable, Static, dynamic.	8
II	**Time Domain Analysis of Continuous and Discrete Time Systems** Zero state and Zero input response, Impulse response, Convolution integral and convolution sum, graphical representation of convolution.	7
III	**Fourier Domain Analysis of Continuous Time Signal** Trigonometric Fourier series, Compact Trigonometric Fourier series, Exponential form, Dirichlet Conditions, Frequency domain representation of periodic signals, Fourier Transform representation of aperiodic signals, Properties of CFT duality, time reversal, Convolution – time and frequency domain, etc.	6
IV	**Laplace Transform Analysis of Signals and System** Definition, Properties, Solution of differential equation. Transfer function, Poles and Zeroes, System analysis using Laplace Transform, min-max phase systems	4
V	**Fourier Domain Analysis of Discrete Time Signal** Representation of CT signals using Samples, Nyquist Sampling Theorem Discrete time Fourier Transform, Representation of aperiodic sequence, Properties of DTFT: time reversal, Linear Convolution – time and frequency domain, conjugate symmetry. Discrete Fourier Transform: Definition and Properties	8

VI	**Z Transform Analysis of Discrete Time Signals and Systems** Definition, Properties, Solution of difference equation. Transfer function, Poles and Zeroes, System analysis using Z-Transform, Minimum phase – maximum phase system, FIR, IIR systems, All pass systems, Zero phase systems, Chirp-Z Transform	7

Text Books	
1	A.V. Oppenheim, A.S. Willsky, S.H. Nawab, Signals and Systems, Prentice Hall,1997.
2	Ashok Ambardar, Analog and Digital Signal Processing, CL Engineering, 1999

References	
1	B. P. Lathi, Linear systems and signals ,Oxford University press, 2005
2	M. J. Roberts , Signals and Systems, Tata McGraw-Hill, 2005
3	Simon Haykin, Barry Van Veen, Signals and systems ,Wiley, 2003
4	Hwei P Hsu, Schaum's Outline Signals and Systems, Tata McGraw-Hill, 1995

Useful Links	
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CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1												1
CO2		1	1											1
CO3					2									1
CO4		2	2											1

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	20	10	20	50
Apply				
Analyze		10	20	30
Evaluate			10	10
Create			10	10
Total	**20**	**20**	**60**	100

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AY 2021-22

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Communication Engineering
Desired Requisites:	Basic Electronics Engineering, Engineering Mathematics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To introduce the techniques of transmitting and receiving information signals using analog carrier modulation techniques and evaluate their performance levels (SNR) in the presence of channel noise.
2	To establish foundation for understanding the relationship among various technical factors useful for designing communication system.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Analyze different components of analog and digitalcommunication	Analyze
CO2	systems such as modulator, demodulator, mixer, receiver etc. in time and frequency domain.	Understand
CO3	Compare analog and digital communication systems on the basis of bandwidth, power requirement and the performance in the presence of	Understand

Module	**Module Contents**	**Hours**
I	**Amplitude Modulation and Demodulation** DSB-FC, DSB-SC, SSB, VSB and ISB transmissions: mathematical Analysis-time and frequency domain analysis, modulation index, generation and detection methods, power requirement of these systems, Comparison of AM modulation schemes, Quadrature Carrier Multiplexing(QAM), frequency division Multiplexing, AM detection : envelope detection, Demodulation of DSBSC : synchronous detection.	9
II	**Frequency Modulation and Demodulation** Frequency Modulation (FM),: Single Tone Frequency Modulation, Spectrum Analysis, Narrowband FM, Wideband FM, Transmission Bandwidth of FM Waves, Generation of FM waves: Direct and Indirect Methods, Demodulation of FM, Phase Locked Loops, Limiting of FM waves, comparison between AM & FM, Phase Modulation, Relation between FM and PM.	9
III	**Sampling theorem and Pulse Modulation Techniques** Sampling theorem, Types of sampling, Inter symbol interferences, Modulation & Demodulation of PAM, PWM, PPM, merits & demerits, Introduction to PCM system, quantization of signals, Differential PCM, Delta Modulation, Adaptive Delta Modulation.	4
IV	**Digital Data Transmission** Definition of Line Coding, various line codes, unipolar, bipolar RZ and NRZ techniques, split phase manchester formats	5

V	**Digital Modulation Techniques** Coherent Quadrature Modulation Techniques, Non Coherent Binary Modulation Techniques, Comparison of Binary and Quaternary Modulation Techniques; M array modulation Techniques, Power spectra, Bandwidth efficiency, M array Modulation formats Viewed in the light of channel Capacity theorem, Effect of inters symbol interference.	6
VI	**Noise** Classification and sources of noise, signal to noise ratio (SNR), noise analysis and measurements, equivalent noise bandwidth, noise figure, noise temperature, AWGN.	6

Text Books	
1	T.L. Singal, "Analog and Digital Communication",6th Edition, Mc Graw Hill, 2012
2	Roy Blake , "Electronic Communication System", Thomson Publications, 2nd Edition,2002
3	Taub Schilling, "Principle of communication system", TMH publication, 4th Edition, 2013

References	
1	Simon Hykin, "Communication System", 4th Edition, John Wiley & Sons, 2000
2	B. P. Lathi, "Modern Digital and Analog Communication Systems", Oxford Publications, 3rd Edition, 1998
3	George Kennedy, "Electronic Communication System", McGraw Hill, 4th Edition, 2009
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Useful Links	
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CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		3											2	
CO2		2	2										3	
CO3			2										2	

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember				
Understand	20	10	30	60
Apply				
Analyze		10	30	40
Evaluate				
Create				
Total	**20**	**20**	**60**	100

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Microcontrollers and Peripherals Interfacing
Desired Requisites:	Digital Electronics 4EN203

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To explain design of Intel 8085 microprocessor based small microcomputer.
2	To explain Intel 8051 microcontroller and its programming in assembly and C language.
3	To explain interfacing of external devices with Intel 8051 and programming in C.
4	To explain Intel 8051 peripherals and their programming in C.
5	To explain PIC16F877A microcontroller, its peripherals and programming in C.
6	To explain design of Intel 8051 and PIC16F877A microcontroller-based system.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Demonstrate** situation-based interfacing of external devices with Intel 8085, Intel 8051 and PIC16F877A.	Apply
CO2	**Write** assembly and C language programs for Intel 8051 and PIC16F877A to meet given system requirements.	Analyze
CO3	**Design** Intel 8051 and PIC16F877A microcontroller-based system.	Create

Module	**Module Contents**	**Hours**
I	**8 bit Microprocessor** Block diagram of Intel 8085; function of each pin; Demultiplexing the multiplexed address data bus; Generating read and write control signals for memory and I/O; Interfacing memory; Memory map; I/O map; Simple microcomputer system; Opcode fetch cycle; Memory read cycle; Memory write cycle; Machine cycle of some instructions.	5
II	**8 bit Microcontroller** Block diagram of Intel 8051; function of each pin; Interfacing memory (ROM and RAM); Machine cycle; Instruction set; Addressing modes; MCS51 family; Assembler directives; Writing assembly language programs; Development tools for Intel 8051; C language for Intel 8051.	7
III	**Interfacing Devices** Logic structure of Intel 8051 ports; Interfacing devices like relay, unipolar stepper motor, seven segment display (Static and Dynamic), character LCD, thumbwheel, array keyboard, matrix keyboard, ADC0808 and DAC0808 with Intel 8051 microcontroller and writing corresponding C programs.	8
IV	**Peripherals** Operation of Timer in Intel 8051, Timer modes, Programming timer as timer in C, Programming timer as counter in C; Operation of UART in Intel 8051, Serial communication modes, Programming UART in C; Intel HEX file format; ISP; Interrupt sources, Interrupt flags, Vector addresses, Interrupt structure of Intel 8051, Interrupt blocking conditions, Interrupt priorities, Interrupt latency, Writing an Interrupt Service Routine in C.	8

V	**RISC Microcontrollers** Block diagram of PIC microcontroller; configuration word, oscillator configurations, power up timer, oscillator startup timer, brown out reset; operation of on chip reset circuit, Timer 0, Watchdog timer; Interfacing devices like relay, unipolar stepper motor, seven segment display (Static and Dynamic) with PIC microcontroller and writing corresponding C programs.	7
VI	**System Design** System requirements; Interface design; Implementing state machine in C; Design of digital voltmeter, temperature indicator, ON OFF temperature controller, Mains frequency meter and Multiprocessor communication system using Intel 8051 and PIC microcontroller; compare Intel 8051 and PIC microcontroller.	5

Text Books	
1	Kenneth J. Ayala,The 8051 Microcontroller Architecture, Programming and Applications, 2nd Edition, Penram International Publication, revised edition 2009
2	Mohammad Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education, 2nd edition, 2010.
3	John B. Peatman, Design with PIC microcontrollers, Pearson Education, 1st edition, 2003
4	Mohammad Ali Mazidi, PIC Microcontroller and Embedded Systems, Pearson Education, 1st edition, 2008.
References	
1	Intel 8085 and 8051 datasheet (www.intel.com)
2	Keil A51 and C51 manuals
3	PIC16F877A datasheet (www.microchip.com)
4	Hi-Tech C Compiler manual
Useful Links	
1	www.tutorials point.com
2	www.coursera.org
3	nptel.ac.in

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand				
Apply	10	10	30	50
Analyze	10	5	20	35
Evaluate				
Create		5	10	15
Total	**20**	**20**	**60**	100

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Control Systems
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To provide with the necessary information regarding sensing of various parameters, Data Acquisition System required in the industries.
2	To provide fundamentals of Control systems such as open loop and closed loop systems, Block diagram, Signal flow graph etc.
3	To introduce fundamentals of time and frequency domain analysis.
4	To develop concept of stability in time and frequency domain.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	**Discuss** characteristics of various types of sensors, open and closed loop systems, Mathematical models, Error constants, Design specifications for second order system, stability, etc	Understand
CO2	**Illustrate** measurement of temp, pressure circuits, mathematical models, transfer function using Block diagram and signal flow graph, Compensating networks, State space model.	Apply
CO3	**Examine** time response analysis, stability using Routh-Hurwitz criteria, Nyquist criteria, Root locus, Bode plots, Controllability and Observability etc.	Apply

Module	**Module Contents**	**Hours**
I	**Introduction** Different types of Transducers, Transducer selection factors, Types of errors and sources of errors, Mathematical models of physical system, Open loop and closed loop systems, regenerative feedback, Transfer function, Block diagrams and reduction techniques including signal flow graphics, deriving transfer function, control system components	9
II	**Time response Analysis** Standard test signals, time response of second order system, steady state errors and error constants, design specifications of second order system. Preliminary design considerations of Compensators need of compensation, lead compensations, lag compensation, lag-lead compensation.	7
III	**Stability Analysis in Time Domain** Concept of stability, condition of stability, characteristic equation, relative stability, Routh-Hurwitz criterion, special cases for determining relative stability.	6
IV	**Root locus techniques** Basic concept, rules of root locus, application of root locus technique for control systems.	6
V	**Frequency Response Analysis** Polar plots, Bode plots, Nyquist stability criterion, gain margin, phase margin, effect of addition of poles and zeros on bode plots.	6
VI	**Analysis of Control Systems in State – Space** Basic concepts of state, state variable and state models, transfer matrix, Controllability, observability, obtaining state space equations in canonical form.	7

Text Books	
1	"Modern Electronic Instrumentation and Measurement Techniques", A.D. Helfrick and
2	W.D. Copper, 5th Edition, Pearson Education, 2002.
3	"Control System Engineering", I.J. Nagrath, M. Gopal, 5th Edition, New AgeInternational Publications, 2008
References	
1	"Electronic Measurement and Instrumentation", Oliver Cage, Tata McGraw Hill Publication.
2	"Modern Control System", Dorf, Bishop, 12th Edition, Prentice Hall, 2013
3	"Feedback and Control Systems", Schaum's Outlines Series book, 2nd Edition, McGraw Hill Education, 2012.
Useful Links	
1	
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CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													2
CO2	1													2
CO3		1	2											2

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	10	30	50
Apply	10	10	30	50
Analyze				
Evaluate				
Create		5		
Total	**20**	**20**	**60**	100

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	ECAD-II LAB
Desired Requisites:	Electronic Circuit Analysis and Design-I Theory and Lab courses

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**LAB ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To **illustrate demonstrate,** proper use of instruments and simulator software
2	To **explain** the process of constructing a circuit and verifying working of circuits mentioned in the experiment list.
3	To **illustrate** the methods used for analysis and design of op-amp based circuits.
4	To Illustrate process of performing the experiment and documenting the results.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive Descriptor
CO1	**Use** the required instruments, with proper theoretical understanding of the instruments and modern tools such as circuit simulation software	Apply
CO2	**Examine practically** the performance of a given opamp based circuit, do correct calculations and properly write the conclusions.	Analyze
CO3	**Design** simple opamp based applications using the circuits studied in related theory course, and as per given problems.	Create
CO4	**Prepare the documentation** of proper observations, neat graphs, writing conclusion in grammatically and technically correct language, explain orally the circuit operation and process of performing the experiments in correct technical language.	Evaluate

List of Experiments / Lab Activities

List of Experiments:

1. Design of Inverting and Non-inverting amplifier
2. Design of Inverting Adder circuit
3. Design of Opamp based subtractor / difference amplifier
4. Design Instrumentation Amplifier
5. Measurement of input offset voltage, input bias current and slew rate
6. Effect of offset voltage and bias current of opamp on circuit output voltage
7. Effect of circuit gain on circuit frequency response for non-inverting amplifier
8. Design of Schmitt trigger
9. Active differentiator/ Integrator
10. Second order Butterworth low pass filter/ high pass filter
11. Square and triangular waveform generator
12. Design of Precision rectifier

Text Books	
1	Sergio Franco, "Design with op-amp and analog integrated circuits", Tata McGraw Hill, 3rd edition, 2009.
2	Ramakant Gaikwad, "Op-amp and Linear Integrated Circuits", PHI, 4th edition 2008
3	
4	

References	
1	Robert F.Coughlin, Frederick F.Driscoll, " Operational Amplifiers and Linear IntegratedCircuits" , Sixth Edition, PHI, 2001.
2	B.S.Sonde, " System design using Integrated Circuits " , 2 nd Edition, New Age Pub, 2001
3	
4	

Useful Links	
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3	
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CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1														
CO2		3												
CO3			3											
CO4										2				

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30

Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	15	10	10	**35**
Analyze	15	10	10	**35**
Evaluate		10	10	**20**
Create			10	**10**
Total	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Communication Engineering and Control System Lab (PART A)
Desired Requisites:	Basic Electronics Engineering, Engineering Mathematics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**LAB ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To illustrate different components of analog communication systems such as modulation, demodulation, sampling, antenna etc
2	To enable the students for design and development of applications of communication system
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive
CO1	Analyze the performance of different modulation and demodulation schemes in terms of bandwidth, power requirement presence of noise.	Analyze
CO2	Compare the performance of different sampling methods, antenna.	Understand
CO3	Demonstrate a small communication system using software packages (MATLAB, Emona Datex board)	Apply

List of Experiments / Lab Activities

List of Experiments:

1. Spectrum analyzer
2. AM Transmitter/ Receiver
   a. DSB-FC system
   b. DSB – SC system
3. FM Transmitter/ Receiver
   a. Reactance and varactor modulator
   b. PLL, quadrature, Foster- Seeley and detuned resonance detectors
4. Sampling theorem and reconstruction
5. Pulse Modulation and demodulation
   a. PAM, PWM,PPM techniques
6. PCM Modulation and Demodulation
7. Digital Data Transmission Techniques
8. Digital Modulation Techniques
9. Experiments on MATLAB
10. Experiments on National Instrument's Emona Datex Board

Text Books	
1	George Kennedy , "Electronic Communication System", McGraw Hill, 4th Edition, 2009
2	Roy Blake , "Electronic Communication System", Thomson Publications, 2nd Edition,2002
3	Taub Schilling, "Principle of communication system", TMH publication, 4th Edition, 2013
4	
References	
1	Wayne Tomasi ,"Adavnced Electronic Communications Systems", Pearson education, 5th Edition, 2014
2	Simon Hykin, "Communication System", 4th Edition, John Wiley & Sons, 2000
3	B. P. Lathi, "Modern Digital and Analog Communication Systems", Oxford Publications, 3rd Edition, 1998
4	
Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1					2								2	
CO2					2									2
CO3					3				2				2	
CO4														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	20	10	10	**40**
Apply	10	10	20	**40**
Analyze		10	10	**20**
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Communication Engineering and Control System Lab (PART B)
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**LAB ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-				

Course Objectives

1	To introduce open and closed loop systems, transfer function, block diagram and signal flow graphs
2	To provide fundamentals of sensors, time and frequency domain analysis.
3	To provide the necessary concept of stability in time and frequency domain.
4	To introduce concepts of state space models and its analysis.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive
CO1	**Discuss** open and closed loop systems, state space models, Error constants, Design specifications for second order system, stability, etc	Understand
CO 2	**Illustrate** mathematical models, transfer function using Block diagram and signal flow graph, Compensating networks, State space models	Apply
CO3	**Execute** stability analysis using Routh-Hurwitz criteria, Nyquist criteria, Root locus, Bode plots etc. using Matlab Programs	Apply
CO 4	**Solve** PD, PI and PID controllers using Matlab	Apply

List of Experiments / Lab Activities

List of Experiments:

1. Potentiometer as transducer and error detector.
2. Synchros as transmitter and error detector.
3. Effect of negative feedback and Speed control of DC motor.
4. DC position Control system (P, PI controller)
5. Time response of second order system.
6. Selection of kp, ki and kd in PID controller
7. To draw Root locus and comment on stability.
8. To draw Bode plots and comment on stability.
9. Conversion of TF model to state space model

Text Books	
1	"Control System Engineering", I.J. Nagrath, M. Gopal, 5th Edition, New Age International Publications, 2008.
2	"Modern Control Engineering", Katsuhiko Ogata, 5th Edition, Prentice Hall, 2015.
3	"Modern Control System", Dorf, Bishop, 12th Edition, Prentice Hall, 2013.
4	

References	
1	"Feedback and Control Systems", Schaum's Outlines Series book, 2nd Edition, McGraw Hill Education, 2012.
2	"Automatic Control Systems", Bejamin C. Kuo, 7th Edition, Wiley Publications, 1995.
3	
4	

Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				**2**									**2**	
CO2				**1**										**2**
CO3					**2**								**2**	
CO4				**2**	**1**					2				**2**

Assessment

There are four components of lab assessment, LA1, LA2, LA3 and LA4
IMP: LA4 is a separate head of passing. LA4 is treated as End Semester Exam and is based on all experiments/lab activities.

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 4 Marks Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Marks Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Marks Submission at the end of Week 14	25
LA4	Lab Performance and documentation	Lab Course faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	25

Week 1 indicates starting week of Semester.
Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

Assessment Plan based on Bloom's Taxonomy Level					
Bloom's Taxonomy Level	**LA1**	**LA2**	**LA3**	**LA4**	**Total**
Remember					
Understand	10	8	7	5	**30**
Apply	15	17	18	20	**70**
Analyze					
Evaluate					
Create					
Total	**25**	**25**	**25**	**25**	**100**

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Microcontrollers and Peripherals Interfacing Lab
Desired Requisites:	Digital Electronics Lab 4EN252,Data Structures and Algorithm Lab

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**LAB ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/Week				
Interaction	-	**Credits: 1**			

Course Objectives	
1	To explain debugging of a C program for AT89C51ED2 and PIC16F877A in uV4 and MPLAB IDE respectively
2	To show downloading and testing of C program for AT89C51ED2 and PIC16F877A in AT89C51ED2 and PIC16F877A development board respectively.
3	To explain development of C program for implementing given system requirements using AT89C51ED2 or PIC16F877A microcontroller
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	After the completion of the course the student should be able to	Bloom's Cognitive Descriptor
CO1	**Use** uV4 and MPLAB IDE to debug a C program for AT89C51ED2 and PIC16F877A microcontroller respectively.	Apply
CO2	**Test** a C program written for AT89C51ED2 using AT89C51ED2 development board and for PIC16F877A microcontroller using PIC16F877A development board.	Analyz
CO3	**Develop** C program for implementing a given system using AT89C51ED2 and PIC16F877A microcontroller.	Create

List of Experiments / Lab Activities

List of Experiments:

1. Conversion of if and for C statements into 8051 instructions
2. Interfacing Unipolar Stepper Motor with 8051 microcontroller.
3. Interfacing 4 digit Multiplexed Display with 8051 microcontroller.
4. Interfacing 16x2 character LCD with 8051 microcontroller.
5. Interfacing 4x4 Matrix Keyboard with 8051 microcontroller.
6. Interfacing DAC0800 with 8051 microcontroller.
7. Interfacing ADC0809 with 8051 microcontroller.
8. Handling External Interrupts
9. Using Timer as Timer
10. Using Timer as Counter
11. Serial communication (Hardware control through PC keyboard)
12. Multiprocessor communication (Using Proteus)
13. Interfacing Unipolar Stepper Motor with PIC16F877A microcontroller.
14. Interfacing 4 digit Multiplexed Display with PIC16F877A microcontroller.

Text Books

1	Kenneth J. Ayala,The 8051 Microcontroller Architecture, Programming and Applications, 2nd Edition, Penram International Publication, revised edition 2009
2	Mohammad Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education, 2nd edition, 2010
3	John B. Peatman, Design with PIC microcontrollers, Pearson Education, 1st edition, 2003
4	Mohammad Ali Mazidi, PIC Microcontroller and Embedded Systems, Pearson Education, 1st edition, 2008.

References

1	Intel 8085 and 8051 datasheet (www.intel.com)
2	Keil A51 and C51 manuals
3	PIC16F877A datasheet (www.microchip.com)
4	Hi-Tech C Compiler manual

Useful Links

1	nptel.ac.in
2	Vlabs.org
3	Coursera.org
4	Tutorials point.com

CO-PO Mapping		
	Programme Outcomes (PO)	PSO

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

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	15	10	10	35
Analyze	15	10	20	45
Evaluate				
Create		10	10	20
Total	**30**	**30**	**40**	**100**