COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC201	NETWORK THEORY	3-1-0-4	2016

Prerequisite: Nil

Course objectives:

- To make the students capable of analyzing any linear time invariant electrical network.
- To study time domain, phasor and Laplace transform methods of linear circuit analysis.
- To study the transient response of networks subject to test signals.
- To develop understanding of the concept of resonance, coupled circuits and two port networks.

Syllabus:

Circuit variables and Circuit elements, Kirchhoff's laws, Network topology, Mesh and node analysis of network, Laplace transform, Inverse Laplace transform, Solution of differential equations by using Laplace transforms, Transient analysis of RL, RC, and RLC networks, Network functions for the single port and two ports, Parameters of two-port network, Resonance, Coupled circuits

Expected outcome:

At the end of the course students will be able to analyze the linear time invariant electrical circuits.

Text Books

1. Ravish R., Network Analysis and Synthesis, 2/e, McGraw-Hill, 2015.
2. Valkenburg V., Network Analysis, 3/e, PHI, 2011.

References:

1. Sudhakar A,S. P. Shyammohan, Circuits and Networks- Analysis and Synthesis, 5/e, McGraw-Hill, 2015.
2. Choudhary R., Networks and Systems, 2/e, New Age International, 2013.
3. Franklin F. Kuo, Network Analysis and Synthesis, 2/e, Wiley India, 2012.
4. Pandey S. K., Fundamentals of Network Analysis and Synthesis, 1/e, S. Chand, 2012.
5. Edminister, Electric Circuits – Schaum's Outline Series, McGraw-Hill,2009.

Course Plan

Module	Course content (48 hrs)	Hours	Sem. Exam Marks
I	Introduction to circuit variables and circuit elements, Review of Kirchhoff's Laws, Independent and dependent Sources, Source transformations	3	15
	Network topology, Network graphs, Trees, Incidence matrix, Tie-set matrix and Cut-set matrix	2	
	Solution methods applied to dc and phasor circuits: Mesh and node analysis of network containing independent and dependent sources	3	
II	Network theorems applied to dc and phasor circuits: Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity theorem, Millman's theorem, Maximum power transfer theorem	6	15

	Laplace transform, properties Laplace Transforms and inverse Laplace transform of common functions, Important theorems: Time shifting theorem, Frequency shifting theorem, Time differentiation theorem, Time integration theorem, s domain differentiation theorem, s domain integration theorem, Initial value theorem, Final value theorem	4	
FIRST INTERNAL EXAM			
III	Partial Fraction expansions for inverse Laplace transforms, Solution of differential equations using Laplace transforms	3	**15**
	Transformation of basic signals and circuits into s-domain	2	
	Transient analysis of RL, RC, and RLC networks with impulse, step, pulse, exponential and sinusoidal inputs	3	
	Analysis of networks with transformed impedance and dependent sources.	3	
IV	Network functions for the single port and two ports, properties of driving point and transfer functions, Poles and Zeros of network functions, Significance of Poles and Zeros	3	**15**
	Time domain response from pole zero plot, Impulse Response	1	
	Network functions in the sinusoidal steady state, Magnitude and Phase response	3	
SECOND INTERNAL EXAM			
V	Parameters of two port network: impedance, admittance, transmission and hybrid parameters, Interrelationship among parameter sets	5	**20**
	Series and parallel connections of two port networks	2	
	Reciprocal and Symmetrical two port network	2	
	Characteristic impedance, Image impedance and propagation constant (derivation not required)	2	
VI	Resonance: Series resonance, bandwidth, Q factor and Selectivity, Parallel resonance	3	**20**
	Coupled circuits: single tuned and double tuned circuits, dot convention, coefficient of coupling, Analysis of coupled circuits	4	
END SEMESTER EXAM			

Question Paper Pattern

The question paper consists of three parts. Part A covers modules I and II, Part B covers modules III and IV and Part C covers modules V and VI. Each part has three questions. Each question can have a maximum of four subparts. Among the three questions one will be a compulsory question covering both the modules and the remaining two questions will be as one question from each module, of which one is to be answered. Mark pattern is according to the syllabus with maximum 30% for theory and 70% for logical/numerical problems, derivation and proof.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC202	SIGNALS & SYSTEMS	3-1-0-4	2016

Prerequisite: Nil

Course objectives:

1. To train students for an intermediate level of fluency with signals and systems in both continuous time and discrete time, in preparation for more advanced subjects in digital signal processing, image processing, communication theory and control systems.
2. To study continuous and discrete-time signals and systems, their properties and representations and methods those are necessary for the analysis of continuous and discrete-time signals and systems.
3. To familiarize with techniques suitable for analyzing and synthesizing both continuous-time and discrete time systems.
4. To gain knowledge of time-domain representation and analysis concepts as they relate to differential equations, difference equations, impulse response and convolution, etc.
5. To study frequency-domain representation and analysis concepts using Fourier analysis tools, Laplace Transform and Z-transform.
6. To study concepts of the sampling process, reconstruction of signals and interpolation.

Syllabus:

Elementary Signals, Continuous time and Discrete time signals and systems, Signal operations, Differential equation representation , difference equation representation, continuous time LTI systems, Discrete Time LTI systems, Correlation between signals, orthogonality of signals. Frequency domain representation, Continuous time Fourier Series ,Continuous Time Fourier Transform, Laplace Transform, Inverse transform, unilateral Laplace Transform, transfer function, Frequency response, sampling , aliasing, Z transform ,Inverse transform , unilateral Z transform, Frequency domain representation of Discrete Time Signals, Discrete Time Fourier Series and Discrete Time Fourier Transform (DTFT), Analysis of Discrete Time LTI systems using all transforms

Expected outcome:

1.Define, represent, classify and characterize basic properties of continuous and discrete time signals and systems.
2.Represent the CT signals in Fourier series and interpret the properties of Fourier transform, Laplace transform
3.Outline the relation between convolutions, correlation and to describe the orthoganality of signals.
4.Illustrate the concept of transfer function and determine the Magnitude and phase response of systems.
5.Explain sampling theorem and techniques for sampling and reconstruction.
6.Determine z transforms, inverse z transforms signals and analyze systems using z transforms.

Text Books:

1. Alan V. Oppenheim and Alan Willsky, Signals and Systems, PHI, 2/e, 2009
2. Simon Haykin Signals & Systems, John Wiley, 2/e, 2003

References:

1. Anand Kumar, Signals and Systems, PHI, 3/e, 2013.
2. Mahmood Nahvi, Signals and System, Mc Graw Hill (India), 2015.
3. P Ramakrishna Rao, Shankar Prakriya, Signals and System, MC Graw Hill Edn 2013.
4. B P. Lathi, Priciples of Signal Processing & Linear systems, Oxford University Press.
5. Gurung, Signals and System , PHI.
6. Rodger E. Ziemer Signals & Systems - Continuous and Discrete, Pearson, 4/e, 2013

Course Plan			
Module	**Course content (48 hrs)**	**Hours**	**Sem. Exam Marks**
I	Elementary Signals, Classification and Representation of Continuous time and Discrete time signals, Signal operations	4	**15**
	Continuous Time and Discrete Time Systems - Classification, Properties.	3	
	Representation of systems: Differential Equation representation of Continuous Time Systems. Difference Equation Representation of Discrete Systems.	2	
II	Continuous Time LTI systems and Convolution Integral.	3	**15**
	Discrete Time LTI systems and linear convolution.	2	
	Stability and causality of LTI systems.	2	
	Correlation between signals, orthoganality of signals.	2	
FIRST INTERNAL EXAM			
III	Frequency Domain Representation of Continuous Time Signals- Continuous Time Fourier Series and its properties.	3	**15**
	Convergence,Continuous Time Fourier Transform: Properties.	2	
	Laplace Transform, ROC, Inverse transform, properties, unilateral Laplace Transform.	3	
	Relation between Fourier and Laplace Transforms.	1	
IV	Analysis of LTI systems using Laplace and Fourier Transforms. Concept of transfer function, Frequency response, Magnitude and phase response.	3	**15**
	Sampling of continuous time signals, Sampling theorem for lowpass signals, aliasing.	3	
SECOND INTERNAL EXAM			
V	Z transform, ROC , Inverse transform, properties, unilateral Z transform.	3	**20**
	Frequency Domain Representation of Discrete Time Signals, Discrete Time Fourier Series and its properties.	3	
	Discrete Time Fourier Transform (DTFT) and its properties	3	
VI	Relation between DTFT and Z-Transform, Analysis of Discrete Time LTI systems using Z transforms and DTFT, Transfer function, Magnitude and phase response.	6	**20**
END SEMESTER EXAM			

Assignment: Convolution by graphical methods, Solution of differential equations.
Project: Use of Matlab in finding various transforms, magnitude and phase responses.

Question Paper Pattern

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COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC203	SOLID STATE DEVICES	3-1-0-4	2016

Prerequisite: Nil

Course objectives:

- To provide an insight into the basic semiconductor concepts
- To provide a sound understanding of current semiconductor devices and technology to appreciate its applications to electronics circuits and systems

Syllabus: Elemental and compound semiconductors, Fermi-Dirac distribution, Equilibrium and steady state conditions: Equilibrium concentration of electrons and holes, Temperature dependence of carrier concentration, Carrier transport in semiconductors, High field effects, Hall effect, Excess carriers in semiconductors , PN junctions ,contact potential, electrical field, potential and charge density at the junction, energy band diagram, minority carrier distribution, ideal diode equation, electron and hole component of current in forward biased pn junction, piecewise linear model of a diode , effect of temperature on VI characteristics, Diode capacitances, electrical breakdown in pn junctions, Tunnel Diode, Metal semiconductor contacts, bipolar junction transistor, metal insulator semiconductor devices, MOSFET, FinFET

Expected outcome:

The students should have a good knowledge in semiconductor theory and electronic devices.

Text Books:

1. Ben G. Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, Pearson, 6/e, 2010
2. Achuthan, K N Bhat, Fundamentals of Semiconductor Devices, 1e, McGraw Hill,2015

References:

1. Tyagi M.S., Introduction to Semiconductor Materials and Devices, Wiley India, 5/e, 2008
2. Sze S.M., Physics of Semiconductor Devices, John Wiley, 3/e, 2005
3. Neamen, Semiconductor Physics and Devices, McGraw Hill, 4/e, 2012
4. Pierret, Semiconductor Devices Fundamentals, Pearson, 2006
5. Rita John, Solid State Devices, McGraw-Hill, 2014
6. Bhattacharya .Sharma, Solid State Electronic Devices, Oxford University Press, 2012
7. Dasgupta and Dasgupta , Semiconductor Devices : Modelling and Technology (PHI)

Course Plan

Module	Course content (48hrs)	Hours	Sem. Exam Marks
I	Elemental and compound semiconductors, Fermi-Dirac distribution, Equilibrium and steady state conditions, Equilibrium concentration of electrons and holes, Temperature dependence of carrier concentration	4	15
	Carrier transport in semiconductors, drift, conductivity and mobility, variation of mobility with temperature and doping, High Field Effects, Hall effect	5	
II	Excess carriers in semiconductors: Generation and recombination mechanisms of excess carriers, quasi Fermi levels, diffusion, Einstein relations, Continuity equations, Diffusion length, Gradient of quasi Fermi level	9	15
	FIRST INTERNAL EXAM		

III	PN junctions : Contact potential, Electrical Field, Potential and Charge density at the junction, Energy band diagram, Minority carrier distribution, Ideal diode equation, Electron and hole component of current in forward biased p-n junction, piecewise linear model of a diode effect of temperature on V-I characteristics	9	**15**
IV	Diode capacitances, switching transients, Electrical Breakdown in PN junctions, Zener and avalanche break down (abrupt PN junctions only), Tunnel Diode basics only, Metal Semiconductor contacts, Ohmic and Rectifying Contacts, current voltage characteristics	9	**15**
SECOND INTERNAL EXAM			
V	Bipolar junction transistor , current components, Minority carrier distributions, basic parameters, Evaluation of terminal currents (based on physical dimensions),Transistor action, Base width modulation	9	**20**
VI	Metal Insulator semiconductor devices: The ideal MOS capacitor, band diagrams at equilibrium, accumulation, depletion and inversion, surface potential, CV characteristics, effects of real surfaces, work function difference, interface charge, threshold voltage MOSFET: Output characteristics, transfer characteristics, sub threshold characteristics, MOSFET scaling (basic concepts)	9	**20**
	FinFET-structure and operation	1	
END SEMESTER EXAM			

Question Paper Pattern

The question paper consists of three parts. Part A covers modules I and II, Part B covers modules III and IV and Part C covers modules V and VI. Each part has three questions. Each question can have a maximum of four subparts. Among the three questions one will be a compulsory question covering both the modules and the remaining two questions will be as one question from each module, of which one is to be answered. Mark pattern is according to the syllabus with maximum 70 % for theory, derivation, proof and 30% for logical/numerical problems.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC204	Analog Integrated Circuits	4-0-0-4	2016

Prerequisite: Nil

Course objectives:

- To equip the students with a sound understanding of fundamental concepts of operational amplifiers
- To know the diversity of operations that op amp can perform in a wide range of applications
- To introduce a few special functions integrated circuits.
- To impart basic concepts and types of data converters

Syllabus: Differential amplifier configurations, Operational amplifiers, Block diagram, Ideal op-amp parameters, Effect of finite open loop gain, bandwidth and slew rate on circuit performance, op-amp applications- linear and nonlinear, Active filters, Specialized IC and their application, Monolithic Voltage Regulators types and its Applications, Data Converters, specifications and types

Expected outcome:

- On completion of this course, the students will have a thorough understanding of operational amplifiers
- Students will be able to design circuits using operational amplifiers for various applications

Text Books:

1. Salivahanan S. ,V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008
2. Franco S., Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, Tata McGraw Hill, 2008

References:

1. David A. Bell, Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition, 2010.
2. Gayakwad R. A., Op-Amps and Linear Integrated Circuits, Prentice Hall, 4/e, 2010.
3. R.F. Coughlin & Fredrick Driscoll, Operational Amplifiers & Linear Integrated Circuits, 6th Edition, PHI,2001
4. C.G. Clayton, Operational Amplifiers, Butterworth & Company Publ. Ltd./ Elsevier, 1971.
5. Roy D. C. and S. B. Jain, Linear Integrated Circuits, New Age International, 3/e, 2010.
6. Botkar K. R., Integrated Circuits, 10/e, Khanna Publishers, 2010.

Course Plan

Module	Course content (54hrs)	Hours	Sem. Exam Marks
I	Differential amplifiers: Differential amplifier configurations using BJT, Large and small signal operations, Balanced and unbalanced output differential amplifiers, Input resistance, voltage gain, CMRR, non ideal characteristics of differential amplifier. Frequency response of differential amplifiers, Current sources, Active load, Concept of current mirror circuits, Wilson current mirror circuits, multistage differential amplifiers.	6	15
	Operational amplifiers: Introduction, Block diagram, Ideal op-	5	

	amp parameters, Equivalent Circuit, Voltage Transfer curve, open loop op-amp configurations, Effect of finite open loop gain, bandwidth and slew rate on circuit performance		
II	Op-amp with negative feedback: Introduction, feedback configurations, voltage series feedback, voltage shunt feedback, properties of Practical op-amp.	3	**15**
	Op-amp applications: Inverting and non inverting amplifier, dc and ac amplifiers, peaking amplifier, summing, scaling and averaging amplifiers, instrumentation amplifier.	4	
FIRST INTERNAL EXAM			
III	Op-amp applications: Voltage to current converter, current to voltage converter, integrator, differentiator, precision rectifiers, log and antilog amplifier, Phase shift and Wien bridge oscillators	6	**15**
IV	Square, triangular and saw tooth wave generators, Comparators, zero crossing detector, Schmitt trigger, characteristics and limitations.	4	**15**
	Active filters, First and Second order Butterworth filter and its frequency response for LPF, HPF, BPF, BSF, and Notch filter.	5	
SECOND INTERNAL EXAM			
V	Specialized IC's and its applications: Timer IC 555 (monostable & astable operation), Voltage controlled oscillator, Analog Multiplier	4	**20**
	PLL, operating principles, Applications: frequency multiplication/division, Frequency synthesizer, AM & FM detection , FM modulator/Demodulator	4	
	Monolithic Voltage Regulators: Three terminal voltage regulators 78XX and 79XX series, IC723 , low voltage and high voltage regulator, Current boosting, short circuit and fold back protection.	4	
VI	Data Converters: D/A converter , specifications , weighted resistor type, R-2R Ladder type, switches for D/A converters, high speed sample-and-hold circuits	4	**20**
	A/D Converters: Specifications, Flash type, Counter ramp type, Successive Approximation type, Single Slope type, Dual Slope type	4	
END SEMESTER EXAM			

Question Paper Pattern

The question paper consists of three parts. Part A covers modules I and II, Part B covers modules III and IV and Part C covers modules V and VI. Each part has three questions. Each question can have a maximum of four subparts. Among the three questions one will be a compulsory question covering both the modules and the remaining two questions will be as one question from each module, of which one is to be answered. Mark pattern is according to the syllabus with maximum 30 % for theory and 70% for logical/numerical problems, derivation and proof.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC205	ELECTRONIC CIRCUITS	3-1-0-4	2016

Prerequisite: Nil

Course objectives:

- To develop the skill of analysis and design of various analog circuits using discrete electronic devices as per the specifications.

Syllabus:

High pass and low pass RC circuits, Differentiator, Integrator, Analysis of BJT biasing circuits, small signal analysis of transistor configurations using small signal hybrid π model, low frequency and high frequency analysis of BJT amplifiers, Cascade amplifiers, Wide band amplifiers, Feedback amplifiers, Oscillators, Tuned amplifiers, Power amplifiers, Sweep circuits and multivibrators, transistor voltage regulator, DC analysis of MOSFET circuits, small signal equivalent circuit, Small signal analysis of MOSFET amplifier circuits, Analysis of multistage MOSFET amplifiers

Expected outcome:

- At the end of the course, students will be able to analyse and design the different electronic circuits using discrete electronic components.

Text Books:

- Sedra A. S. and K. C. Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2013
- Millman J. and C. Halkias, Integrated Electronics, 2/e, McGraw-Hill, 2010

References:

1. Neamen D., Electronic Circuits - Analysis and Design, 3/e, TMH, 2007
2. Rashid M. H., Microelectronic Circuits - Analysis and Design, Cengage Learning, 2/e, 2011
3. Spencer R. R. and M. S. Ghausi, Introduction to Electronic Circuit Design, Pearson, 2003
4. Razavi B., Fundamentals of Microelectronics, Wiley, 2015

Course Plan

Module	Course content (48 hrs)	Hours	Sem. Exam Marks
I	RC Circuits: Response of high pass and low pass RC circuits to sine, step, pulse and square wave inputs, Differentiator, Integrator	5	15
	BJT biasing circuits: Types, Q point, Bias stability, Stability factors, RC coupled amplifier and effect of various components, Concept of DC and AC load lines, Fixing of operating point, Classification of amplifiers	5	
II	Small signal analysis of CE, CB and CC configurations using small signal hybrid π model (gain, input and output impedance). Small signal analysis of BJT amplifier circuits, Cascade amplifier	7	15
	FIRST INTERNAL EXAM		
III	High frequency equivalent circuits of BJT, Short circuit current gain, cutoff frequency, Miller effect, Analysis of high frequency response of CE, CB and CC amplifiers	4	15
	Wide band amplifier: Broad banding techniques, low frequency and high frequency compensation, Cascode amplifier.	4	
IV	Feedback amplifiers: Effect of positive and negative feedback on gain, frequency response and distortion, Feedback topologies and	3	15

	its effect on input and output impedance, Feedback amplifier circuits in each feedback topologies (no analysis required)		
	Oscillators & Tuned Amplifiers: Classification of oscillators, Barkhausen criterion, Analysis of RC phase shift and Wien bridge oscillators, Working of Hartley, Colpitts and Crystal oscillators; Tuned amplifiers, synchronous and stagger tuning	6	
SECOND INTERNAL EXAM			
V	Power amplifiers: Classification, Transformer coupled class A power amplifier, push pull class B and class AB power amplifiers, efficiency and distortion, Transformer-less class B and Class AB power amplifiers, Class C power amplifier (no analysis required)	6	**20**
	Switching Circuits: Simple sweep circuit, Bootstrap sweep circuit, Astable, Bistable, and Monostable multivibrators, Schmitt Trigger	5	
VI	Transistor based voltage regulator: Design and analysis of shunt and series voltage regulator, load and line regulation, Short circuit protection	4	**20**
	MOSFET amplifiers: Biasing of MOSFET amplifier, DC analysis of single stage MOSFET amplifier, small signal equivalent circuit. Small signal voltage and current gain, input and output impedances of CS configuration, MOSFETCascade amplifier	5	
END SEMESTER EXAM			

Question Paper Pattern

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COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC206	Computer Organisation	3-0-0-3	2016

Prerequisite: EC207 Logic circuit design

Course objectives:

- To impart knowledge in different aspects of processor design.
- To develop understanding about processor architecture.
- To impart knowledge in programming concepts.
- To develop understanding on I/O accessing techniques and memory structures.

Syllabus:

Functional units of a computer, Arithmetic Circuits, Processor architecture, Instructions and addressing modes, Execution of program, micro architecture design process, design or data path and control units, I/O accessing techniques, Memory concepts, memory interface, cash and virtual memory concepts

Expected outcome:

The student should be able to:

- Illustrate the structure of a computer
- Categorize different types of memories
- Explain various techniques in computer design.

Text Books:

1. David Money Harris, Sarah L Harris, Digital Design and Computer Architecture, Morgan Kaufmann – Elsevier, 2009

References:

1. William Stallings: "Computer Organisation and Architecture", Pearson Education.
2. John P Hayes: "Computer Architecture and Organisation", Mc Graw Hill.
3. Andrew S Tanenbaum: "Structured Computer Organisation", Pearson Education.
4. Craig Zacker: "PC Hardware : The Complete Reference", TMH.
5. Carl Hamacher : "Computer Organization ", Fifth Edition, Mc Graw Hill.
6. David A. Patterson and John L. Hennessey, "Computer Organisation and Design", Fourth Edition, Morgan Kaufmann.

Course Plan

Module	Course content (42 hrs)	Hours	Sem. Exam Marks
I	Functional units of a computer: Arithmetic Circuits – Adder- Carry propagate adder, Ripple carry adder, Basics of carry look ahead and prefix adder, Subtractor, Comparator, ALU	4	15
	Shifters and rotators, Multiplication, Division	3	
	Number System- Fixed Point & Floating Point	1	
II	Architecture – Assembly Language, Instructions, Operands – Registers, Register set, Memory, Constants	2	15
	Machine Language –R-Type, I-Type, J-Type Instructions, Interpreting Machine Language code	3	
FIRST INTERNAL EXAM			

III	Addressing Modes – register only, immediate, base, PC-relative, Pseudo – direct	3	**15**
	Steps for Executing a Program – Compilation, Assembling, Linking, Loading	3	
	Pseudoinstuctions, Exceptions, Signed and Unsigned Instructions, Floating Point Instructions	3	
IV	Microarchitecture- design process	2	**15**
	Single cycle processor, Single cycle data path, single cycle control	2	
	multi cycle processor, multi cycle data path, multi cycle control	3	
SECOND INTERNAL EXAM			
V	Memory & I/O systems – I/O accessing techniques: programmed, interrupt driven and DMA, DMA bus arbitration	3	**20**
	Memory Arrays – Bit Cells, Organization, Memory Ports Memory types- DRAM, SRAM, Register Files, ROM	3	
VI	Memory - Hierarchy, Performance analysis	1	**20**
	Cache Memory – direct mapped, multi way set associate cache, Fully associate cache	3	
	Virtual Memory – Address Translation, Page Table, Translation Look aside Buffer, Memory Protection, replacement polices	3	
END SEMESTER EXAM			

Question Paper Pattern

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COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC207	LOGIC CIRCUIT DESIGN	3-0-0-3	2016

Prerequisite:Nil

Course objectives:

- To work with a positional number systems and numeric representations
- To introduce basic postulates of Boolean algebra and show the correlation between Boolean expression
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To study the fundamentals of HDL
- To design and implement combinational circuits using basic programmable blocks
- To design and implement synchronous sequential circuits

Syllabus:

Positional Number Systems, Boolean algebra, Combinational Logic, HDL concepts ,Digital ICs, Programmable Logic Devices, Sequential Logic, Sequential Circuits

Expected outcome:

The student should able to:

1. Compare various positional number systems and binary codes
2. Apply Boolean algebra in logic circuit design
3. Design combinational and sequential circuits
4. Design and implement digital systems using basic programmable blocks
5. Formulate various digital systems using HDL

Text Books:

1. Donald D Givone, Digital Principles and Design, Tata McGraw Hill, 2003
2. John F Wakerly, Digital Design Principles and Practices, Pearson Prentice Hall, 2007

References:

1.Ronald J Tocci, Digital Systems, Pearson Education, 11th edition,2010
2.Thomas L Floyd, Digital Fundamentals, Pearson Education, 8th edition 2009
3.Moris Mano, Digital Design, Prentice Hall of India, 3rd edition, 2002
4.John M Yarbrough, Digital Logic Applications and Design, Cenage learning, 2009
5.David Money Harris, Sarah L Harris, Digital Design and Computer Architecture, Morgan Kaufmann – Elsevier, 2009

Course Plan

Module	Course content (42 hrs)	Hours	Sem. Exam Marks
I	Number systems- decimal, binary, octal, hexa decimal, base conversion	2	15
	1's and 2's complement, signed number representation Binary arithmetic, binary subtraction using 2's complement	2	
	Binary codes (grey, BCD and Excess-3), Error detection and correcting codes : Parity(odd, even), Hamming code (7,4), Alphanumeric codes : ASCII	2	
II	Logic expressions, Boolean laws, Duality, De Morgan's law, Logic functions and gates	2	15
	Canonical forms: SOP, POS, Realisation of logic expressions using K-	2	

	map (2,3,4 variables)		
	Design of combinational circuits – adder, subtractor, 4 bit adder/subtractor, BCD adder, MUX, DEMUX, Decoder,BCD to 7 segment decoder, Encoder, Priority encoder, Comparator (2/3 bits)	4	
FIRST INTERNAL EXAM			
III	Introduction to HDL : Logic descriptions using HDL, basics of modeling (only for assignments)	**2**	**0**
	Logic families and its characteristics: Logic levels, propagation delay, fan in, fan out, noise immunity , power dissipation, TTL subfamilies	1	**15**
	NAND in TTL (totem pole, open collector and tri-state), CMOS:NAND, NOR, and NOT in CMOS, Comparison of logic families (TTL,ECL,CMOS) in terms of fan-in, fan-out, supply voltage, propagation delay, logic voltage and current levels, power dissipation and noise margin	2	
	Programmable Logic devices - ROM, PLA, PAL, implementation of simple circuits using PLA	2	
IV	Sequential circuits - latch, flip flop (SR, JK, T, D), master slave JK FF, conversion of FFs, excitation table and characteristic equations	3	**15**
	Asynchronous and synchronous counter design, mod N counters, random sequence generator	5	
SECOND INTERNAL EXAM			
V	Shift Registers - SIPO, SISO, PISO, PIPO, Shift registers with parallel LOAD/SHIFT Shift register counter - Ring Counter and Johnson Counter	3	**20**
	Mealy and Moore models, state machine ,notations, state diagram, state table, transition table, excitation table, state equations	3	
VI	Construction of state diagram – up down counter, sequence detector	3	**20**
	Synchronous sequential circuit design - State equivalence	2	
	State reduction – equivalence classes, implication chart	2	
END SEMESTER EXAM			

Assignments:

1. Simple combinational circuit design using MUX,DEMUX, PLA & PAL
2. HDL simulation of circuits like simple ALU, up-down counter, linear feedback shift register, sequence generator

Question Paper Pattern

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COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC208	ANALOG COMMUNICATION ENGINEERING	3-0-0-3	2016

Prerequisite: EC205 Electronic circuits

Course objectives:

- To study the concepts and types of modulation schemes.
- To study different types of radio transmitters and receivers.
- To study the effects of noise in analog communication systems

Syllabus:

Elements of communication system, Need for modulation, amplitude Modulation, amplitude modulator circuit, demodulator circuit, AM transmitters, Types of AM, AM Receiver, Angle modulation: principles of frequency modulation, phase modulation, frequency modulator circuits, FM transmitters, FM receiver, Noise in communication system, Effect of noise in Analog Communication Systems, Telephone systems, standard telephone set, cordless telephones .

Expected outcome:

- Student will understand the fundamentals ideas of noises and its effect in communication system.
- Students can explain the principle and working of AM, FM, and PM system and transmitters and receivers.
- Students will be able to know the basic ideas of PSTN and advanced line communication systems.

Text Books:

1. Simon Haykin, Communication Systems, Wiley 4/e, 2006.
2. Tomasi, Electronic Communications System, Pearson, 5/e,2011.

References:

3. Dennis Roody and John Coolen, Electronic Communication, Pearson, 4/e, 2011.
4. Tomasi,Advanced Electronic Communications Systems, Pearson, **6/e**, 2012.
5. Taub ,Schilling, Saha,Principles of communication system,McGraw Hill,2013.
6. George Kennedy, ElectronicCommunication Systems, McGrawHill, 4/e, 2008.
7. Blake, Electronic Communication system, Cengage, 2/e , 2012.

Course Plan

Module	Course content (42 hrs)	Hours	Sem. Exam Marks
I	Introduction, elements of communication system, time and frequency domains, Need for modulation	2	15
	Noise in communication system, shot noise, thermal noise, white noise, partition noise, flicker noise, burst noise, signal to noise ratio, noise figure, noise temperature, narrow band noise, representation in terms of in-phase and quadrature components, envelope and phase components, sine wave plus narrow band noise.	5	
II	Amplitude modulation: Sinusoidal AM modulation index, Average power, Effective voltage and current, Nonsinusoidal modulation	4	
	Amplitude modulator circuits, Amplitude demodulator circuit,	3	

	AM transmitters		
FIRST INTERNAL EXAM			
III	AM Receiver, super heterodyne receiver, detector, tuning range, tracking, sensitivity and gain, Image rejection, double conversion, adjacent channel rejection, Automatic Gain Control (AGC).	4	**15**
	Single Sideband Modulation,Principles, Balanced Modulators, Singly & Doubly Balanced Modulators, SSB Generation, Filter Method, Phasing Method & Third Method, SSB Reception, Modified SSB Systems , Pilot Carrier SSB & ISB, Companded SSB.	5	
IV	Angle modulation: Frequency modulation, Sinusoidal FM, Frequency spectrum, modulation index ,average power, Non-sinusoidal modulation, deviation ratio, comparison of AM and FM	3	**15**
	Phase modulation, Equivalence between PM and FM, Sinusoidal Phase Modulation, Digital Phase Modulation.	3	
SECOND INTERNAL EXAM			
	Angle modulator Circuits : Varactor Diode Modulators, Transistors Modulators, FM Transmitters: Direct & Indirect Methods.	2	
V	FM receiver, slope detector, balanced slope detector, Foster-Seeley discriminator, Ratio Detector, Quadrature detector, PLL demodulator, Automatic Frequency Control, Amplitude limiters, Pre-emphasis and De-emphasis,	3	**20**
	Effect of noise in analog communication Systems- AM Systems, DSBSC AM, SSB AM, Angle modulation, Threshold Effect in Angle modulation.	4	
VI	Telephone systems, standard telephone set, basic call procedures and tones, DTMF, cordless telephones.	4	
END SEMESTER EXAM			

Assignment

Study of

1. **The telephone circuit - Local subscriber loop, Private-line circuits, Voice-frequency circuit arrangements.**
2. **The public telephone network - Instruments, Local loops, Trunk circuits and exchanges, Local central office Exchanges, Automated central office switches and Exchanges.**

Question Paper Pattern

The question paper consists of three parts. Part A covers modules I and II, Part B covers modules III and IV and Part C covers modules V and VI. Each part has three questions. Each question can have a maximum of four subparts. Among the three questions one will be a compulsory question covering both the modules and the remaining two questions will be as one question from each module, of which one is to be answered. Mark pattern is according to the syllabus with maximum 30 % for theory and 70% for logical/numerical problems, derivation and proof.

Course code	Course Name	L-T-P - Credits	Year of Introduction
EC209	Analog Electronics	3-1-0-4	2016

Prerequisites :Nil

Course Objectives

- To familiarize basic electronic elements and their characteristics
- To develop understanding about BJT and FET circuits
- To understand the concept of power amplifier and differential amplifiers

Syllabus

Diode: Diode as a circuit element-diode clipping circuits-clamping circuits-voltage regulators-BJT: Operating point of a BJT-thermal runaway-h parameter model of a BJT-frequency response of amplifiers-FET: Construction and characteristics of JFET and MOSFET-Feedback: - Concepts – negative and positive feedback-Power Amplifiers- Class A, B, AB, C, D & S power amplifier-Differential Amplifiers:- The BJT differential pair- Large and small signal operation-MOS differential amplifier- Large and small signal operation-UJT- 555 Timer IC, PLL.

Expected outcome.

- Will get knowledge on electronic elements and their characteristics.

Text Book:

1. Allen Mottershead, *Electronic Devices and Circuits: An Introduction*, Prentice Hall of India.
2. V. Boylestad and Nashelsky, *Electronic Devices and Circuits*, Pearson Education
3. Ramakant A Gayakwad, *Op- Amps and Linear Integrated Circuits*, Prentice Hall of India

References:

1. Schilling and Belove, Electronic Circuits, McGraw Hill
2. Theodore F. Bogart Jr., Electronic Devices and Circuits,
3. Coughlin and Driscoll, Operational amplifiers and Linear Integrated Circuits,
4. K. R. Botkar, Integrated Circuits, Khanna Publishers
5. Somanathan Nair, Linear Integrated Circuits – Analsysis, Design & Application, Wiley-India

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	**Diode:** Diode as a circuit element - load line - piecewise linear model – single-phase half wave and full wave rectifier circuits – voltage regulation - ripple factor - rectifier efficiency - bridge rectifier - rectifier filters - diode clipping circuits - single level and two level clippers - clamping circuits –Zener diodes - Zener voltage regulators.	9	15%
II	**BJT:** Operating point of a BJT – DC biasing - bias stability - thermal runaway - AC Concepts –role of capacitors in amplifiers – common emitter AC equivalent circuit - amplifier gain and impedance calculations- h parameter model of a BJT –cascaded amplifiers, frequency response of amplifiers	9	15%

FIRST INTERNAL EXAMINATION			
III	**FET** Construction and characteristics of JFET and MOSFET, biasing a JFET and MOSFET, JFET and MOSFET small signal model - CS and CD amplifiers. feedback: - Concepts – negative and positive feedback feedback -feedback connection types - practical feedback circuits	9	15%
IV	**Power Amplifiers** Class A, B, AB, C, D & S power amplifiers - harmonic distortion efficiency -wide band amplifier - broad banding techniques - low frequency and high frequency compensation -cascode amplifier - broad banding using inductive loads - Darlington pairs.	10	15%
SECOND INTERNAL EXAMINATION			
V	**OSCILLATORS & MULTI VIBRATORS** Classification of oscillators – Barkhausen criteria- operation and analysis of RC phase shift – Hartely and Colpitts oscillators – Multi vibrators – astable, mono stable and bi stable multi vibrators	9	20%
VI	**UJT**-construction –working-UJT oscillator-UPS-brief overview of online UPS &off line UPS-SMPS-operation **Timer IC 555**: Functional diagram- astable and monostable modes **Phase Locked Loops**: Principles – building blocks of PLL-VCO-lock and capture ranges - capture process - frequency multiplication using PLL	10	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS
8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS
5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions
(3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS
4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions
(2 x15 = 30 marks)

Course code	Course Name	L-T-P - Credits	Year of Introduction
EC212	Linear Integrated Circuits and Digital Electronics	4-0-0 -4	2016

Prerequisites :Nil

Course Objectives

- To introduce the concepts for realizing functional building blocks in ICs and applications of IC.
- To know the fundamentals of combinational and sequential digital circuits.

Syllabus

Ideal OP-AMP characteristics, DC characteristics- AC characteristics- offset voltage and current: voltage series feedback - shunt feedback amplifiers, differential amplifier- frequency response of OP-AMP- Basic applications of OP-AMP – summer, differentiator ,integrator, V/I &I/V converter-Instrumentation amplifier-Basic Comparators- regenerative comparators- multivibrators- waveform Generators- clippers- clampers- peak detector- S/H circuit- First and Second order active filter-, D/A converter (R-2R ladder and weighted resistor types)- A/D converter - Dual slope- successive approximation and flash types- 555 Timer circuit – Functional block- characteristics & applications:- IC 566-voltage controlled oscillator circuit- OP-AMP-Voltage regulator-Series- Shunt and Switching regulator- Review of number system:- types and conversion- codes- Boolean algebra: De-Morgan's theorem- Minimization of Boolean function using K-maps & Quine McCluskey method- Combinational circuits: -Adder- subtractors- code converters- encoders- decoders- multiplexers and demultiplexers- Combinational Logic by using Multiplexers- ROM- PLA and PAL-Memories - ROM, Static and Dynamic RAM- Read/Write Memory- EPROM, EEPROM-Flip flops – SR- D- JK - T and Master Slave FF- Shift registers-Counters-Asynchronous and Synchronous Counters- Up-Down Counter- Modulo Counter- Ring Counter-Analysis of Asynchronous Counters

Expected outcome:

- The students will learn to know about the IC'S and their application, digital circuits, combinational and sequential circuits.

Text Book:

1. Ramakant A.Gayakward, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2003 / PHI.
2. D.Roy Choudhary, Sheil B.Jani, Linear Integrated Circuits, II edition, New Age, 2003.
3. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India, 2002

References:

1. Robert F.Coughlin, Fredrick F.Driscoll, Op-amp and Linear ICs, Pearson Education, 4th edition, 2002 /PHI.
2. David A.Bell, Op-amp & Linear ICs, Prentice Hall of India, 2nd edition, 1997.
3. Charles H.Roth, Fundamentals Logic Design, Jaico Publishing, IV edition, 2002.
4. Floyd, Digital Fundamentals, 8th edition, Pearson Education, 2003.

Course Plan			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	OP-AMP-Ideal OP-AMP characteristic-offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier- frequency response of OP-AMP- Basic applications of op-amp – differentiator and integrator, V/I &I/V converter**.**	9	15%
II	Instrumentation amplifier- Basic Comparators- regenerative comparators- multivibrators- waveform generators- clippers, clampers- peak detector- S/H circuit- isolation amplifier - log and antilog amplifiers analog multipliers	9	15%
FIRST INTERNAL EXAMINATION			
III	D/A converter (R-2R ladder and weighted resistor types)- A/D converter - Dual slope, successive approximation and flash types Active filters-filter transfer function-Butterworth and Chebyshev filters-First order and second order function for low-pass, high-pass, band –pass, band-stop and all –pass filters	9	15%
IV	Review of number system- types and conversion- codes- one's complement and two's complement-Arithmetic operations of Binary Boolean algebra: De-Morgan's theorem- Minimization of Boolean function using K-maps &QuineMcCluskey method.	9	15%
SECOND INTERNAL EXAMINATION			
V	Combinational circuits: Adder- subtractor- code converters, encoders, decoders, multiplexers and demultiplexers. Implementation of Combinational Logic by using Multiplexers, ROM, PLA and PAL. Memories – ROM- Static and Dynamic RAM- Read/Write Memory- EPROM- EEPROM	10	20%
VI	Flip flops - SR, D, JK , T and Master Slave Flip Flop -Shift registers -Counters-Asynchronous and Synchronous Counters-Up-Down Counter- Modulo Counter- Ring Counter-Analysis of Asynchronous Counters-sequence detector.	10	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS

8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS

5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions (3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS

4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions

(2 x15 = 30 marks)

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC230	LOGIC CIRCUIT DESIGN LAB	0-0-3-1	2016

Prerequisite: EC207 Logic circuit design

Course objectives:

- To study the working of standard digital ICs and basic building blocks
- To design and implement combinational circuits
- To design and implement sequential circuits

List of Experiments: -(Minimum 12 experiments are to be done)

1. Realization of functions using basic and universal gates (SOP and POS forms).
2. Design and Realization of half /full adder and subtractor using basic gates and universal gates.
3. 4 bit adder/subtractor and BCD adder using 7483.
4. 2/3 bit binary comparator.
5. Binary to Gray and Gray to Binary converters.
6. Study of Flip Flops: S-R, D, T, JK and Master Slave JK FF using NAND gates
7. Asynchronous Counter: Realization of 4-bit counter
8. Asynchronous Counter: Realization of Mod-N counters.
9. Asynchronous Counter:3 bit up/down counter
10. Synchronous Counter: Realization of 4-bit up/down counter.
11. Synchronous Counter: Realization of Mod-N counters.
12. Synchronous Counter:3 bit up/down counter
13. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO (using FF & 7495)
14. Ring counter and Johnson Counter. (using FF & 7495)
15. Realization of counters using IC's (7490, 7492, 7493).
16. Multiplexers and De-multiplexers using gates and ICs. (74150, 74154),
17. Realization of combinational circuits using MUX & DEMUX.
18. Random sequence generator.
19. LED Display: Use of BCD to 7 Segment decoder / driver chip to drive LED display
20. Static and Dynamic Characteristic of NAND gate (MOS/TTL)

Expected outcome:

The student should able to:

1. Design and demonstrate functioning of various combination circuits
2. Design and demonstrate functioning of various sequential circuits
3. Function effectively as an individual and in a team to accomplish the given task

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC231	Electronic Devices & Circuits Lab	0-0-3-1	2016

Prerequisite: Should have registered for EC205 Electronic circuits

Course objectives:

- To study the working of analog electronic circuits.
- To design and implement analog circuits as per the specifications using discrete electronic components.

List of Experiments: (12 Mandatory Experiments)

1. VI Characteristics of rectifier and zener diodes
2. RC integrating and differentiating circuits (Transient analysis with different inputs and frequency response)
3. Clipping and clamping circuits (Transients and transfer characteristics)
4. Fullwave Rectifier -with and without filter- ripple factor and regulation
5. Simple Zener voltage regulator (load and line regulation)
6. Characteristics of BJT in CE configuration and evaluation of parameters
7. Characteristics of MOSFET in CS configuration and evaluation of parameters
8. RC coupled CE amplifier - frequency response characteristics
9. MOSFET amplifier (CS) - frequency response characteristics
10. Cascade amplifier – gain and frequency response
11. Cascode amplifier -frequency response
12. Feedback amplifiers (current series, voltage series) - gain and frequency response
13. Low frequency oscillators –RC phaseshift, Wien bridge,
14. High frequency oscillators –Colpitt's and Hartley
15. Power amplifiers (transformer less) - Class B and Class AB
16. Transistor series voltage regulator (load and line regulation)
17. Tuned amplifier - frequency response
18. Bootstrap sweep circuit
19. Multivibrators -Astable, Monostable and Bistable
20. Schmitt trigger

Expected outcome:

The student should able to:

1. Design and demonstrate functioning of various discrete analog circuits.
2. Function effectively as an individual and in a team to accomplish the given task.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC232	ANALOG INTEGRATED CIRCUITS LAB	0-0-3-1	2016

Prerequisite:.Should have registered for EC204 Analog Integrated Circuits

Course objectives:

- To acquire skills in designing and testing analog integrated circuits
- To expose the students to a variety of practical circuits using various analog ICs.

List of Experiments: (Minimum 12 experiments are to be done)

1. Familiarization of Operational amplifiers - Inverting and Non inverting amplifiers, frequency response, Adder, Integrator, comparators.
2. Measurement of Op-Amp parameters.
3. Difference Amplifier and Instrumentation amplifier.
4. Schmitt trigger circuit using Op –Amps.
5. Astable and Monostable multivibrator using Op -Amps.
6. Timer IC NE555
7. Triangular and square wave generators using Op- Amps.
8. Wien bridge oscillator using Op-Amp - without & with amplitude stabilization.
9. RC Phase shift Oscillator.
10. Precision rectifiers using Op-Amp.
11. Active second order filters using Op-Amp (LPF, HPF, BPF and BSF).
12. Notch filters to eliminate the 50Hz power line frequency.
13. IC voltage regulators.
14. A/D converters- counter ramp and flash type.
15. D/A Converters- ladder circuit.
16. Study of PLL IC: free running frequency lock range capture range

Expected outcome:

The student should able to:

1. Design and demonstrate functioning of various analog circuits
2. Students will be able to analyze and design various applications of analog circuits.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC233	ELECTRONICS DESIGN AUTOMATION LAB	0-0-3-1	2016

Prerequisite: Nil

Course Objectives :

The primary objective of this course is to familiarize the students, how to simulate the electronics/digital circuits, signals and systems using the soft-wares which are available for the modern design methodologies for the rapid design and verification of complex electronic systems.

List of Exercises / Experiments

1. **Introduction to SPICE**

[Institution can use any one circuit simulation package with schematic entry like EDWinXP, PSpice, Multisim, Proteus or CircuitLab.]

Introduction to SPICE software. Recognize various schematic symbols /model parameters of resistor, capacitor, inductor, energy sources (VCVS, CCVS, Sinusoidal source, pulse, etc), transformer, DIODE, BJT, FET, MOSFET, etc., units & values. Use SPICE Schematic Editor to draw and analyse (DC, AC, Transient) simple analog and digital electronic circuits.

List of Experiments using SPICE [Six experiments mandatory]

Simulation of following circuits using SPICE [Schematic entry of circuits using standard package, Analysis –Transient, AC, DC]

1. Potential divider network
2. RC integrating and differentiating circuits
3. Diode, BJT and MOSFET characteristics
4. Diode Circuits (Clipping, Clamping, Rectifiers)
5. RC coupled amplifier (Single & two stages)
6. RC oscillator (RC phase shift / Wien Bridge)
7. Astable multivibrator
8. Truth table verification of basic and universal gates
9. Half adder /full adder circuits using gates
10. 4 bit adder/BCD adder
11. Encoder/Multiplexers
12. Flipflops/Counters

2. **Introduction to MATLAB**

[Institution can use any one numerical computational package like SciLab, Octave, Spyder, Python (scipy) or Freemat instead of MATLAB]

Fundamentals, basic operations on array, matrix, complex numbers etc., Script and function files, plotting commands, control statements.

Writing simple programs for handling arrays and plotting of mathematical functions, plotting of analog, discrete and noise signals, analysing the simple electronic circuits/network using node and mesh equations.

List of Experiments [Four experiments mandatory]

Write program and obtain the solutions

1. Solve /plot the mathematical equations containing complex numbers, array, matrix multiplication and quadratic equations etc

	2. Obtain different types of plots (2D/3D, surface plot, polar plot) 3. Generate and plot various signals like sine square, pulse in same window. 4. Plot the diode/transistor characteristics. 5. Solve node, mesh and loop equations of simple electrical/network circuits. 6. Find the poles and zeros hence plot the transfer functions/polynomials 7. Sort numbers in ascending order and save to another text file using text read and sort function after reading n floating point numbers from a formatted text file stored in the system. 8. Plot a full wave rectified waveform using Fourier series
3	**Introduction to HDL** [Institution can choose VHDL or Verilog as language to describe the problem and any one simulation/synthesis tool like Xilinix ISE, Modelsim, QSim, verilog, VHDL, EDwinXP or ORCAD etc. for the simulation.] **List of Experiments using HDL** Write the HDL code to realise and simulate the following circuits: (at least 4 of the following) 1. Basic gates/universal gates 2. Combinational Circuits (Half adder/Half subtractor) 3. Full adder in 3 modelling styles (Dataflow/structural/Behavioural) 4. Multiplexer/De-multiplexer 5. Decoder/Encoder 6. 4 bit adder/BCD adder 7. Flipflops (SR,JK,T,D) 8. Binary Counters 9. Finite state machines
Expected outcomes: 1. An ability to apply knowledge of computer, science, and engineering to the analysis of electrical and electronic engineering problems. 2. An ability to design systems which include hardware and software components. 3. An ability to identify, formulate and solve engineering problems. 4. An ability to use modern engineering techniques	

Course code	Course Name	L-T-P - Credits	Year of Introduction
EC234	Linear Integrated Circuits and Digital Electronics Laboratory	0-0-3--1	2016

Prerequisite: EC212 Linear integrated circuits and digital electronics

Course Objectives

- To study various digital and linear integrated circuits used in simple system configuration

List of Exercises/Experiments : (10 experiments are mandatory)

1. Operational Amplifiers (IC741)-Characteristics
2. Square , triangular and ramp generation using op-amps
3. Log and Antilog amplifiers.
5. Astable and monostable multivibrators using op-amps
6. Active notch filter realization using op-amps
7. Wein bridges oscillator using OpAmp
8. OpAmp Integrator and Differentiator.
9. Code converter - Binary to gray and Gray to binary.
10. Adder and Subtractor Circuits using logic IC
11. Implementation of combinational logic circuits using MUX IC
12. Design and implementation of multiplexer and demultiplexer.
13. 3-bit synchronous counter design
14. Asynchronous counter design and Mod-n counter
15. Shift registers - SISO/SIPO & PISO/PIPO
16. Ring and Johnson Counters

List of major equipment

CRO, Function generator , Single power supply , Dual power supply, Digital multimeter, Ammeter ,Voltmeter.

Expected outcome .

On completion ,the students will be able to

1. Design simple circuits like amplifiers using OP-AMPs.
2. Design waveform Generating circuits.
3. Understand Digital concepts
4. Logically explain the concepts of combinational and sequential circuits.

Text Book:

1.RamakantA.Gayakward, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2003 / PHI.
2. D.RoyChoudhary, SheilB.Jani, Linear Integrated Circuits, II edition, New Age, 2003.
3. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India, 2002

Course code	Course Name	L-T-P - Credits	Year of Introduction
EC235	ANALOG ELECTRONICS LABORATORY	0-0-3:1	2016

Prerequisite: EC209 Analog electronics

Course Objectives

- To develop working knowledge on electronic devices and their performance characteristics

List of Exercises/Experiments : (Ten experiments are mandatory)

1. Study & Use of CRO: Measurement of current voltage, frequency and phase shift.
2. Diode Clipping Circuits
3. Clamping Circuits
4. Rectifiers and filters with and without shunt capacitors- Characteristics full wave rectifier- Ripple factor, Rectification efficiency, and % regulation
5. RC coupled amplifier using BJT in CE configuration- Measurement of gain, input and output impedance and frequency response
6. FET amplifier- Measurement of voltage gain, current gain, input and output impedance
7. Darlington Emitter Follower
8. R.C. Phase Shift Oscillator using BJT or Op- Amp
9. Characteristics of voltage regulators- Design and testing of: a) simple zener voltage regulator b) zener regulator with emitter follower output
10. Series & Parallel Resonance Circuits
11. Voltage Series Feedback Amplifier
12. Class 'B' Push-Pull Amplifier
13. Astable and monostable multivibrators using IC 555
14. Design of PLL for given lock and capture ranges& frequency multiplication
15. Applications using PLL

List of major equipments

CRO, Function generator, Regulated power supply , Dual power supply, Digital multimeter, Ammeter ,Voltmeter.

Expected outcome.

- On completion of the course the student will be able to understand the working of electrical devices ,their performance characteristics and will be able to design circuits for various electronic devices

Text Book:

Allen Mottershead, *Electronic Devices and Circuits: An Introduction,* Prentice Hall of India