

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 - Credits	Year of Introduction
EC202	SIGNALS & SYSTEMS	3-1-0 -4	2016
Prerequisite: Nil			
Course Objectives			
<ol style="list-style-type: none"> 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. 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 Laplace transform, Unilateral Laplace transform, Transfer function, Frequency response, Sampling, Aliasing, Z transform, Inverse Z 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 the above transforms			
Expected outcome .			
The student will be able to:			
<ol style="list-style-type: none"> i. Define, represent, classify and characterize basic properties of continuous and discrete time signals and systems. ii. Represent the CT signals in Fourier series and interpret the properties of Fourier transform and Laplace transform iii. Outline the relation between convolutions, correlation and to describe the orthogonality of signals. iv. Illustrate the concept of transfer function and determine the magnitude and phase response of LTI systems. v. Explain sampling theorem and techniques for sampling and reconstruction. vi. Determine z transforms, inverse z transforms and analyze LTI systems using z transform. 			
Text Book:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 1. Anand Kumar, Signals and Systems, PHI, 3/e, 2013. 2. B P. Lathi, Principles of Signal Processing & Linear systems, Oxford University Press. 3. Gurung, Signals and System, PHI. 4. Mahmood Nahvi, Signals and System, Mc Graw Hill (India), 2015. 5. P Ramakrishna Rao, Shankar Prakriya, Signals and System, MC Graw Hill Edn 2013. 			

6. Rodger E. Ziemer, Signals & Systems - Continuous and Discrete, Pearson, 4/e, 2013

Course Plan			
Module	Contents	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, Orthogonality of signals.	2	
FIRST INTERNAL EXAMINATION			
III	Frequency domain representation of continuous time signals-continuous time Fourier series and its properties.	4	15%
	Convergence, Continuous time fourier transform and its properties.	3	
	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.	4	15%
	Sampling of continuous time signals, Sampling theorem for lowpass signals, aliasing.	3	
SECOND INTERNAL EXAMINATION			
V	Z transform, ROC , Inverse transform, properties, Unilateral Z transform.	4	20%
	Frequency domain representation of discrete time signals, Discrete time fourier series and its properties.	4	
	Discrete time fourier transform (DTFT) and its properties	4	
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:			
<ul style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> Ben G. Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, Pearson, 6/e, 2010 Achuthan, K N Bhat, Fundamentals of Semiconductor Devices, 1e, McGraw Hill,2015 			
References:			
<ol style="list-style-type: none"> Tyagi M.S., Introduction to Semiconductor Materials and Devices, Wiley India, 5/e, 2008 Sze S.M., Physics of Semiconductor Devices, John Wiley, 3/e, 2005 Neamen, Semiconductor Physics and Devices, McGraw Hill, 4/e, 2012 Pierret, Semiconductor Devices Fundamentals, Pearson, 2006 Rita John, Solid State Devices, McGraw-Hill, 2014 Bhattacharya .Sharma, Solid State Electronic Devices, Oxford University Press, 2012 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

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Course code	Course Name	L-T-P - Credits	Year of Introduction
EC204	ANALOG INTEGRATED CIRCUITS	4-0-0-4	2016
Prerequisite: Nil			
Course Objectives			
<ul style="list-style-type: none"> • To equip the students with a sound understanding of fundamental concepts of operational amplifiers • To understand the wide range of applications of operational amplifiers • To introduce special function integrated circuits To introduce the 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 ICs and their applications, Monolithic Voltage Regulators - types and its applications, Data converters - specifications and types.			
Expected outcome .			
The students will			
<ol style="list-style-type: none"> i. have a thorough understanding of operational amplifiers ii. be able to design circuits using operational amplifiers for various applications 			
Text Book:			
<ol style="list-style-type: none"> 1. Franco S., Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, Tata McGraw Hill, 2008 2. Salivahanan S. ,V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008 			
References:			
<ol style="list-style-type: none"> 1. Botkar K. R., Integrated Circuits, 10/e, Khanna Publishers, 2010 2. C.G. Clayton, Operational Amplifiers, Butterworth & Company Publ. Ltd. Elsevier, 1971 3. David A. Bell, Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition, 2010 4. Gayakwad R. A., Op-Amps and Linear Integrated Circuits, Prentice Hall, 4/e, 2010 5. R.F. Coughlin & Fredrick Driscoll, Operational Amplifiers & Linear Integrated Circuits, 6th Edition, PHI,2001 6. Roy D. C. and S. B. Jain, Linear Integrated Circuits, New Age International, 3/e, 2010 7. Sedra A. S. and K. C. Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2013 			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Differential amplifiers: Differential amplifier configurations using BJT, Large and small signal operations, 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 (Analysis using hybrid 'pi' model only).	6	15%
	Operational amplifiers: Introduction, Block diagram, Ideal op-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	5	
II	Op-amp with negative feedback: Introduction, Feedback	3	15%

	configurations, Voltage series feedback, Voltage shunt feedback, Properties of practical op-amp.		
	Op-amp applications: Inverting and non inverting amplifier, DC and AC amplifiers, Summing, Scaling and averaging amplifiers, Instrumentation amplifier.	4	
FIRST INTERNAL EXAMINATION			
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	7	15%
IV	Astable and monostable multivibrators, Triangular and saw tooth wave generators, Comparators, Zero crossing detector, Schmitt trigger	5	15%
	Active filters: Advantages, First and second order low pass, High pass, Band pass and band reject filters, Design of filters using Butterworth approximations	5	
SECOND INTERNAL EXAMINATION			
V	Specialized ICs and its applications: Timer IC 555 : Astable and monostable operations, applications. Analog Multipliers: Introduction, Gilbert multiplier cell. Voltage Controlled Oscillator IC AD633 and their applications.	3	20%
	Phase Locked Loop – Operation, Closed loop analysis, Lock and capture range, Basic building blocks, PLL IC 565, Applications of PLL for AM & FM detection and Frequency multiplication, Frequency division, Frequency synthesizing.	4	
	Monolithic Voltage Regulators - Fixed voltage regulators, 78XX and 79XX series, Adjustable voltage regulators, IC 723 – Low voltage and high voltage configurations, Current boosting, Current limiting, Short circuit and Fold-back protection.	4	
VI	Data Converters: D/A converter, Specifications, Weighted resistor type, R-2R Ladder type.	3	20%
	A/D Converters: Specifications, Classification, Flash type, Counter ramp type, Successive approximation type, Single slope type, Dual slope type, Sample-and-hold circuits.	5	
END SEMESTER EXAM			

Assignment

1. Explain the importance of frequency compensated networks in opamps and the commonly used compensation techniques.
2. Write short notes on commercially available integrated circuits (Opamp, ADC, DAC, VCO, Analog multiplier, PLL) with pin outs and their important features

Question Paper Pattern

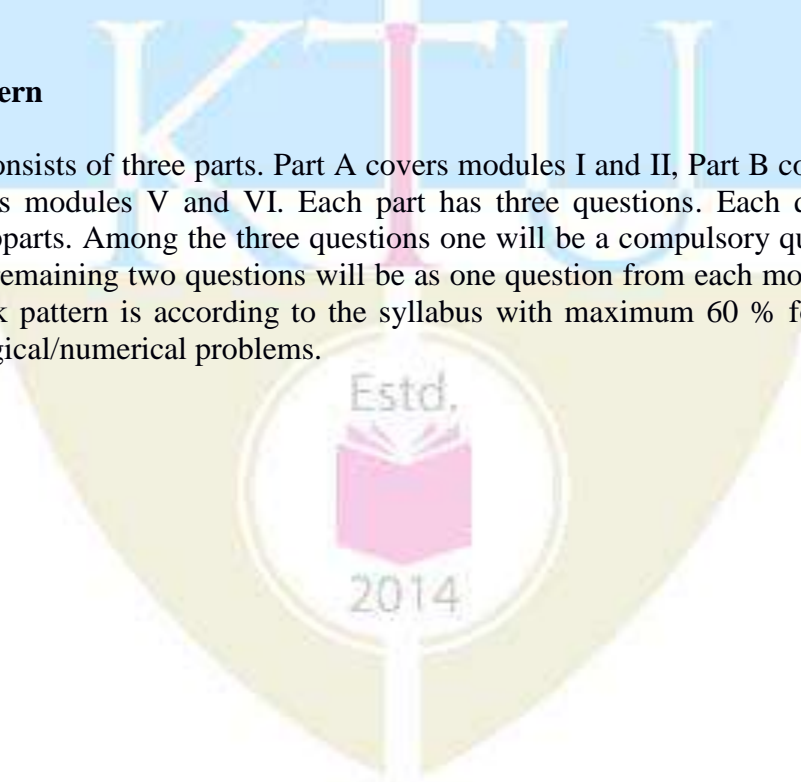
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COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC205	ELECTRONIC CIRCUITS	3-1-0-4	2016
Prerequisite: Nil			
Course objectives:			
<ul style="list-style-type: none"> To develop the skill of analysis and design of various analog circuits using discrete 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:			
<ul style="list-style-type: none"> At the end of the course, students will be able to analyse and design the different electronic circuits using discrete electronic components. 			
Text Books:			
<ul style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> Neamen D., Electronic Circuits - Analysis and Design, 3/e, TMH, 2007 Rashid M. H., Microelectronic Circuits - Analysis and Design, Cengage Learning, 2/e, 2011 Spencer R. R. and M. S. Ghauri, Introduction to Electronic Circuit Design, Pearson, 2003 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, MOSFET Cascade amplifier	5	
END SEMESTER EXAM			

Question Paper Pattern

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Course code	Course Name	L-T-P - Credits	Year of Introduction
EC206	COMPUTER ORGANISATION	3-0-0-3	2016
Prerequisite: EC207 Logic Circuit Design			
Course Objectives			
<ul style="list-style-type: none"> To impart knowledge in computer architecture. To impart knowledge in machine language programming. 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 of data path and control units, I/O accessing techniques, Memory concepts, Memory interface, Cache and Virtual memory concepts.			
Expected outcome .			
The students will be able to:			
<ol style="list-style-type: none"> Understand the functional units of a computer Identify the different types of instructions Understand the various addressing modes Understand the I/O addressing system Categorize the different types of memories 			
Text Book:			
<ol style="list-style-type: none"> David A. Patterson and John L. Hennessey, Computer Organisation and Design, Fourth Edition, Morgan Kaufmann David Money Harris, Sarah L Harris, Digital Design and Computer Architecture, Morgan Kaufmann – Elsevier, 2009 			
References:			
<ol style="list-style-type: none"> Carl Hamacher : “Computer Organization ”, Fifth Edition, Mc Graw Hill John P Hayes: “Computer Architecture and Organisation”, Mc Graw Hill William Stallings: “Computer Organisation and Architecture”, Pearson Education Andrew S Tanenbaum: “Structured Computer Organisation”, Pearson Education Craig Zacker: “PC Hardware : The Complete Reference”, TMH 			
Course Plan			
Module	Contents	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: Review of Fixed point & Floating point number system	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 EXAMINATION			
III	MIPS Addressing modes – Register only, Immediate, Base, PC-relative, Pseudo - direct	3	15%

	MIPS memory map , Steps for executing a program - Compilation, Assembling, Linking, Loading	3	
	Pseudoinstructions, Exceptions, Signed and Unsigned instructions, Floating point instructions	3	
IV	MIPS Microarchitectures – State elements of MIPS processor	1	15%
	Design process and performance analysis of Single cycle processor, Single cycle data path, Single cycle control for R – type arithmetic/logical instructions.	3	
	Design process and performance analysis of multi cycle processor, Multi cycle data path, Multi cycle control for R – type arithmetic/logical instructions.	3	
SECOND INTERNAL EXAMINATION			
V	I/O system – Accessing I/O devices, Modes of data transfer, Programmed I/O, Interrupt driven I/O, Direct Memory Access, Standard I/O interfaces – Serial port, Parallel port, PCI, SCSI, and USB.	3	20%
	Memory system – Hierarchy, Characteristics and Performance analysis, Semiconductor memories (RAM, ROM, EPROM), Memory Cells – SRAM and DRAM, internal organization of a memory chip, Organization of a memory unit.	4	
VI	Cache Memory – Concept/principle of cache memory, Cache size, mapping methods – direct, associated, set associated, Replacement algorithms, Write policy- Write through, Write back.	3	20%
	Virtual Memory – Memory management, Segmentation, Paging, Address translation, Page table, Translation look aside buffer.	3	
END SEMESTER EXAM			

Question Paper Pattern

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2014

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC207	LOGIC CIRCUIT DESIGN	3-0-0-3	2016
Prerequisite: Nil			
Course objectives:			
<ul style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> Donald D Givone, Digital Principles and Design, Tata McGraw Hill, 2003 John F Wakerly, Digital Design Principles and Practices, Pearson Prentice Hall, 2007 			
References:			
<ol style="list-style-type: none"> Ronald J Tocci, Digital Systems, Pearson Education, 11th edition, 2010 Thomas L Floyd, Digital Fundamentals, Pearson Education, 8th edition 2009 Moris Mano, Digital Design, Prentice Hall of India, 3rd edition, 2002 John M Yarbrough, Digital Logic Applications and Design, Cenage learning, 2009 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

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 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 50 % for theory, derivation, proof and 50% for logical/numerical problems.

Course code	Course Name	L-T-P - Credits	Year of Introduction
EC208	ANALOG COMMUNICATION ENGINEERING	3-0-0-3	2016
Prerequisite: EC205 Electronic Circuits			
Course Objectives			
<ul style="list-style-type: none"> • 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. <p>To impart basic knowledge on public telephone systems.</p>			
Syllabus			
Elements of communication system, Need for modulation, Noises, Amplitude Modulation, Amplitude modulator circuits, Demodulator circuits, AM transmitters, Types of AM, Angle modulation: principles of frequency modulation, phase modulation, AM and FM Receivers, Frequency modulator circuits, FM transmitters, FM receiver, Noise in AM and FM systems, Public telephone systems, standard telephone set, cordless telephones.			
Expected outcome .			
The students will be able to:			
<ol style="list-style-type: none"> i. understand the different analog modulation schemes. ii. understand the fundamental ideas of noises and its effect in communication systems. iii. explain the principle and working of analog transmitters and receivers. iv. know the basic idea of telephone systems. 			
Text Book:			
<ol style="list-style-type: none"> 1. Dennis Roody and John Coolen, Electronic Communication, Pearson, 4/e, 2011. 2. George Kennedy, Electronic Communication Systems, McGrawHill, 4/e, 2008. 3. Tomasi, Electronic Communications System, Pearson, 5/e, 2011. 			
References:			
<ol style="list-style-type: none"> 1. Blake, Electronic Communication system, Cengage, 2/e, 2012. 2. Simon Haykin, Communication Systems, Wiley 4/e, 2006. 3. Taub, Schilling, Saha, Principles of communication system, McGraw Hill, 2013. 4. Tomasi, Advanced Electronic Communications Systems, Pearson, 6/e, 2012. 			
Course Plan			
Module	Contents	Hours	Sem. Exam Marks
I	Introduction, Elements of communication systems, Need for modulation	2	15%
	Noise in communication system, Thermal noise (white noise), Shot noise, Partition noise, Flicker noise, Burst noise, Signal to noise ratio, Noise factor, Noise temperature, Narrow band noise.	3	
II	Amplitude modulation: Sinusoidal AM, Modulation index, Average power, Effective voltage and current, Nonsinusoidal modulation.	4	15%
	Amplitude modulator circuits, Amplitude demodulator circuits, AM transmitters, Noise in AM Systems.	5	
FIRST INTERNAL EXAMINATION			
III	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.	6	15%

IV	Angle modulation: Frequency modulation, Sinusoidal FM, Frequency spectrum, Modulation index, Average power, Non-sinusoidal modulation, Deviation ratio, Comparison of AM and FM.	4	15%
	AM & FM Receivers: Super heterodyne receiver, Tuning range, Tracking, Sensitivity and gain, Image rejection, Double conversion, Adjacent channel selectivity, Automatic Gain Control (AGC).	4	
SECOND INTERNAL EXAMINATION			
V	Phase modulation, Equivalence between PM and FM, Sinusoidal phase modulation, Digital phase modulation.	3	20%
	Angle modulator Circuits: Varactor diode modulators, Transistor modulators. FM Transmitters: Direct and Indirect Methods.	3	
VI	Angle modulation detectors, Slope detector, Balanced slope detector, Foster-Seeley discriminator, PLL demodulator, Automatic Frequency Control (AFC), Amplitude limiters, Noise in FM systems, Pre-emphasis and De-emphasis.	4	20%
	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 exchanges, Automated central office switches and exchanges.

Question Paper

The question paper shall consist of three parts. Part A covers I and II module, Part B covers III and IV module, Part C covers V and VI module. Each part has three questions, which may have maximum four subdivisions. Among the three questions, one will be a compulsory question covering both modules and the remaining from each module, of which one to be answered. Part A & Part B questions shall carry 15 marks each and Part C questions shall carry 20 marks each with maximum 60 % for theory and 40% 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			
<ul style="list-style-type: none"> 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.			
<ul style="list-style-type: none"> Will get knowledge on electronic elements and their characteristics. 			
Text Book:			
1. Allen Mottershead, <i>Electronic Devices and Circuits: An Introduction</i> , Prentice Hall of India. 2. V. Boylestad and Nashelsky, <i>Electronic Devices and Circuits</i> , Pearson Education 3. Ramakant A Gayakwad, <i>Op- Amps and Linear Integrated Circuits</i> , Prentice Hall of India			
References:			
1. Schilling and Belove, <i>Electronic Circuits</i> , McGraw Hill 2. Theodore F. Bogart Jr., <i>Electronic Devices and Circuits</i> , 3. Coughlin and Driscoll, <i>Operational amplifiers and Linear Integrated Circuits</i> , 4. K. R. Botkar, <i>Integrated Circuits</i> , Khanna Publishers 5. Somanathan Nair, <i>Linear Integrated Circuits – Analysis, Design & Application</i> , 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 <ul style="list-style-type: none"> 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 <p>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</p>			
Expected outcome: <ul style="list-style-type: none"> The students will learn to know about the IC'S and their application, digital circuits, combinational and sequential circuits. 			
Text Book: <ol style="list-style-type: none"> Ramakant A.Gayakward, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2003 / PHI. D.Roy Choudhary, Sheil B.Jani, Linear Integrated Circuits, II edition, New Age, 2003. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India, 2002 			
References: <ol style="list-style-type: none"> Robert F.Coughlin, Fredrick F.Driscoll, Op-amp and Linear ICs, Pearson Education, 4th edition, 2002 /PHI. David A.Bell, Op-amp & Linear ICs, Prentice Hall of India, 2nd edition, 1997. Charles H.Roth, Fundamentals Logic Design, Jaico Publishing, IV edition, 2002. 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:			
<ul style="list-style-type: none"> • 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)			
<ol style="list-style-type: none"> 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 be able to:			
<ol style="list-style-type: none"> 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:			
<ul style="list-style-type: none"> 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)			
<ol style="list-style-type: none"> VI Characteristics of rectifier and zener diodes RC integrating and differentiating circuits (Transient analysis with different inputs and frequency response) Clipping and clamping circuits (Transients and transfer characteristics) Fullwave Rectifier -with and without filter- ripple factor and regulation Simple Zener voltage regulator (load and line regulation) Characteristics of BJT in CE configuration and evaluation of parameters Characteristics of MOSFET in CS configuration and evaluation of parameters RC coupled CE amplifier - frequency response characteristics MOSFET amplifier (CS) - frequency response characteristics Cascade amplifier – gain and frequency response Cascode amplifier -frequency response Feedback amplifiers (current series, voltage series) - gain and frequency response Low frequency oscillators –RC phaseshift, Wien bridge, High frequency oscillators –Colpitt’s and Hartley Power amplifiers (transformer less) - Class B and Class AB Transistor series voltage regulator (load and line regulation) Tuned amplifier - frequency response Bootstrap sweep circuit Multivibrators -Astable, Monostable and Bistable Schmitt trigger 			
Expected outcome:			
The student should able to:			
<ol style="list-style-type: none"> Design and demonstrate functioning of various discrete analog circuits. 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: <ul style="list-style-type: none"> 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) <ol style="list-style-type: none"> Familiarization of Operational amplifiers - Inverting and Non inverting amplifiers, frequency response, Adder, Integrator, comparators. Measurement of Op-Amp parameters. Difference Amplifier and Instrumentation amplifier. Schmitt trigger circuit using Op –Amps. Astable and Monostable multivibrator using Op -Amps. Timer IC NE555 Triangular and square wave generators using Op- Amps. Wien bridge oscillator using Op-Amp - without & with amplitude stabilization. RC Phase shift Oscillator. Precision rectifiers using Op-Amp. Active second order filters using Op-Amp (LPF, HPF, BPF and BSF). Notch filters to eliminate the 50Hz power line frequency. IC voltage regulators. A/D converters- counter ramp and flash type. D/A Converters- ladder circuit. Study of PLL IC: free running frequency lock range capture range 			
Expected outcome:			
The student should able to:			
<ol style="list-style-type: none"> Design and demonstrate functioning of various analog circuits 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	<p><u>Introduction to SPICE</u></p> <p>[Institution can use any one circuit simulation package with schematic entry like EDWinXP, PSpice, Multisim, Proteus or CircuitLab.]</p> <p>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.</p> <p>List of Experiments using SPICE [Six experiments mandatory]</p> <p>Simulation of following circuits using SPICE [Schematic entry of circuits using standard package, Analysis –Transient, AC, DC]</p> <ol style="list-style-type: none"> 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	<p><u>Introduction to MATLAB</u></p> <p>[Institution can use any one numerical computational package like SciLab, Octave, Spyder, Python (scipy) or Freemat instead of MATLAB]</p> <p>Fundamentals, basic operations on array, matrix, complex numbers etc., Script and function files, plotting commands, control statements.</p> <p>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.</p> <p>List of Experiments [Four experiments mandatory]</p> <p>Write program and obtain the solutions</p> <ol style="list-style-type: none"> 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 Xilinx 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			
<ul style="list-style-type: none"> To study various digital and linear integrated circuits used in simple system configuration 			
<p>List of Exercises/Experiments : (10 experiments are mandatory)</p> <ol style="list-style-type: none"> Operational Amplifiers (IC741)-Characteristics Square , triangular and ramp generation using op-amps Log and Antilog amplifiers. Astable and monostable multivibrators using op-amps Active notch filter realization using op-amps Wein bridges oscillator using OpAmp OpAmp Integrator and Differentiator. Code converter - Binary to gray and Gray to binary. Adder and Subtractor Circuits using logic IC Implementation of combinational logic circuits using MUX IC Design and implementation of multiplexer and demultiplexer. 3-bit synchronous counter design Asynchronous counter design and Mod-n counter Shift registers - SISO/SIPO & PISO/PIPO 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			
<ol style="list-style-type: none"> Design simple circuits like amplifiers using OP-AMPs. Design waveform Generating circuits. Understand Digital concepts Logically explain the concepts of combinational and sequential circuits. 			
Text Book:			
<ol style="list-style-type: none"> Ramakant A. Gayakward, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2003 / PHI. D. Roy Choudhary, Sheil B. Jani, Linear Integrated Circuits, II edition, New Age, 2003. 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			
<ul style="list-style-type: none"> To develop working knowledge on electronic devices and their performance characteristics 			
List of Exercises/Experiments : (Ten experiments are mandatory)			
<ol style="list-style-type: none"> Study & Use of CRO: Measurement of current voltage, frequency and phase shift. Diode Clipping Circuits Clamping Circuits Rectifiers and filters with and without shunt capacitors- Characteristics full wave rectifier- Ripple factor, Rectification efficiency, and % regulation RC coupled amplifier using BJT in CE configuration- Measurement of gain, input and output impedance and frequency response FET amplifier- Measurement of voltage gain, current gain, input and output impedance Darlington Emitter Follower R.C. Phase Shift Oscillator using BJT or Op- Amp Characteristics of voltage regulators- Design and testing of: a) simple zener voltage regulator b) zener regulator with emitter follower output Series & Parallel Resonance Circuits Voltage Series Feedback Amplifier Class 'B' Push-Pull Amplifier Astable and monostable multivibrators using IC 555 Design of PLL for given lock and capture ranges& frequency multiplication Applications using PLL 			
List of major equipments			
CRO, Function generator, Regulated power supply , Dual power supply, Digital multimeter, Ammeter , Voltmeter.			
Expected outcome.			
<ul style="list-style-type: none"> 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, <i>Electronic Devices and Circuits: An Introduction</i> , Prentice Hall of India			

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC301	Digital Signal Processing	3-1-0-4	2016
Prerequisite: EC 202 Signals & Systems			
Course objectives:			
<ol style="list-style-type: none"> 1. To provide an understanding of the principles, algorithms and applications of DSP 2. To study the design techniques for digital filters 3. To give an understanding of Multi-rate Signal Processing and its applications 4. To introduce the architecture of DSP processors 			
Syllabus			
Discrete Fourier Transform and its Properties, Linear Filtering methods based on the DFT, Frequency analysis of signals using the DFT, Computation of DFT, FFT Algorithms, IDFT computation using Radix-2 FFT Algorithms, Efficient computation of DFT of two real sequences and a 2N-Point real sequence, Design of FIR Filters, Design of linear phase FIR Filters using window methods and frequency sampling method, Design of IIR Digital Filters from Analog Filters, IIR Filter Design, Frequency Transformations, FIR Filter Structures, IIR Filter Structures, Introduction to TMS320C67xx digital signal processor, Multi-rate Digital Signal Processing, Finite word length effects in DSP systems, IIR digital filters, FFT algorithms.			
Expected outcome:			
The students will understand			
<ol style="list-style-type: none"> (i) the principle of digital signal processing and applications. (ii) the utilization of DSP to electronics engineering 			
Text Books:			
<ol style="list-style-type: none"> 1. Oppenheim A. V., Schafer R. W. and Buck J. R., Discrete Time Signal Processing, 3/e, Prentice Hall, 2007. 2. Proakis J. G. and Manolakis D. G., Digital Signal Processing, 4/e, Pearson Education, 2007. 			
References:			
<ol style="list-style-type: none"> 1. Chassaing, Rulph., DSP applications using C and the TMS320C6x DSK. Vol. 13. John Wiley & Sons, 2003. 2. Ifeachor E.C. and Jervis B. W., Digital Signal Processing: A Practical Approach, 2/e, Pearson Education, 2009. 3. Lyons, Richard G., Understanding Digital Signal Processing, 3/e. Pearson Education India, 2004. 4. Mitra S. K., Digital Signal Processing: A Computer Based Approach, 4/e McGraw Hill (India), 2014. 5. NagoorKani, Digital Signal Processing, 2e, Mc Graw –Hill Education New Delhi, 2013 6. Salivahanan, Digital Signal Processing,3e, Mc Graw –Hill Education New Delhi, 2014 (Smart book) 7. Singh A., Srinivasan S., Digital Signal Processing: Implementation Using DSP Microprocessors, Cenage Learning, 2012. 			

Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	The Discrete Fourier Transform: DFT as a linear transformation, Relationship of the DFT to other transforms, IDFT	2	15
	Properties of DFT and examples Circular convolution	4	
	Linear Filtering methods based on the DFT- linear convolution using circular convolution, overlap save and overlap add methods	3	
	Frequency Analysis of Signals using the DFT	2	
II	Computation of DFT: Radix-2 Decimation in Time and Decimation in Frequency FFT Algorithms	3	15
	IDFT computation using Radix-2 FFT Algorithms	2	
	Efficient computation of DFT of Two Real Sequences and a 2N-Point Real Sequence	2	
FIRST INTERNAL EXAM			
III	Design of FIR Filters- Symmetric and Anti-symmetric FIR Filters	2	15
	Design of linear phase FIR Filters using Window methods (rectangular, Hamming and Hanning) and frequency sampling Method	6	
	Comparison of Design Methods for Linear Phase FIR Filters	1	
IV	Design of IIR Digital Filters from Analog Filters (Butterworth)	4	15
	IIR Filter Design by Impulse Invariance, and Bilinear Transformation	3	
	Frequency Transformations in the Analog and Digital Domain	2	
SECOND INTERNAL EXAM			
V	Block diagram and signal flow graph representations of filters	1	20
	FIR Filter Structures: (Linear structures), Direct Form, Cascade Form and Lattice Structure	3	
	IIR Filter Structures: Direct Form, Transposed Form, Cascade Form and Parallel Form	2	
	Computational Complexity of Digital filter structures	1	
	Computer architecture for signal processing : Introduction to TMS320C67xx digital signal processor	2	
VI	Multi-rate Digital Signal Processing: Decimation and Interpolation (Time domain and Frequency Domain Interpretation without proof)	3	20
	Finite word length effects in DSP systems: Introduction (analysis not required), fixed-point and floating-point DSP arithmetic, ADC quantization noise	2	

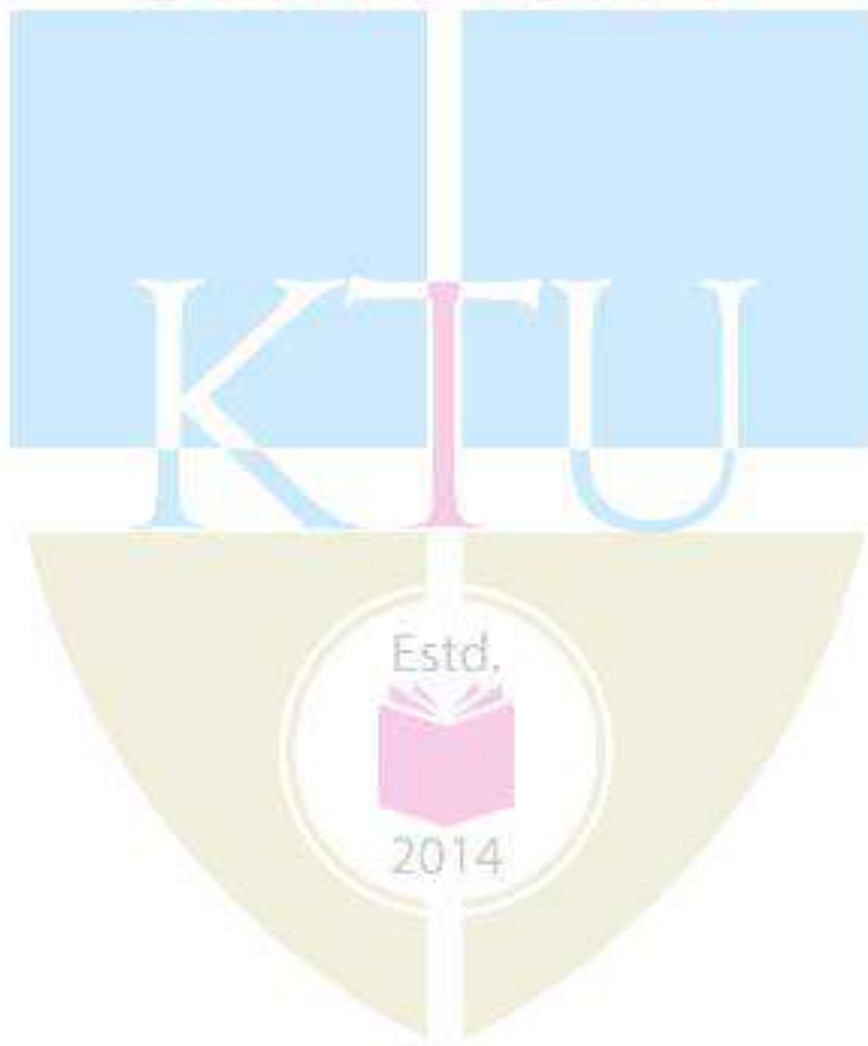
	Finite word length effects in IIR digital filters: coefficient quantization errors	2	
	Finite word length effects in FFT algorithms: Round off errors	2	
END SEMESTER EXAM			

Question Paper Pattern (End Sem Exam)

Maximum Marks: 100

Time : 3 hours

The question paper shall consist 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 uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 40 % for theory and 60% for logical/numerical problems, derivation and proof.



COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC303	Applied Electromagnetic Theory	3-0-0-3	2016
Prerequisite: Nil			
Course objectives:			
<ol style="list-style-type: none"> 1. To introduce basic mathematical concepts related to electromagnetic vector fields. 2. To impart knowledge on the basic concepts of electric and magnetic fields 3. To develop a solid foundation in the analysis and application of electromagnetic fields, Maxwell's equations and Poynting theorem. 4. To become familiar with propagation of signal through transmission lines and waveguides. 			
Syllabus:			
Co-ordinate transformation, vector algebra, vector calculus, electrostatics, magneto statics, Maxwell's equations, Boundary condition, Solution of wave equation, propagation of plane EM wave in different media, Poynting vector theorem, transmission lines, Smith chart, Waveguides.			
Expected outcome:			
At the end of the course, students will be able:			
<ol style="list-style-type: none"> 1. To develop a solid foundation and a fresh perspective in the analysis and application of electromagnetic fields. 2. To analyse the propagation of electromagnetic waves in different media. 3. To analyze the characteristics of transmission lines. 4. To solve the different transmission line problems using Smith chart 5. To understand the different modes of propagation in waveguides. 			
Text Books:			
<ol style="list-style-type: none"> 1. John D. Kraus, Electromagnetics, 5/e, TMH, 2010. 2. Mathew N O Sadiku, Elements of Electromagnetics, Oxford University Press, 6/e, 2014. 3. William, H., Jf Hayt, and John A. Buck. Engineering Electromagnetics. McGraw-Hill, 8/e McGraw-Hill, 2014. 			
References:			
<ol style="list-style-type: none"> 1. Jordan and Balmain , Electromagnetic waves and Radiating Systems, PHI, 2/e,2013 2. Joseph A Edminister , Electromagnetics, Schaum's Outline Series McGraw Hill, 4/e, 1995 3. Martin A Plonus , Applied Electromagnetics, McGraw Hill, 2/e,1978. 4. <u>Matthew N.O. Sadiku & S.V. Kulkarni</u> "Principles of Electromagnetics', Oxford University Press Inc. Sixth Edition, Asian Edition,2015 5. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, Pearson, 6/e, 2006. 6. Umran S. Inan and Aziz S. Inan, Engineering Electromagnetics, Pearson, 2010. 			

Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	Review of vector calculus, Spherical and Cylindrical coordinate system, Coordinate transformation	1	0
	Curl, Divergence, Gradient in spherical and cylindrical coordinate system.	1	
	Electric field – Application of Coulomb’s law, Gauss law and Amperes current law (proof not required, simple problems only)	1	15
	Poisson and Laplace equations (proof not required, simple problems only), Determination of E and V using Laplace equation.	1	
	Derivation of capacitance and inductance of two wire transmission line and coaxial cable. Energy stored in Electric and Magnetic field.	2	
	Displacement current density, continuity equation. Magnetic vector potential. Relation between scalar potential and vector potential.	2	
II	Maxwell’s equation from fundamental laws.	1	15
	Boundary condition of electric field and magnetic field from Maxwell's equations	1	
	Solution of wave equation	1	
	Propagation of plane EM wave in perfect dielectric, lossy medium, good conductor, media-attenuation, phase velocity, group velocity, skin depth.	3	
FIRST INTERNAL EXAM			
III	Reflection and refraction of plane electromagnetic waves at boundaries for normal & oblique incidence (parallel and perpendicular polarization), Snell’s law of refraction, Brewster angle.	4	15
	Power density of EM wave, Poynting vector theorem, Complex Poynting vector.	3	
	Polarization of electromagnetic wave-linear, circular and elliptical polarisation.	2	
IV	Uniform lossless transmission line - line parameters	1	15
	Transmission line equations, Voltage and Current distribution of a line terminated with load	2	
	Reflection coefficient and VSWR. Derivation of input impedance of transmission line.	2	
SECOND INTERNAL EXAM			
V	Transmission line as circuit elements (L and C).	2	20
	Half wave and quarter wave transmission lines.	1	
	Development of Smith chart - calculation of line impedance and VSWR using smith chart.	2	

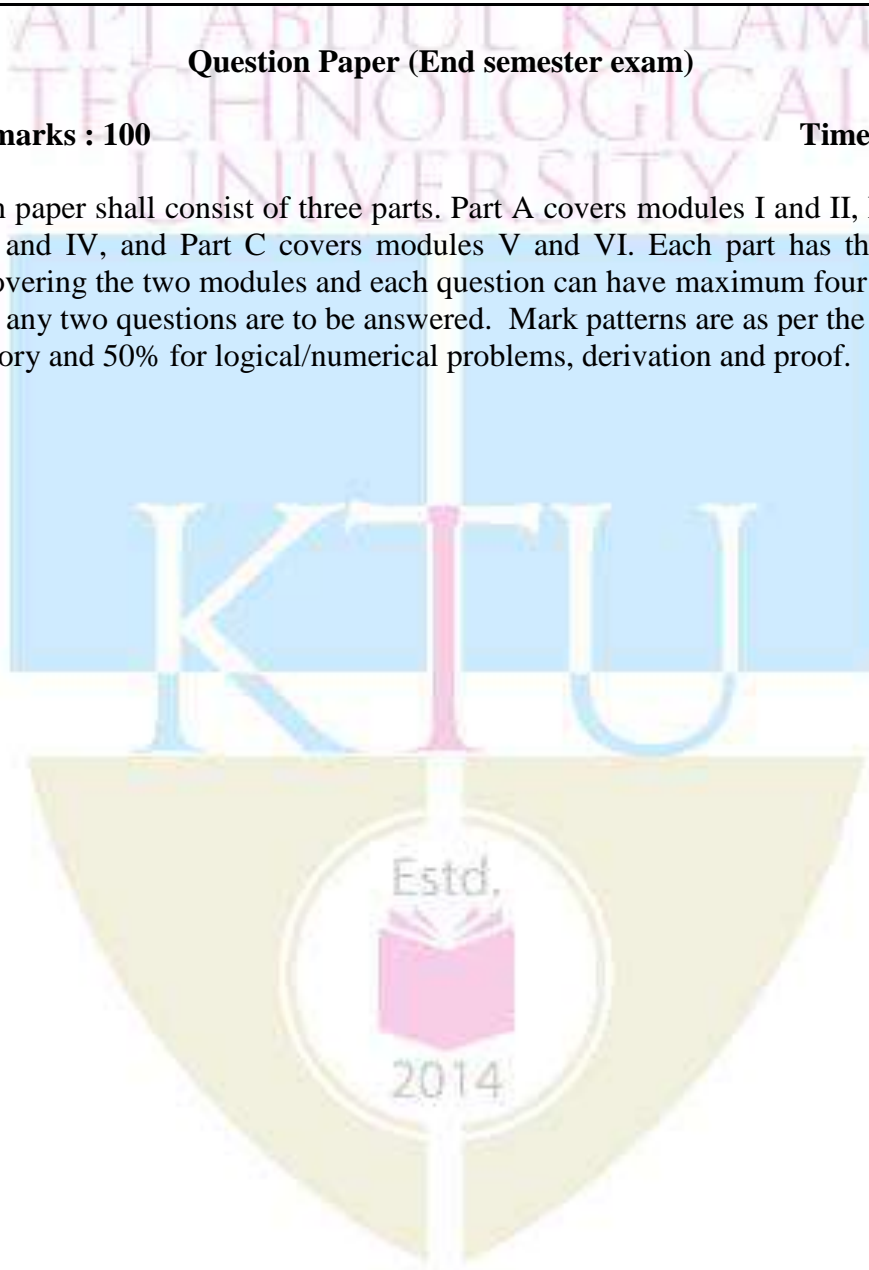
	Single stub matching (Smith chart and analytical method).	2	
VI	Parallel-Plate Waveguide - TE & TM waves.	1	20
	The hollow rectangular wave guide – modes of propagation of wave- dominant mode, group velocity and phase velocity - derivation and simple problems only.	3	
	Attenuation in wave guides, guide wavelength and impedance -derivation and simple problems only.	3	
END SEMESTER EXAM			

Question Paper (End semester exam)

Maximum marks : 100

Time: 3 hours

The question paper shall consist 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 uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 50 % for theory and 50% for logical/numerical problems, derivation and proof.



COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC305	Microprocessor & Microcontroller	3-0-0-3	2016
Prerequisite: EC207 Logic Circuit Design			
Course objectives:			
<ol style="list-style-type: none"> 1. To understand fundamental operating concepts of microprocessors and microcontrollers. 2. To communicate with various devices using controller. 3. To design a microcontroller based system with the help of the interfacing devices. 4. To program the controller to make various peripherals work for specified application. 			
Syllabus:			
<p>Microprocessors: 8085 architecture and its operation, microprocessor initiated operations and bus organization, pin configuration and functions, generation of control signals for external operations- fetch, IO/M, read/write, machine cycles and bus timings. Addressing modes, instruction set, instruction classification. Overview/concept of peripheral IC interfacing with 8085 microprocessor (8251, 8253, 8255, 8279). Simple examples in assembly language programming for 8085 (only for internal examination). Introduction to development tools: IDE, cross assembler, builder, linker and debugger.(not required for exam). Introduction to 8086 and comparison between 8086, 80286, 80386, 80486 and Pentium.</p> <p>Microcontrollers: 8051- features, architecture, memory organization, registers, I/O ports, pin configuration and functions. Addressing modes, instruction set, instruction classification. Assembly language programming. Interrupts in 8051. Timer/Counter programming: Operating modes, time delay generation, Waveform generation. Serial communication: RS 232 interface, registers in UART, modes of operation, programming examples for serial data transmission and reception. Interfacing of DIP switch, stepper motor, ADC, DAC, LEDs and seven segment displays, alphanumeric LCD module with 8051.</p>			
Expected outcome:			
<p>The students will be able to:</p> <ol style="list-style-type: none"> 1. Distinguish various types of processor architectures. 2. Describe architectures, memory organization of 8085 microprocessor and 8051. 3. Develop programming skills in assembly for interfacing peripheral devices with 8051 			
Text Books:			
<ol style="list-style-type: none"> 1. Kenneth J. Ayala, The 8051 Microcontroller, Cengage learning, 3/e. 2. Lyla B.Das : Microprocessors and Microcontrollers, Pearson Education, India, 2011 3. Ramesh S. Goankar. 8085 Microprocessors Architecture Application and Programming. Penram International, 5/e. 			
References:			
<ol style="list-style-type: none"> 1. Aditya P Mathur, Introduction to Microprocessor. Tata Mc Graw – Hill 2. Han Way Hung, “PIC Microcontroller, An introduction to software and hardware interfacing “, Cenage learning. 3. I.Scott Mackenzie, Raphel C.-W Phan, The 8051 microcontroller, 4th edition. 4. Muhammed Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education, 2nd edition 5. Nagoorkani, Microprocessors and Microcontrollers 2e, McGraw Hill Education India, 2012. 6. Soumitra Kumar Mandal. Microprocessors and Microcontrollers Architecture, Programming & Interfacing Using 8085, 8086 and 8051, McGraw Hill Education (2011). 7. 			

Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	Microprocessors: Introduction, organization of a microprocessor based system, evolution of microprocessors, 8085 architecture and its operation, microprocessor initiated operations and bus organization, pin configuration and functions, generation of control signals for external operations-fetch, IO/M, read/write.	5	15
II	Machine cycles and bus timings, Addressing modes, instruction set instruction classification.	4	15
	Overview/concept of peripheral IC interfacing with 8085 microprocessor (8251, 8253, 8255, 8279).	3	
	Simple examples in assembly language programming for 8085 (only for internal examination)	2	0
	Introduction to development tools: IDE, cross assembler, builder, linker and debugger.(not required for exam)	3	
FIRST INTERNAL EXAM			
III	Introduction to 8086 and comparison between 8086,80286,80386,80486 and Pentium	2	15
	Microcontrollers: Introduction, comparison between microprocessors and microcontrollers, microcontroller families, 8051- features, architecture, memory organization, registers, I/O ports, pin configuration and functions.	6	
IV	Addressing modes, instruction set, instruction classification.	2	15
	Assembly language programming examples for 8051.	3	
SECOND INTERNAL EXAM			
V	Interrupts in 8051: Types, interrupt source, interrupt handling and programming	2	20
	Timer/Counter programming: Operating modes, time delay generation, Waveform generation.	2	
	Serial communication: RS 232 interface, registers in UART, modes of operation, programming examples for serial data transmission and reception	2	
VI	Interfacing: Interfacing (block schematic and assembly language programming) of DIP switch, stepper motor, ADC, DAC, LEDs and seven segment displays, alphanumeric LCD module with 8051.	6	20
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

Max. Marks: 100

Time: 3 hours

The question paper shall consist 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 uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 80 % for theory and 20% for logical/numerical problems and programming.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC307	Power Electronics & Instrumentation	3-0-0-3	2016
Prerequisite: EC205 Electronic Circuits			
Course objectives:			
<ol style="list-style-type: none"> 1. To provide an insight on the concepts of Power Electronics and Electronic instruments. 2. To study the applications of Power electronics such as Switched mode regulators and inverters. 3. To develop understanding of the concept of Transducers and Digital instruments. 			
Syllabus:			
<p>Power semiconductor switches and its static and dynamic characteristics. Switched mode regulators, SMPS, Switched mode inverters, UPS.</p> <p>Performance characteristics of instruments, Measurement of passive components, Different Transducers, Digital Instruments.</p>			
Expected outcome:			
The students will be able:			
<ol style="list-style-type: none"> 1. To understand the concepts of Power Electronics and the various applications. 2. To get an insight on various electronic instruments, their configuration and measurements using them. 3. To understand the principle of operation of Transducers 			
Text Books:			
<ol style="list-style-type: none"> 1. Bell D. A., Electronic Instrumentation and Measurements, Oxford University Press, 2003. 2. Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, Third Edition, New Delhi. 3. Umanand L., Power Electronics Essentials and Applications, Wiley India, 2015. 			
References:			
<ol style="list-style-type: none"> 1. Daniel W. Hart, Power Electronics, McGraw Hill, 2011. 2. Doebelin E., Measurement Systems, 5/e, McGraw Hill, 2003. 3. Helfrick A. D. and W. D. Cooper: Modern Electronic Instrumentation and Measurement Techniques, 5/e, PHI, 2003. 4. Mandal, Power Electronics 1e, McGraw Hill Education India, 2014 5. Mohan N. and T. M. Undeland, Power Electronics: Converters, Applications and Design, John Wiley, 2007. 6. Nakra, Instrumentation, Measurement and Analysis, 4e, Mc Graw –Hill Education New Delhi, 2016 7. Patranabis D., Principles of Electronic Instrumentation, PHI, 2008. 			

Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	Linear Electronics versus Power Electronics - Power semiconductor switches.	1	15
	Power diodes-structure, static and dynamic characteristics	2	
	Power transistors - Power BJT, Power MOSFET, GTO and IGBT	3	
	Steady state and switching characteristics of Power BJT, Power MOSFET and IGBT.	2	
II	Introduction to Switched mode regulators	1	15
	Buck, Boost and Buck-Boost DC-DC converters	2	
	Waveforms and expression of DC-DC converters for output voltage, voltage and current ripple under continuous conduction mode. (Derivation not required)	1	
	Isolated converters - Flyback, Forward, Push Pull, Half Bridge and Full Bridge Converters - waveforms and governing equations. (Derivation not required)	3	
FIRST INTERNAL EXAM			
III	Overview of SMPS, Switched mode inverters- Principles of PWM switching schemes.	2	15
	Single phase inverters - half bridge, full bridge and push pull.	2	
	UPS - on line and off line.	1	
	Three phase inverters - PWM and Space vector modulation in three phase inverters.	3	
IV	Generalized configurations of instruments - Functional elements. Classification of instruments	1	15
	Generalized performance characteristics of instruments - Static characteristics and Dynamic characteristics.	2	
	Measurement of: resistance using Wheastone's bridge, inductance using Maxwell-Wien bridge, and capacitance using Schering's bridge.	2	
SECOND INTERNAL EXAM			
V	Transducers - Classification, Selection of transducers.	1	20
	Resistance transducers - Principle of operation, strain gauge.	2	
	Inductive Transducers: LVDT.	2	
	Capacitive transducers - different types, capacitor microphone, Hall Effect transducer, proximity transducers.	2	
VI	Electronic Multimeter, Audio Power Meter, RF power meter	2	20
	Digital Instruments - Basics, digital measurement of time, phase, frequency and digital voltmeter.	2	
	Frequency synthesizer, Spectrum analyzers, Logic State analyzers (block diagram only).	1	

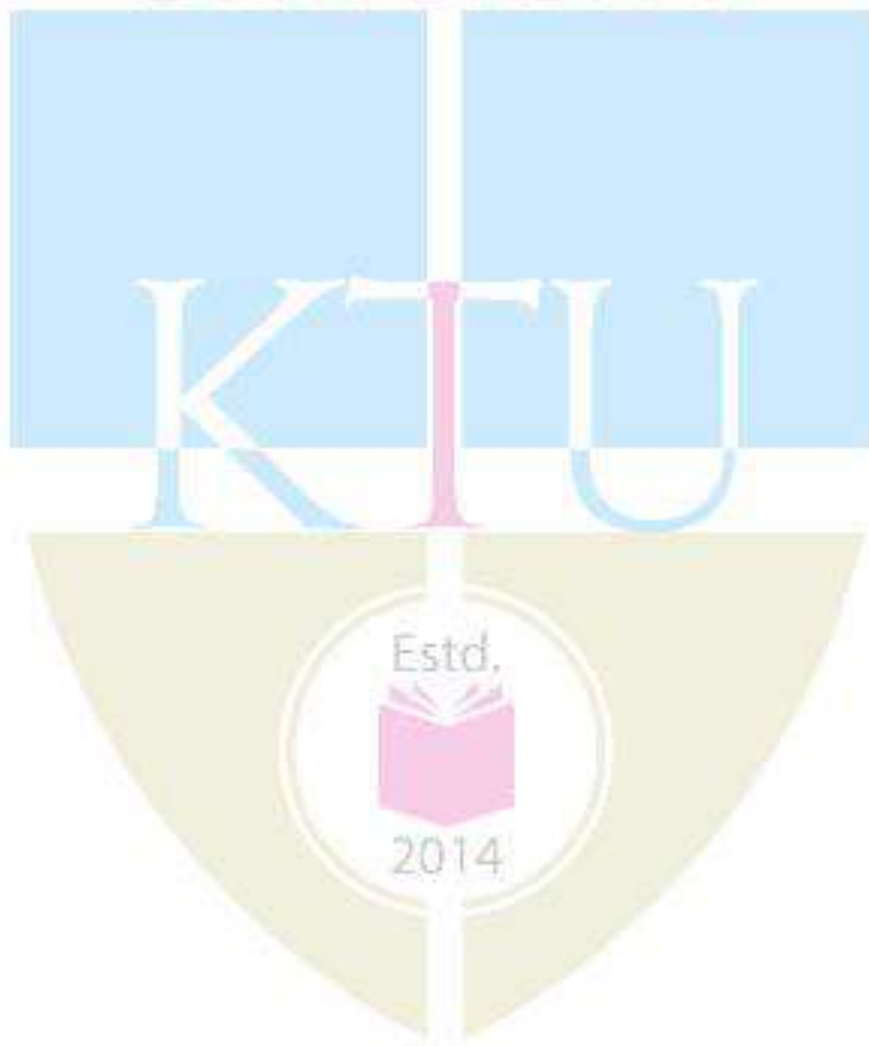
Digital storage oscilloscope – Working Principle, controls and applications.	2	
END SEMESTER EXAM		

Question Paper Pattern (End Sem Exam)

Max. Marks: 100

Time: 3 hours

The question paper shall consist 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 uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 100 % for theory.



COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC333	Digital Signal Processing Lab	0-0-3-1	2016
Prerequisite: EC 213 Electronics Design Automation Lab, EC 202 Signals & Systems			
Course objectives: <ul style="list-style-type: none"> To enable the students to explore the concepts of design, simulation and implementation of various systems using MATLAB/SciLab/OCTAVE and DSP kit. 			
List of Experiments:			
Part A: Experiments on Digital Signal Processor/ DSP kits: (All experiments are mandatory)			
<ol style="list-style-type: none"> 1. Generation of sine wave and standard test signals. 2. Convolution : Linear and Circular 3. Real Time FIR Filter implementation (Low-pass, High-pass and Band-pass) by inputting a signal from the signal generator 4. Real Time IIR Filter implementation (Low-pass, High-pass and Band-pass) by inputting a signal from the signal generator 5. Sampling of analog signal and study of aliasing. 			
Part B: Experiments based on MATLAB/SciLab/OCTAVE (7 experiments are mandatory)			
<ol style="list-style-type: none"> 1. Generation of Waveforms (Continuous and Discrete) 2. Verification of Sampling Theorem. 3. Time and Frequency Response of LTI systems (First and second order). 4. Linear Convolution, Circular Convolution and Linear Convolution using Circular Convolution. 5. To find the DFT and IDFT for the given input sequence. 6. Linear convolution using DFT (Overlap-add and Overlap-Save methods). 7. To find the DCT and IDCT for the given input sequence. 8. To find FFT and IFFT for the given input sequence. 9. FIR and IIR filter design using Filter Design Toolbox. 10. FIR Filter (Low-pass, High-pass and Band-pass)design (Window method). 11. IIR Filter (Low-pass, High-pass and Band-pass)design (Butterworth and Chebychev). 12. Generation of AM, FM & PWM waveforms and their spectrum. 13. Generation of DTMF signal. 14. Study of sampling rate conversion (Decimation, Interpolation, Rational factor). 15. Filtering of noisy signals 16. Implementation of simple algorithms in audio processing (delay, reverb, flange etc.). 17. Implementation of simple algorithms in image processing (detection, de-noising, filtering etc.) 			
Expected outcome: The students will be able to: Design, simulate and realize various systems related to DSP.			

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC335	Power Electronics & Instrumentation Lab	0-0-3-1	2016
Prerequisite: NIL			
Course objectives:			
<ul style="list-style-type: none"> • To design and implement basic power electronic circuits • To study the working of transducers • To train the usage of Digital Instruments 			
List of Experiments (8 experiments mandatory):			
<p>Cycle I (Four mandatory)</p> <ol style="list-style-type: none"> 1. Design and Set up DC-DC converter 2. Design and Set up Push pull DC- DC Converter 3. Design and Set up Buck DC-DC Converters 4. Design and Set up Simple SMPS 5. Design and Set up Half bridge and full bridge converters 6. Design and Set up basic Inverter Circuits <p>Cycle II (Four mandatory)</p> <ol style="list-style-type: none"> 7. Transducer measurements using diode thermometer 8. Transducer measurements using LVDT 9. Transducer measurements using Strain gauge. 10. Transducer measurements using Pressure transducer. 11. Transducer measurements using Thermocouple & RTDS 12. Transducer measurements using Photocells <p>Desired Experiment</p> <ol style="list-style-type: none"> 13. Study of Digital LCR meter, Frequency synthesizer, Spectrum analyzer and Logic State analyzer application. 			
Expected outcome:			
The students will be able to:			
<ol style="list-style-type: none"> 1. Design and demonstrate basic power electronic circuits. 2. Use transducers for application. 3. Function effectively as an individual and in a team to accomplish the given task. 			

2014

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC360	Soft Computing	3-0-0 -3	2016
Prerequisite: NIL			
Course objectives:			
<ol style="list-style-type: none"> 1. To familiarize various components of soft computing like fuzzy logic, neural networks and genetic algorithm. 2. To give an overview of fuzzy Logic and to understand the concepts and terminologies of fuzzy systems 3. To give a description on artificial neural networks with its advantages and application. 4. To study the fundamentals of Genetic Algorithm (GA). 5. To understand the concepts of hybrid systems. 			
Syllabus:			
Fuzzy sets and systems. Neural Networks - Applications - typical architecture, pattern Classification and pattern Association. Fundamentals of Genetic Algorithm, AI search algorithm and hybrid structure.			
Expected outcome:			
The students will be able to:			
<ol style="list-style-type: none"> 1. Identify and describe soft computing techniques and their roles in building intelligent Machines. 2. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems 3. Recognize the feasibility of applying a soft computing methodology for a particular Problem. 4. Apply neural networks to pattern classification and regression problems. 5. Apply genetic algorithms to combinatorial optimization problems 			
Text Books:			
<ol style="list-style-type: none"> 1. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley,N.Y, 1989. 2. Laurene V. Fausett, (1993) "Fundamentals of Neural Networks: Architecture, Algorithms and Applications", Prentice Hall. 3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India. 			
References:			
<ol style="list-style-type: none"> 1. Ibrahim A. M., Introduction to Applied Fuzzy Electronics, PHI, 2013. 2. J. Yen and R. Langari, Fuzzy Logic, Intelligence, Control and Information, Pearson Education. 3. K.H.Lee, First Course on Fuzzy Theory and Applications, Springer-Verlag. 4. Lin C. T. and C.S. G. Lee, Neural Fuzzy Systems, Prentice Hall, 1996. 5. S. Rajsekarani & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India. 6. S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007. ISBN: 10: 81-265-1075-7. 			

Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	Soft computing: Introduction, soft computing vs hard computing, Fuzzy Computing, Neural Computing, Genetic Algorithms. applications of soft computing	2	15
	Introduction to fuzzy sets and systems-crispness, vagueness, uncertainty and fuzziness. Basics of fuzzy sets, membership functions, support of a fuzzy set height, normalized fuzzy set, alpha cuts.	3	
II	Type- 2 fuzzy sets. Operation on fuzzy set-complement, intersection, union, Demorgan's Law Equality & subset hood.	4	15
	Extension Principle and its application, Fuzzy relation-operations, projection, max-min, min-max composition, cylindrical extension.	3	
FIRST INTERNAL EXAM			
III	Reflexivity, symmetry and transitivity of fuzzy relations. Fuzzy prepositions, fuzzy connectives, linguistic variables, hedges.	4	15
	Approximate reasoning or fuzzy inference, Fuzzy rule based system. Fuzzification and defuzzification using centroid, centre of sums.	4	
IV	Introduction to Neural Networks - Applications –Biological neuron- Typical architecture of Artificial Neural Networks - Common activation function.	4	15
	McCulloh Pitts Neuron – Architecture, logic implementatons. Supervised and Unsupervised learning	4	
SECOND INTERNAL EXAM			
V	Linear Separability, Pattern Classification: Perceptrons	2	20
	Back propagation network and its architecture, Back propagation learning, back propagation algorithm	4	
VI	Genetic Algorithm Basic concepts, Initialization and selection, Survival of the Fittest - Fitness Computations.	5	20
	Operators - Cross over, Mutation.	3	
END SEMESTER EXAM			

Question Paper (End semester exam)

Max. Marks: 100

Time : 3 hours

The question paper shall consist 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 uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 50 % for theory, derivation, proof and 50% for logical/numerical problems.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC361	Digital System Design	3-0-0-3	2016
Prerequisite: EC207 Logic Circuit Design			
Course objectives:			
<ol style="list-style-type: none"> To study synthesis and design of CSSN To study synthesis and design of ASC To study hazards and design hazard free circuits To study PLA folding 			
<ol style="list-style-type: none"> To study architecture of one CPLDs and FPGA family 			
Syllabus:			
Clocked synchronous networks, asynchronous sequential circuits, Hazards, Faults, PLA, CPLDs and FPGA			
Expected outcome:			
The student will be able:			
<ol style="list-style-type: none"> To analyze and design clocked synchronous sequential circuits To analyze and design asynchronous sequential circuits To apply their knowledge in diagnosing faults in digital circuits, PLA To interpret architecture of CPLDs and FPGA 			
Text Books:			
<ol style="list-style-type: none"> Donald G Givone, Digital Principles & Design, Tata McGraw Hill, 2003 John F Wakerly, Digital Design, Pearson Education, Delhi 2002 John M Yarbrough, Digital Logic Applications and Design, Thomson Learning 			
References:			
<ol style="list-style-type: none"> Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, Digital Systems Testing and Testable Design, John Wiley & Sons Inc. Morris Mano, M.D.Ciletti, Digital Design, 5th Edition, PHI. N. N. Biswas, Logic Design Theory, PHI Richard E. Haskell, Darrin M. Hanna , Introduction to Digital Design Using Diligent FPGA Boards, LBE Books- LLC Samuel C. Lee, Digital Circuits and Logic Design, PHI Z. Kohavi, Switching and Finite Automata Theory, 2nd ed., 2001, TMH 			
Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	Analysis of clocked Synchronous Sequential Networks(CSSN)	2	15
	Modelling of CSSN – State assignment and reduction	1	
	Design of CSSN	2	
	Iterative circuits	1	
	ASM Chart and its realization	2	
II	Analysis of Asynchronous Sequential Circuits (ASC)	2	15
	Flow table reduction- Races in ASC	1	
	State assignment problem and the transition table- Design of AS	2	
	Design of Vending Machine controller.	2	

FIRST INTERNAL EXAM			
III	Hazards – static and dynamic hazards – essential	1	15
	Design of Hazard free circuits – Data synchronizers	1	
	Mixed operating mode asynchronous circuits	1	
	Practical issues- clock skew and jitter	1	
	Synchronous and asynchronous inputs – switch bouncing	2	
IV	Fault table method – path sensitization method – Boolean difference method	2	15
	Kohavi algorithm	2	
	Automatic test pattern generation – Built in Self Test(BIST)	3	
SECOND INTERNAL EXAM			
V	PLA Minimization - PLA folding	2	20
	Foldable compatibility Matrix- Practical PLA	2	
	Fault model in PLA	1	
	Test generation and Testable PLA Design.	3	
VI	CPLDs and FPGAs - Xilinx XC 9500 CPLD family, functional block diagram– input output block architecture - switch matrix	3	20
	FPGAs – Xilinx XC 4000 FPGA family – configurable logic block - input output block, Programmable interconnect	3	
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

Max. Marks: 100

Time : 3 hours

The question paper shall consist 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 uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 50 % for theory, derivation, proof and 50% for logical/numerical problems.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC363	Optimization Techniques	3-0-0-3	2016
Prerequisite: NIL			
Course objectives:			
<ol style="list-style-type: none"> 1. To understand the need and origin of the optimization methods. 2. To get a broad picture of the various applications of optimization methods used in engineering. 3. To define optimization problem and its various components 			
Syllabus: Engineering applications of optimization, Formulation of design problems as mathematical programming problems, objective function, constraints, classification of optimization problems/techniques, necessary and sufficient conditions for optimality, unimodality, convexity, Mathematical formulation of LP Problems, Reduction of a LPP to the standard form. Feasible solutions, Graphical solution methods, optimality conditions, degeneracy, Simplex algorithm, Duality in linear programming, Transportation Problem, Game theory, Network path models, Nonlinear unconstrained optimization, Modern methods of optimization, Genetic algorithm. Introduction to optimization tools and software.			
Expected outcome:			
<p>The students will (i) have a thorough understanding of optimization techniques (ii) be able to formulate and solving the engineering optimization problems</p>			
Text Books:			
<ol style="list-style-type: none"> 1. H.A. Taha, “ Operations Research”, 5/e, Macmillan Publishing Company, 1992. 2. Kalynamoy Deb. “Optimization for Engineering Design- Algorithms and Examples”, Prentice-Hall of India Pvt. Ltd., New Delhi 3. Singiresu S Rao, “Engineering optimization Theory and Practice”, New Age International, 2009 			
References:			
<ol style="list-style-type: none"> 1. A. Ravindran, D. T. Phillips, J. J. Solberg, Operations Research – Principles and Practice, John Wiley and Sons. 2. Ashok D Belegundu, Tirupathi R Chandrupatla, “Optimization concepts and Application in Engineering”, Pearson Education. 3. Hadley, G. “Linear programming”, Narosa Publishing House, New Delhi 4. J. S. Arora, Introduction to Optimum Design, McGraw-Hill Book Company. 5. Kanti Swarup, P.K.Gupta and Man Mohan, Operations Research, Sultan Chand and Sons 6. Papalambros & Wilde, Principles of Optimal Design, Cambridge University Press, 2008 			

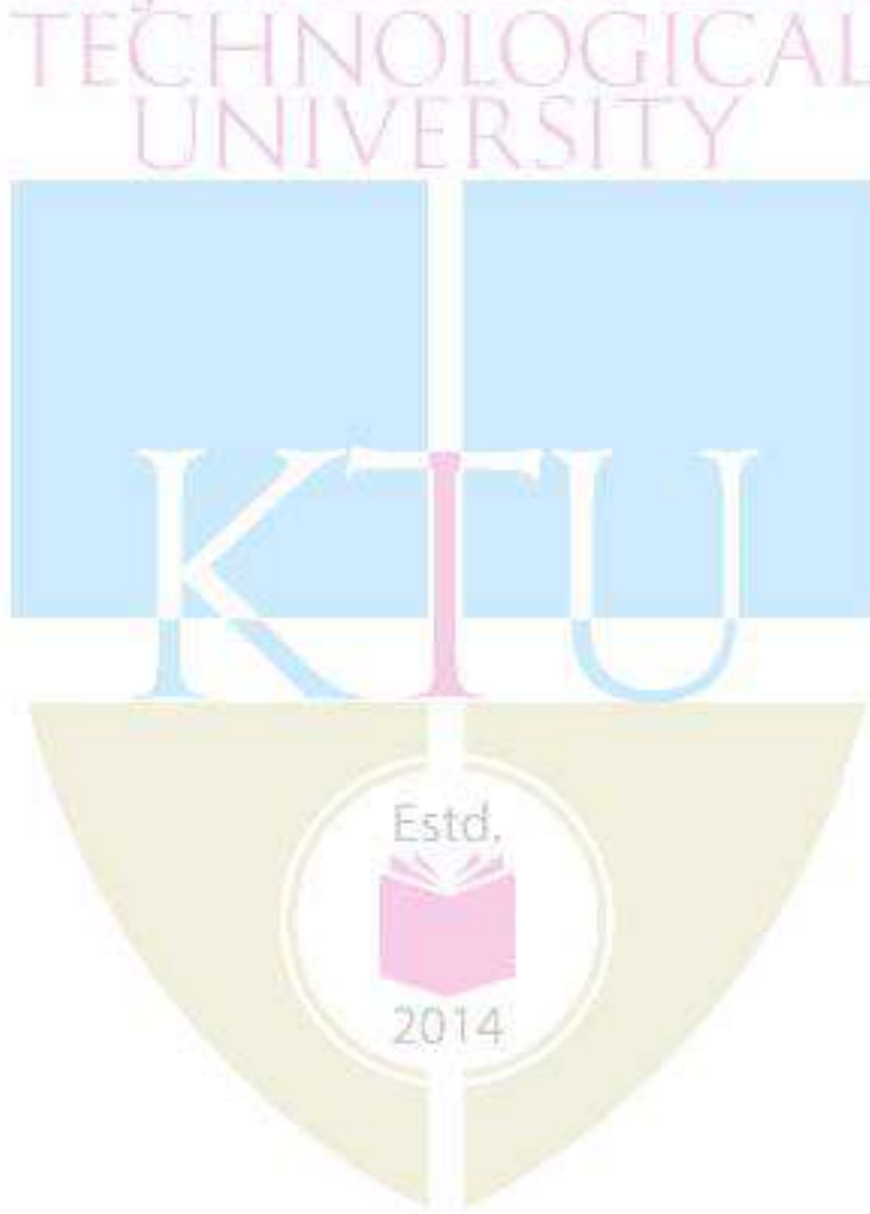
Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	Introduction: Engineering applications of optimization, Formulation of design problems as mathematical programming problems, objective function, constraints, classification of optimization problems/techniques.	2	15
	Optimization techniques: Classical optimization, unconstrained single and multivariable minimization- necessary and sufficient conditions for optimality, uni-modality, convexity.	5	
II	Linear programming problems-I: Mathematical formulation of LP Problems, slack, surplus and artificial variables. Reduction of a LPP to the standard form, feasible solutions. Graphical solution method, simplex algorithm and solution using tabular method, optimality conditions and degeneracy. Duality in linear programming	7	15
FIRST INTERNAL EXAM			
III	Transportation Problem: Formulation of transportation problem, Basic feasible solution using different methods- East West corner method, Vogel approximation method, Optimality methods, MODI method, Unbalanced transportation problem	7	15
IV	Game Theory: Introduction, 2- person zero – sum game; Saddle point; Mini-Max and Maxi-Min Theorems (statement only); Graphical solution (2x n, m x 2 game), dominance property. Network path Models: Tree Networks – Minimal Spanning Tree - Prim's Algorithm. Shortest path problems- solution methods – Dijkstra's Method.	7	15
SECOND INTERNAL EXAM			
V	Nonlinear unconstrained optimization: Single variable optimization methods- Fibonacci search method, Newton-Raphson method. Multi-variable methods- Hook-Jeeves pattern search method, Cauchy's (steepest descent) method.	7	20
VI	Modern methods of optimization: Introduction to Genetic algorithm, Cross over, Mutation, Reproduction, Simple examples of applications in electronics engineering	5	20
	Introduction to optimization tools and softwares. Solution of optimization Problems using MATLAB.	2	0
END SEMESTER EXAM			

Question Paper Pattern (End sem. Exam.)

Max. Marks: 100

Time : 3 hours

The question paper shall consist 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 uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 30 % for theory and 70% for logical/numerical problems, derivation and proof.



API ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY



COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC365	Biomedical Engineering	3-0-0-3	2016
Prerequisite: Nil			
Course objectives:			
<ol style="list-style-type: none"> 1. To introduce student to basic biomedical engineering technology 2. To understand the anatomy & physiology of major systems of the body in designing equipment for medical treatments. 3. To impart knowledge about the principle and working of different types of bio-medical electronic equipment/devices. 			
Syllabus:			
Human body-overview, Physiological systems of body, Measurement of physiological parameters, Assisting and therapeutic devices, Medical laboratory equipments, Telemetry in patient care, Patient safety, Medical imaging system			
Expected outcome:			
The students will be able:			
<ol style="list-style-type: none"> 1. To understand diagnosis and therapy related equipments. 2. To understand the problem and identify the necessity of equipment for diagnosis and therapy. 3. To understand the importance of electronics engineering in medical field. 4. To understand the importance of telemetry in patient care 			
Text Books:			
<ol style="list-style-type: none"> 1. K S Kandpur, "Hand book of Biomedical instrumentation", Tata McGraw Hill 2nd e/d. 2. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, PHI, 2nd Edition, 2004 			
References:			
<ol style="list-style-type: none"> 1. Barbara Christe, Introduction to Biomedical Instrumentation, Cambridge University Press, 2008. 2. J. J. Carr, "Introduction to Biomedical Equipment Technology", Pearson Education 4th e/d. 3. John G Webster, "Medical Instrumentation application and design", John Wiley 3rd e/d. 4. Richard Aston, "Principle of Biomedical Instrumentation and Measurement". Merrill Education/Prentice Hall. 			
Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	Introduction to bio-medical instrumentation system, overview of anatomy and physiological systems of the body.	1	15
	Sources of bio-electric potential: Resting and action potential, propagation of action potentials. Bioelectric potentials examples (ECG, EEG, EMG, ERG, EOG, EGG, etc introduction only.)	2	
	Electrode theory: Nernst relation Bio potential electrodes: Microelectrodes, skin surface electrodes, needle electrodes.	1	

	Instrumentation for clinical laboratory: Bio potential amplifiers-instrumentation amplifiers, carrier amplifiers, isolation amplifiers, chopper amplifiers	2	
II	Heart and cardiovascular system (brief discussion), electro conduction system of the heart. Electrocardiography, ECG machine block diagram, ECG lead configurations, ECG recording system, Einthoven triangle, analysis of ECG signals.	3	15
	Measurement of blood pressure: Direct, indirect and relative methods of blood pressure measurement, auscultatory method, oscillometric and ultrasonic non-invasive pressure measurements.	2	
	Measurement of blood flow: Electromagnetic blood flow meters and ultrasonic blood flow meters.	2	
FIRST INTERNAL EXAM			
III	The human nervous system. Neuron, action potential of brain, brain waves, types of electrodes, placement of electrodes, evoked potential, EEG recording, analysis of EEG.	2	15
	Electromyography: Nerve conduction velocity, instrumentation system for EMG.	1	
	Physiology of respiratory system (brief discussion), Respiratory parameters, spirometer, body plethysmographs, gas exchange and distribution.	2	
	Instruments for clinical laboratory: Oxymeters, pH meter, blood cell counter, flame photometer, spectrophotometer	3	
IV	Therapeutic Equipments: Principle, block schematic diagram, working and applications of : pacemakers, cardiac defibrillators, heart-lung machine, dialyzers, surgical diathermy equipment, ventilators	6	15
SECOND INTERNAL EXAM			
V	Medical Imaging systems (Basic Principle only): X-ray imaging - Properties and production of X-rays, X-ray machine, applications of X-rays in medicine.	2	20
	Computed Tomography: Principle, image reconstruction, scanning system and applications.	2	
	Ultrasonic imaging systems: Basic pulse echo system, propagation of ultrasonic through tissues and reflections, display types, A-Scan, B-Scan, M-Scan, applications, real-time ultrasonic imaging systems and probes.	3	
VI	Magnetic Resonance Imaging – Basic NMR components, Biological effects and advantages of NMR imaging	3	20
	Biomedical Telemetry system: Components of biotelemetry system, application of telemetry in medicine, single channel telemetry system for ECG and temperature	2	
	Patient Safety: Electric shock hazards, leakage current, safety codes for electro medical equipments	1	
END SEMESTER EXAM			

Question Paper Pattern (End Sem. Exam)

Maximum Marks: 100

Time : 3 hours

The question paper shall consist 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 uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 100 % for theory.

