COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC 301	**Digital Signal Processing**	**3-1-0-4**	**2015**

Prerequisite: EC 202 Signals & Systems

Course objectives:

The purpose of this course is:

1. To provide an understanding of Digital Signal Processing principles, algorithms and applications
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, Introduction to DCT and properties, Computation of DFT, FFT Algorithms, IDFT computation using Radix-2 FFT Algorithms, DFT Computation using Radix-4 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:

After the course, the student will understand the principle of digital signal processing and applications. The utilization of DSP to electronics engineering will also studied.

Text Books:

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:

1. Lyons, Richard G., Understanding Digital Signal Processing, 3/e. Pearson Education India, 2004.
2. Ifeachor E.C. and Jervis B. W., Digital Signal Processing: A Practical Approach, 2/e, Pearson Education, 2009.
3. Mitra S. K., Digital Signal Processing: A Computer Based Approach, 4/e McGraw Hill (India), 2014.
4. Salivahanan, Digital Signal Processing,3e, Mc Graw –Hill Education New Delhi, 2014 (Smart book)
5. Chassaing, Rulph., DSP applications using C and the TMS320C6x DSK. Vol. 13. John Wiley & Sons, 2003.
6. NagoorKani, Digital Signal Processing, 2e, Mc Graw –Hill Education New Delhi, 2013
7. Singh A., Srinivasan S., Digital Signal Processing: Implementation Using DSP Microprocessors, Cenage Learning, 2012.

Course Plan			
Module	**Course content**	**Hours**	**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

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. 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
EC 303	Applied Electromagnetic Theory	3-0-0-3	2015

Prerequisite: MA201 Linear Algebra & Complex Analysis, MA 101Calculus, MA 102 Differential equations

Course objectives:

The purpose of this course is:

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 shall be able:

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:

1. Mathew N O Sadiku, Elements of Electromagnetics, Oxford University Press, 6/e, 2014.
2. William, H., Jf Hayt, and John A. Buck. Engineering Electromagnetics. McGraw-Hill, 8/e McGraw-Hill, 2014.
3. John D. Kraus, Electromagnetics, 5/e, TMH, 2010.

References:

1. Joseph A Edminister , Electromagnetics, Schaum's Outline Series McGraw Hill, 4/e, 1995
2. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, Pearson, 6/e, 2006.
3. Umran S. Inan and Aziz S. Inan, Engineering Electromagnetics, Pearson, 2010.
4. Martin A Plonus , Applied Electromagnetics, McGraw Hill, 2/e,1978.
5. Jordan and Balmain , Electromagnetic waves and Radiating Systems, PHI, 2/e,2013
6. Matthew N.O. Sadiku & S.V. Kulkarni "'Principles of Electromagnetics', Oxford University Press Inc. Sixth Edition, Asian Edition,2015

Course Plan			
Module	**Course content**	**Hours**	**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

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. 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
EC 305	**Microprocessor & Microcontroller**	**2-1-0 -3**	**2015**

Prerequisite: EC207 Logic Circuit Design

Course objectives:

The purpose of this course is:

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:

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.

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.

Expected outcome:

The student should be able to:

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:

1. Ramesh S. Goankar. 8085 Microprocessors Archiecture Application and Programming. Penram International, 5/e.
2. Kenneth J. Ayala, The 8051 Microcontroller, Cengage learning, 3/e.
3. Lyla B.Das : Microprocessors and Microcontrollers, Pearson Education, India, 2011

References:

1. Soumitra Kumar Mandal. Microprocessors and Microcontrollers Architecture, Programming & Interfacing Using 8085, 8086 and 8051, McGraw Hill Education (2011).
2. Nagoorkani, Microprocessors and Microcontrollers 2e, McGraw Hill Education India, 2012.
3. Aditya P Mathur, Introduction to Microprocessor. Tata Mc Graw – Hill
4. Muhammed Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education, 2nd edition
5. I.Scott Mackenzie, Raphel C.-W Phan, The 8051 microcontroller, 4th edition.
6. Han Way Hung, "PIC Microcontroller, An introduction to software and hardware interfacing ", Cenage learning.
7. Muhammad Ali Mazidi " PIC Microcontroller and Embedded systems using assembly and C for PIC 18" Pearson.

Course Plan

Module	Course content	Hours	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

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 has 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 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	2015

Prerequisite: EC205 Electronic Circuits

Course objectives:

The purpose of this course is:

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 ofTransducers and Digital instruments.

Syllabus:

Power semiconductor switches and its static and dynamic characteristics. Switched mode regulators, SMPS, Switched mode inverters, UPS.

Performance characteristics of instruments, Measurement of passive components, Different Transducers, Digital Instruments.

Expected outcome:

The student should able:

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:

1. Umanand L., Power Electronics Essentials and Applications, Wiley India, 2015.
2. Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, Third Edition, New Delhi.
3. Bell D. A., Electronic Instrumentation and Measurements, Oxford University Press, 2003.

References:

1. Mohan N. and T. M. Undeland, Power Electronics: Converters, Applications and Design, John Wiley, 2007.
2. Mandal, Power Electronics 1e, McGraw Hill Education India, 2014
3. Nakra, Instrumentation, Measurement and Analysis,4e, Mc Graw –Hill Education New Delhi,2016
4. Daniel W. Hart, Power Electronics, McGraw Hill, 2011.
5. Doeblin E., Measurement Systems, 5/e, McGraw Hill, 2003.
6. Helfrick A. D. and W. D. Cooper: Modern Electronic Instrumentation and Measurement Techniques, 5/e, PHI, 2003.
7. Patranabis D., Principles of Electronic Instrumentation, PHI, 2008.

Course Plan			
Module	**Course content**	**Hours**	**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

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 100 % for theory.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC 361	DIGITAL SYSTEM DESIGN	3-0-0-3	2015

Prerequisite: EC207 Logic Circuit Design

Course objectives:

The purpose of this course is:

5. To study synthesis and design of CSSN
6. To study synthesis and design of ASC
7. To study hazards and design hazard free circuits
8. To study PLA folding
9. 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 should able:

1. To analyze and design clocked synchronous sequential circuits
2. To analyze and design asynchronous sequential circuits
3. To apply their knowledge in diagnosing faults in digital circuits, PLA
4. To interpret architecture of CPLDs and FPGA

Text Books:

1. Donald G Givone, Digital Principles & Design, Tata McGraw Hill, 2003
2. John M Yarbrough, Digital Logic Applications and Design, Thomson Learning
3. John F Wakerly, Digital Design, Pearson Education, Delhi 2002

References:

1. Richard E. Haskell, Darrin M. Hanna , Introduction to Digital Design Using Digilent FPGA Boards, LBE Books- LLC
2. N. N. Biswas, Logic Design Theory, PHI
3. Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, Digital Systems Testing and Testable Design, John Wiley & Sons Inc.
4. Z. Kohavi, Switching and Finite Automata Theory, 2nd ed., 2001, TMH
5. Morris Mano, M.D.Ciletti, Digital Design, 5th Edition, PHI.
6. Samuel C. Lee, Digital Circuits and Logic Design, PHI

Course Plan

Module	Course content	Hours	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

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 has 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 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	2015

Prerequisite: NIL

Course objectives:

The purpose of this course is:

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, uni-modality, 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:

1. On completion of this course, the students will have a thorough understanding of optimization techniques
2. Students will be able to formulate and solving the engineering optimization problems

Text Books:

1. Singiresu S Rao, "Engineering optimization Theory and Practice", New Age International, 2009
2. H.A. Taha, " Operations Research", 5/e, Macmillan Publishing Company, 1992.
3. Kalynamoy Deb. "Optimization for Engineering Design- Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi

References:

1. Hadley, G. "Linear programming", Narosa Publishing House, New Delhi
2. Ashok D Belegundu, Tirupathi R Chandrupatla, "Optimization concepts and Application in Engineering", Pearson Education.
3. Kanti Swarup, P.K.Gupta and Man Mohan, Operations Research, Sultan Chand and Sons
4. J. S. Arora, Introduction to Optimum Design, McGraw-Hill Book Company.
5. A. Ravindran, D. T. Phillips, J. J. Solberg, Operations Research – Principles and Practice, John Wiley and Sons.
6. Papalambros & Wilde, Principles of Optimal Design, Cambridge University Press, 2008

Course Plan			
Module	**Course content**	**Hours**	**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

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. Mark patterns are as per the syllabus with 30 % for theory and 70% for logical/numerical problems, derivation and proof.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC365	Biomedical Engineering	3-0-0-3	2015

Prerequisite: Nil

Course objectives:

The purpose of this course is:

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:

On completion of this course, the students will be able:

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:

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:

1. J. J. Carr, "Introduction to Biomedical Equipment Technology", Pearson Education 4th e/d.
2. John G Webster, "Medical Instrumentation application and design", John Wiley 3rd e/d.
3. Richard Aston, "Principle of Biomedical Instrumentation and Measurement". Merrill Education/Prentice Hall.
4. Barbara Christe, Introduction to Biomedical Instrumentation, Cambridge University Press, 2008.

Course Plan

Module	Course content	Hours	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 Tomograpy: 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

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. Mark patterns are as per the syllabus with 100 % for theory.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC 367	Soft Computing	3-0-0 -3	2015

Prerequisite: NIL

Course objectives:

The purpose of this course is:

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:

1. The student should able to:
2. Identify and describe soft computing techniques and their roles in building intelligent Machines.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
4. Recognize the feasibility of applying a soft computing methodology for a particular Problem.
5. Apply neural networks to pattern classification and regression problems.
6. Apply genetic algorithms to combinatorial optimization problems

Text Books:

1. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.
2. Laurene V. Fausett, (1993) “Fundamentals of Neural Networks: Architecture, Algorithms and Applications", Prentice Hall.
3. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley,N.Y, 1989.

References:

1. S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007. ISBN: 10: 81-265-1075-7.
2. Lin C. T. and C.S. G. Lee, Neural Fuzzy Systems, Prentice Hall, 1996.
3. Ibrahim A. M., Introduction to Applied Fuzzy Electronics, PHI, 2013.
4. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.
5. K.H.Lee, First Course on Fuzzy Theory and Applications, Springer-Verlag.
6. J. Yen and R. Langari, Fuzzy Logic, Intelligence, Control and Information, Pearson Education.

Course Plan			
Module	**Course content**	**Hours**	**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.	2	
	Type- 2 fuzzy sets. Operation on fuzzy set-complement, intersection, union, Demorgan's Law Equality & subset hood.	2	
II	Extension Principle and its application, Fuzzy relation-operations, projection, max-min, min-max composition, cylindrical extension.	2	**15**
	Reflexivity, symmetry and transitivity of fuzzy relations. Fuzzy prepositions, fuzzy connectives, linguistic variables, hedges.	3	
	Approximate reasoning or fuzzy inference, Fuzzy rule based system. Fuzzification and defuzzification using centroid, centre of sums.	3	
FIRST INTERNAL EXAM			
III	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	
IV	Linear Separability, Pattern Classification: Perceptrons	2	**15**
	Back propagation network and its architecture, Back propagation learning, back propagation algorithm	4	
SECOND INTERNAL EXAM			
V	Genetic Algorithm Basic concepts, Initialization and selection, Survival of the Fittest - Fitness Computations.	5	**20**
	Operators - Cross over, Mutation.	3	
VI	Introduction to Neural Fuzzy Controller	2	**20**
	Parameter learning for Neural fuzzy controllers – Neural Fuzzy controller with Fuzzy singleton Rules.	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 has 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 50 % for theory, derivation, proof and 50% for logical/numerical problems.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC333	Digital Signal Processing Lab	0-0-3-1	2015

Prerequisite:
EC 213 Electronics Design Automation Lab, EC 202 Signals & Systems

Course objectives:

- 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)

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)

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 student should able to:

Design, simulate and realize various systems related to DSP.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC 335	Power Electronics & Instrumentation Lab	0-0-3-1	2015

Prerequisite: EC307 Power Electronics & Instrumentation

Course objectives:

- 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):

Cycle I (Four mandatory)

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

Cycle II (Four mandatory)

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

Desired Experiment

13. Study of Digital LCR meter, Frequency synthesizer, Spectrum analyzer and Logic State analyzer application.

Expected outcome:

The student should able to:

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.