| 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 course shall provide:

1. Concepts of Discrete Fourier Transform, Fast Fourier Transform & Discrete Cosine Transforms
2. Understanding about the development of algorithms for efficient computation of DFT
3. Details about the concepts of design of IIR and FIR filters.
4. Understanding of the realization of various structures for IIR and FIR Filters.
5. Practical consideration about sampling, multirate conversion and its applications
6. Concepts of quantisation effects in digital implementation of IIR and FIR systems.
7. Introduction of the architecture of DSP processors

**Syllabus:**

DFT, DCT, FFT algorithm, Design of FIR and IIR filters, Realization structures for FIR and IIR filters, Introduction to digital signal processors, Multirate signal processing, Finite word length effects in DSP systems

**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. Proakis J. G. and Manolakis D. G., Digital Signal Processing, 4/e, Pearson Education, 2007.
2. Mitra S. K., Digital Signal Processing: A Computer Based Approach, 4/e McGraw Hill(India), 2013.
3. Ifeachor E.C. and Jervis B. W., Digital Signal Processing: A Practical Approach, 2/e, Pearson Education, 2009.

**References**

1. Oppenheim A. V., Schafer R. W. and Buck J. R., Discrete Time Signal Processing, 3/e, Prentice Hall, 2007.
2. Singh A., and Srinivasan S., Digital Signal Processing: Imlementation Using DSP Microprocessors, Cenage Learning, 2012.
3. Salivahanan, Digital Signal Processing,2e, Mc Graw –Hill Education New Delhi,2009
4. NagoorKani,Digital Signal Processing,1e, Mc Graw –Hill Education New Delhi,2010
5. Vaidyanathan P. P., Multirate Systems and Filter Banks, Pearson Education, 2008.
6. Tan L., and Jiang J., Digital Signal Processing, 2/e, Elsevier, 2013.
7. 5. Kumar A. A., Digital Signal Processing, 2/e, Prentice Hall, 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 | 1 | 15 |
| | Properties of DFT and examples | 2 | |
| | Linear Filtering methods based on the DFT | 2 | |
| | Frequency Analysis of Signals using the DFT | 1 | |

| | | | |
|---|---|---|---|
| | The Discrete Cosine Transform: Forward DCT, Inverse DCT and DCTY as an Orthogonal Transform | 2 | |
| **II** | Computation of DFT: Radix-2 FFT Algorithms | 2 | **15** |
| | IDFT computation using Radix-2 FFT Algorithms | 1 | |
| | DFT Computation using Radix-4 FFT Algorithms | 2 | |
| | DFT Computation Using Split-Radix FFT Algorithms | 2 | |
| | Efficient computation of DFT of Two Real Sequences and a 2N-Point Real Sequence | 1 | |
| **FIRST INTERNAL EXAM** | | | |
| **III** | Design of FIR Filters- Symmetric and Anti-symmetric | 1 | **15** |
| | Design of linear phase FIR Filters using Window method | 3 | |
| | Design of linear phase FIR Filters using Window method and Frequency Sampling Method | 2 | |
| | Design of Hilbert Transformers, Comparison of Design Methods for Linear Phase FIR Filters | 2 | |
| **IV** | Characteristics of Commonly Used Analog Filters | 1 | **15** |
| | Design of Analog Butterworth Low Pass Filters | 2 | |
| | IIR Digital Filters from Analog Filters (Butterworth) by Impulse Invariance and Bilinear Transformation, | 3 | |
| | Frequency Transformations in the Analog Domain | 2 | |
| **SECOND INTERNAL EXAM** | | | |
| **V** | Block diagram and signal flow graph representations | 1 | **20** |
| | FIR Filter Structures: Direct Form, Cascade Form and Lattice Structure | 2 | |
| | IIR Filter Structures: Direct Form, Transposed Form, Cascade Form and Parallel Form | 2 | |
| | Computational Complexity of Digital filter structures | 1 | |
| | Digital Signal Processors: Computer architecture for signal processing, General purpose and special purpose DSP hardware, Architectural description of TMS320C5545 fixed point digital signal processor | 2 | |
| VI | Multi-rate Digital Signal Processing: Decimation and Interpolation (Time domain and Frequency Domain Interpretation), Sampling Rate Conversion by non-integer factors | 2 | **20** |
| | Application examples: High quality analog-to-digital conversion for digital audio and multirate narrowband digital filtering. | 1 | |
| | Analysis of finite word length effects in DSP systems: Introduction, fixed-point and floating-point DSP | 2 | |
| | Finite word length effects in IIR digital filters: coefficient quantization errors overflow errors, scaling, product round off errors, limit cycle oscillations | 2 | |
| | Finite wordlength effects in FFT algorithms: Round off errors, overflow errors and scaling | 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 maximum 30 % for theory and 70% 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:**

1. To develop a solid foundation in the analysis and application of electromagnetic fields, Maxwell's equations and Poynting theorem.
2. To understand boundary conditions of Electric and Magnetic fields and their physical significances.
3. To understand propagation of uniform plane waves in different media.
4. To understand various parameters of transmission lines like VSWR, Reflection coefficient and impedance of transmission lines and to solve the different transmission line problems using Smith chart.

**Syllabus:**

Co-ordinate transformation, vector algebra, vector calculus, electrostatics, magnetostatics, 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 to

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, 5/e, 2010.
2. Joseph A Edminister , Electromagnetics, Schaum's Outline Series McGraw Hill, 4/e, 1995

**References**


1. Umran S. Inan and Aziz S. Inan, Engineering Electromagnetics, Pearson , 2010.
2. W. H. Hayt, Engineering Electromagnetics, McGraw Hill, 7/e, 1994.
3. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, Pearson, 6/e, 2006.
4. G. S. N. Raju, Eletromagnetic Field Theory and Transmission Lines, Pearson, 2005.
5. John D. Kraus, Electromagnetics, 5/e, TMH, 2010.
6. Martin A Plonus , Applied Electromagnetics, McGraw Hill, 2/e,1978.
7. David K. Cheng, Field and Wave Electromagnetics, Pearson , 2/e, 2013.
8. Jordan and Balmain , Electromagnetic waves and Radiating Systems, PHI, 2/e,2013
9. Mahapathra, Principles of Electromagnetics,2e, Mc Graw –Hill Education New Delhi,2015


**Course Plan**

| Module | Course content (42 hrs) | Hours | Sem. Exam Marks |
|---|---|---|---|

| | | | |
|---|---|---|---|
| I | Review of vector calculus, Spherical and Cylindrical coordinate system, Coordinate transformation | 1 | 15 |
| | Elemental displacement, area and volume for spherical and cylindrical coordinate system. | 2 | |
| | Curl, Divergence, Gradient in spherical and cylindrical coordinate system. | 1 | |
| | Electric field – Coulomb's law, Stokes theorem, Gauss law and Amperes current law. | 1 | |
| | Poisson and Laplace equations, 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 | 20 |
| | 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 | 20 |
| | 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). | 1 | 15 |
| | 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. | 2 | 15 |
| | The hollow rectangular wave guide – modes of propagation of wave- dominant mode, group velocity and | 2 | |

| | | | |
|---|---|---|---|
| | Attenuation in wave guides, guide wavelength and | 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 maximum 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:**

- To differentiate microprocessor and microcontroller & familiarize the working of a Microprocessor.
- To program the controller to make various peripherals work in connection with the application.
- To communicate with various devices using controller
- To design a microcontroller based system with the help of the above interfacing devices

**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 (8251,8253,8255,8257,8259,8275,8279).Comparison (tabular form) between 8086,80286,80386,80486 and Pentium. Simple examples in assembly language programming for 8085(internal examination only).Microcontrollers 8051- features, architecture, memory organization, registers, I/O ports, pin configuration and functions. Addressing modes, instruction set, instruction classification. Assembly language programming examples for 8051. Interrupts in 8051, Timer/Counter programming,Interfacing (block schematic and assembly language programming), PIC Microcontrollers,Introduction to development tools.

**Expected outcome:**

The student should able to:

- Distinguish various types of processor architectures.
- Describe architectures, memory organization of 8085 microprocessor and 8051 and PIC 16F microcontroller.
- 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 , 5th Edition.
2. Kenneth J Ayala, The 8051 Microcontroller, Cengage learning, 3rd edition.
3. Microprocessors and Microcontrollers: Lyla. B. Das, Pearson Education India

**References:**

1. Aditya P Mathur, Introduction to Microprocessor. Tata Mc Graw – Hill
2. Muhammed Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education, 2nd edition
3. I.Scott Mackenzie, Raphel C.-W Phan,The 8051 microcontroller, 4th edition.
4. Han Way Hung, “PIC Microcontroller, An introduction to software and hardware interfacing “, Cenage learning.
5. Muhammad Ali Mazidi “ PIC Microcontroller and Embedded systems using assembly and C for PIC 18” Pearson.
6. Jack Ganssle, Embedded Hardware: Know It All, Newness
7. MandaL, Microprocessors and Microcontrollers 1e, McGraw Hill Education India, 2011

6. Nagoorkani, Microprocessors and Microcontrollers 2e, McGraw Hill Education India, 2012
7. PATEL, The 8051 Microcontrollers Based Embedded Systems 1e, McGraw Hill Education India, 2014

| Course Plan | | | |
|---|---|---|---|
| **Module** | **Course content (42 hrs)** | **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. machine cycles and bus timings. | 5 | **15** |
| **II** | Addressing modes, instruction set, instruction classification. Overview/concept of peripheral IC interfacing with 8085 microprocessor (8251,8253,8255,8257,8259,8275,8279). Comparison (tabular form) between 8086,80286,80386,80486 and Pentium. | 5 | **15** |
| | Simple examples in assembly language programming for 8085(internal examination only) | 2 | **0** |
| **FIRST INTERNAL EXAM** | | | |
| **III** | Microcontrollers: Introduction, comparison between microprocessors and microcontrollers, microcontroller families, 8051- features, architecture, memory organization, registers, I/O ports, pin configuration and functions.<br>Addressing modes, instruction set, instruction classification. | 7 | |
| **IV** | Assembly language programming examples for 8051. | 3 | **15** |
| | Interrupts in 8051: Types, interrupt source, interrupt handling and programming | 2 | |
| | 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 | |
| **SECOND INTERNAL EXAM** | | | |
| **V** | Interfacing: Interfacing (block schematic and assembly language programming) of DIP switch, DIP switches, stepper motor, ADC, DAC, LEDs, 7 segment displays, alphanumeric LCD module with 8051. LEDs & 7 Segment displays | 8 | **20** |

| | | | |
|---|---|---|---|
| VI | PIC Microcontrollers: Overview of PIC microcontrollers, PIC 18 family, features, programming model, CPU, registers, addressing modes, instruction format, instruction set, resets, timers and CCP devices. | 5 | **20** |
| | Introduction to development tools: IDE, cross assembler, builder, linker and debugger. | 1 | **0** |
| **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 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 and 50% 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:**

To provide an insight on the concepts of Power Electronics and Electronic instruments.
To study the applications of Power electronics such as Switched mode regulators and inverters.
To develop understanding of the concept of Transducers 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 to:

- Understand the concepts of Power Electronics and the various applications.
- Get an insight on various electronic instruments, their configuration and measurements using them.
- Understand the principle of operation of Transducers

**Text Books:**

1. Umanand L., Power Electronics Essentials and Applications, Wiley India, 2015.
2. Bell D. A., Electronic Instrumentation and Measurements, PHI, 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.
8. Kishore K. L., Electronic Measurements and Instrumentation, 3/e, Pearson, 2009.
1. Kalsi H. S., Electronic Instrumentation, 3/e, Tata McGraw Hill, 2010.


**Course Plan**

| Module | Course content (42 hrs) | 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** | 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 | |
| | Overview of SMPS | 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** | Switched mode inverters- Principles of PWM switching schemes. | 1 | **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, inductance and capacitance using bridges. | 2 | |
| **SECOND INTERNAL EXAM** | | | |
| **V** | Transducers - Classification, Selection of transducers. | 1 | **20** |
| | Resistance transducers - Principle of operation, resistance, potentiometers,strain gauge. | 2 | |
| | Inductive Transducers - Induction potentiometer, variable reluctance transducers, LVDT, eddy current transducers, synchros and resolvers. | 2 | |
| | Capacitive transducers - different types, capacitor microphone. Hall Effect transducer, proximity transducer, magnetostrictive transducers. | 2 | |
| VI | Electronic Multimeter, Audio Power Meter, RF power meter, True RMS meter. | 2 | 20 |
| | Digital Instruments - Basics, digital measurement of time, phase, frequency, Digital LCR meter and digital voltmeter. | 2 | |
| | Frequency synthesizer, Spectrum analyzers, Logic State analyzers (block diagram only). | 1 | |
| | Digital storage oscilloscope – Operation –controls – 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 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 100 % for theory.

| COURSE CODE | COURSE NAME | L-T-P-C | YEAR OF INTRODUCTION |
|---|---|---|---|
| EC 361 | DIGITAL SYSTEM DESIGN | 2-1-0 -3 | |

**Prerequisite: EC207 LOGIC CIRCUIT DESIGN**

**Course objectives:**

- 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
- 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 to:

1. Analyze and design clocked synchronous sequential circuits
2. Analyze and design asynchronous sequential circuits
3. apply their knowledge in diagnosing faults in digital circuits ,PLA
4. 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
4. N. N. Biswas, Logic Design Theory, PHI
5. Richard E. Haskell, Darrin M. Hanna , Introduction to Digital Design Using Digilent FPGA Boards , LBE Books- LLC


**REFERENCES**


1. Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, Digital Systems Testing and Testable Design, John Wiley & Sons Inc.
2. Z. Kohavi,Switching and Finite Automata Theory, 2nd ed., 2001, TMH
3. Morris Mano, M.D.Ciletti, Digital Design, 5th Edition, PHI.
4. Samuel C. Lee, Digital Circuits and Logic Design, PHI


**Course Plan**

| Module | Course content (42 hrs) | 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 such as clock skew | 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 | | |
| | Test generation and Testable PLA Design. | 3 | |
| **VI** | CPLDs and FPGAs – Xilinx XC 9500 CPLD family , function block – architecture – input output block architecture – switch matrix | 3 | **20%** |
| | FPGAs – Xilinx XC 4000 FPGA family – configurable logic block – input output block | 3 | |
| | Programmable interconnect. | 1 | |
| **END SEMESTER EXAM** | | | |

**Question Paper Pattern**

The question paper consists of three parts. Part A covers modules I and II, Part B covers modules III and IV and Part C covers modules V and VI. Each part has three questions. Each question 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-C | YEAR OF INTRODUCTION |
|---|---|---|---|
| EC363 | OPTIMIZATION TECHNIQUES | 4-0-0-4 | 2015 |

**Prerequisite:nil**

**Course objectives:**

- Understand the need and origin of the optimization methods.
- Get a broad picture of the various applications of optimization methods used in engineering.
- 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, dual simplex method, Transportation Problem, Game theory, Network path Models, Nonlinear unconstrained optimization, Modern methods of optimization, Genetic algorithm. Introduction to optimization tools and softwares.

**Expected outcome:**

- On completion of this course, the students will have a thorough understanding of optimization techniques
- 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", Fifth Edn. Macmillan Publishing Company, 1992.
3. Hadley, G. "Linear programming", Narosa Publishing House, New Delhi
4. Kalynamoy Deb. "Optimization for Engineering Design- Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi,

**References:**

1. Ashok D Belegundu, Tirupathi R Chandrupatla, "Optimization concepts and Application in Engineering", Pearson Education.
2. Kanti Swaroop – " Operations Research"
3. J. S. Arora, Introduction to Optimum Design, McGraw-Hill Book Company.
4. A. Ravindran, D. T. Phillips, J. J. Solberg, Operations Research – Principles and Practice, John Wiley and Sons.
5. Papalambros& Wilde, Principles of Optimal Design, Cambridge University Press, 2008

**Course Plan**

| Module | Course content (42 hrs) | 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. | 7 | **15** |
| **FIRST INTERNAL EXAM** | | | |
| **III** | Linear programming problems-II: Duality in linear programming, dual simplex method.<br>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, Degeneracy in transportation problems, Applications of transportation problems. | 8 | **15** |
| **IV** | Game theory :<br>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.<br>Network path Models:<br>Tree Networks – Minimal Spanning Tree - Prim's Algorithm. Shortest path problems- solution methods – Dijkstra's Method. | 8 | **15** |
| **SECOND INTERNAL EXAM** | | | |
| **V** | Nonlinear unconstrained optimization: Single variable optimization methods- Fibonacci search method, Newton-Raphson method.<br>Multi-variable methodss- Hook-Jeeves pattern search method, Cauchy's (steepest descent) method. | 7 | **20** |
| VI | Modern methods of optimization: Genetic algorithm Introduction. Examples of applications in electronics engineering.<br>Introduction to optimization tools and softwares. Solution of optimization Problems using MATLAB | 5 | **20** |
| **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 maximum 40 % for theory, derivation, proof and 60% for logical/numerical problems and algorithms.

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

**Prerequisite:** EC307 Power Electronics &Instrumentation

**Course objectives:**

- To introduce student to basic biomedical engineering technology
- To understand the anatomy & physiology of major systems of the body in designing equipments for medical treatments.
- To impart knowledge about the principle and working of different types of bio-medical electronic equipments/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:**

1. Ability to understand diagnosis and therapy related equipments.
2. Understanding the problem and ability to identify the necessity of equipment for diagnosis and therapy.
3. Understanding the importance of electronics engineering in medical field.
4. Understanding 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".
4. Barbara Christe, Introduction to Biomedical Instrumentation, Cambridge University Press, 2008


**Course Plan**

| Module | Course content (42 hours) | Hours | |
|---|---|---|---|
| **I** | Introduction, bio-medical instrumentation system, overview of anatomy and physiological systems of the body, Bio-electric potential: Resting and action potential, electrical equivalent of cell, Nernest relation, bio-electric signals and their characteristics of ECG, EEG, EMG, ERG and EOG. | 3 | 15 |
| | Bio potential electrodes and sensors: Types, materials, properties and characteristics, method of selection and applications. | 1 | |
| | Transducers for biological applications: Transducers for the measurement of pressure, flow, pulse and respiration. | 3 | |

| | | | |
|---|---|---|---|
| | Bio-signal acquisition and safety: Physiological signal amplifiers, isolation amplifier, bridge amplifier and chopper amplifier, Electrical safety: physiological effects due to current passage, micro current shock, macro current shock, leakage current, devices to protect against electrical hazards, safety codes for electro medical equipments, electromagnetic interference to medical electronic equipments. | 3 | |
| **II** | Measurement of blood pressure: Direct, indirect and relative methods of blood pressure measurement, auscultatory method, oscillometric and ultrasonic non-invasive pressure measurements. | 2 | 15 |
| | Measurement of blood flow: Electromagnetic blood flow meters and ultrasonic blood flow meters. | 2 | |
| | Electrocardiography: Cardiac action potential, electrocardiogram, , ECG lead configurations, ECG recording system, analysis of ECG signals, basic concepts of vector cardiography, phonocardiography and echocardiography. | 2 | |
| **FIRSTINTERNAL 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. Electromyography: Nerve conduction velocity, instrumentation system for EMG. | 3 | 15 |
| | Physiology of Respiratory system, Tests and Instrumentation for the respiratory measurements, respiratory gas analyzers. | 2 | |
| | Diagnosis Equipments: Principle, block schematic diagram, working and applications of oxi meters, plethysmograph , pH meter, blood cell counter, flame photometer, spectrophotometer , colorimeter and chromatographs. | 3 | |
| **IV** | Therapeutic Equipments: Principle, block schematic diagram, working and applications of pacemakers, cardiac defibrillators, heart–lung machine, dialyzers, surgical diathermy equipment, electrotherapy, infant incubators, ventilators and automatic drug delivery systems. | 5 | 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, radiography and fluorography. Computed Tomography: Principle, image reconstruction, scanning system and applications. 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. Magnetic Resonance Imaging: principle, magnetic relaxation and MRI parameters, basic NMR imaging system, biological effects of NMR imaging, MRI instrumentation system, advantages, risks and limitations Positron Emission Tomography: Principle, scanning, PET instrumentation system, advantages of PET scan. | 11 | 20 |

| | | | |
|---|---|---|---|
| VI | Biomedical Telemetry system: Components of biotelemetry system, application of telemetry in medicine, single channel telemetry system for ECG and temperature, multi channel telemetry system, implantable telemetry system. | 2 | 20 |
| **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 maximum 100 % for theory.

| COURSE CODE | COURSE NAME | L-T-P-C | YEAR OF INTRODUCTION |
|---|---|---|---|
| EC 360? | SOFT COMPUTING | 3-0-0 -3 | 2016 |

**Course objectives:**

• To familiarize various components of soft computing like fuzzy logic, neural networks and genetic algorithm.

• To give an overview of fuzzy Logic and to understand the concepts and terminologies of fuzzy systems.

• To give a description on artificial neural networks with its advantages and application.

• To study the fundamentals of Genetic Algorithm (GA).

• 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 student should able to:

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:**

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. Lin C. T. and C.S. G. Lee, Neural Fuzzy Systems, Prentice Hall, 1996.
2. Ibrahim A. M., Introduction to Applied Fuzzy Electronics, PHI, 2013.
3. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications” Prentice Hall of India.
4. K.H.Lee.. First Course on Fuzzy Theory and Applications, Springer-Verlag.
5. J. Yen and R. Langari.. Fuzzy Logic, Intelligence, Control and Information, Pearson Education.

**Course Plan**

| Module | Course content (42hrs) | Hours | Sem. Exam Marks |
|---|---|---|---|
| I | Soft computing: Introduction of soft computing, soft computing vs hard computing, various types of soft computing techniques, 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. | 2 | **15** |
| | Mc. Culloh Pitts Neuron – Architecture, logic implementatons. Supervised and Unsupervised learning-Learning Algorithms .Linear Separability. | 3 | |
| | Pattern Classification – Hebb Net, Perceptrons, ADALINE networks (Architecture, Algorithm and simple Applications). | 3 | |
| **IV** | Pattern Association- training algorithms- Hetro Associative Network, Auto Associative Network, Hopfield Network, BAM Network. | 3 | **15** |
| | Back propogation learning methods-back propagation algorithm, factors affecting backpropagation training & applications. (Architecture, Algorithm and simple Applications). | 3 | |
| **SECOND INTERNAL EXAM** | | | |
| **V** | Genetic Algorithm (GA) Basic concepts, Genetic representations, (encoding) Initialization and selection, Survival of the Fittest - Fitness Computations. | 3 | **20** |
| | Cross over - Mutation –Reproduction, applications. Rank method–Rank space method AI search algorithm. | 3 | |
| VI | Introduction to Neural Fuzzy Controller- Neural Fuzzy controller with hybrid structure. | 2 | **20** |
| | Parameter learning for Neural fuzzy controllers – Neural Fuzzy controller with Fuzzy singleton Rules. | 3 | |
| | Integration of neural networks, fuzzy logic and genetic algorithms. | 3 | |
| | | | |

**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 maximum 40 % for theory, derivation, proof and 60% for logical/numerical problems and algorithms.

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

**Prerequisite**:
EC213 Electronics Design Automation Lab, EC 202 Signals & Systems, EC301 Digital Signal Processing

**Course objectives:**

- Enable the students to explore the concepts of design, simulation and implementation of various systems using MATLAB 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 (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:

1. 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** | **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:**

1. Design and Step up DC-DC converter
2. Design and Step up Push pull DC- DC Converter
3. Design and Step up Buck DC-DC Converters
4. Design and Step up Simple SMPS
5. Design and Step up Half bridge and full bridge converters
6. Design and Step up basic Inverter Circuits
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
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