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:

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

(i) the principle of digital signal processing and applications.

(ii) the utilization of DSP to electronics engineering

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. 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.

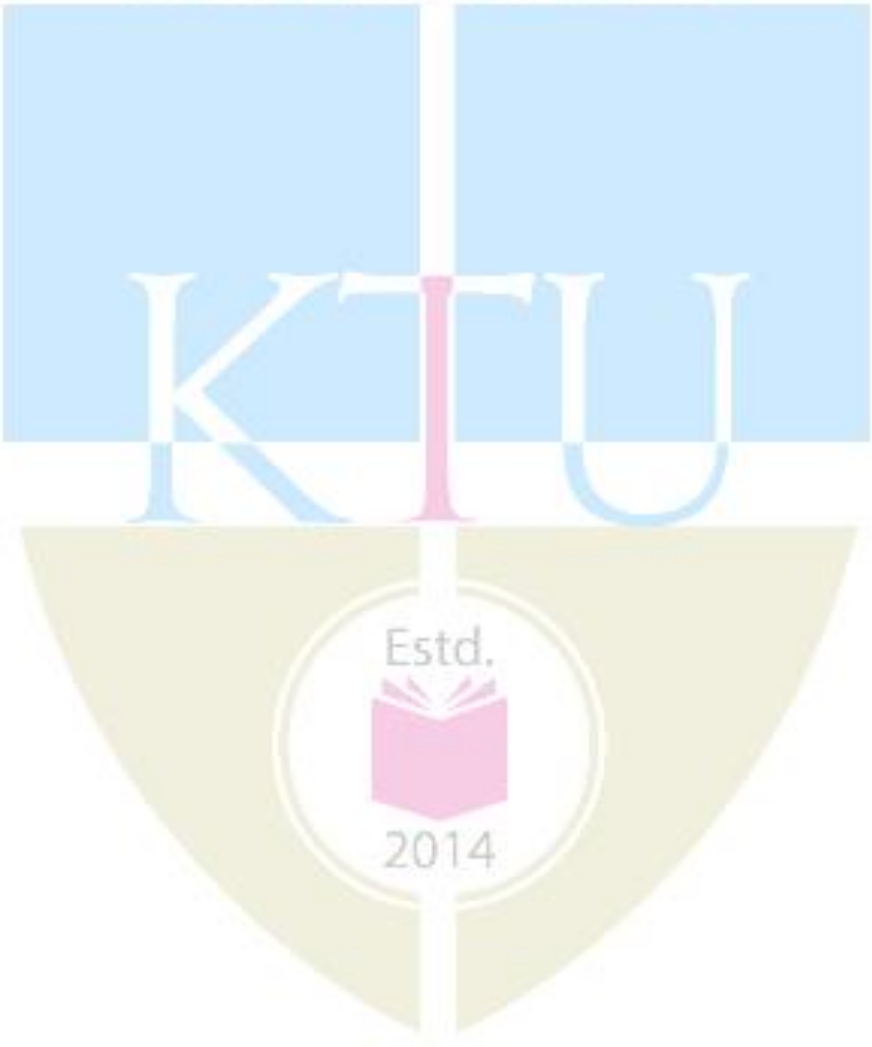
Course Plan			
Module	**Course content**	**Hours**	**End Sem. Exam Marks**
I	The Discrete Fourier Transform: DFT as a linear transformation, Relationship of the DFT to other transforms, IDFT	2	**15**
	Properties of DFT and examples Circular convolution	4	
	Linear Filtering methods based on the DFT- linear 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:

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:

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. 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:

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. Matthew N.O. Sadiku & S.V. Kulkarni "'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:

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 students will 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. 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 Archiecture Application and Programming. Penram International, 5/e.

References:

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:

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:

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 students will be 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. 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:

1. Daniel W. Hart, Power Electronics, McGraw Hill, 2011.
2. Doeblin 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 - Credits	Year of Introduction
HS300	Principles of Management	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To develop ability to critically analyse and evaluate a variety of management practices in the contemporary context;
- To understand and apply a variety of management and organisational theories in practice;
- To be able to mirror existing practices or to generate their own innovative management competencies, required for today's complex and global workplace;
- To be able to critically reflect on ethical theories and social responsibility ideologies to create sustainable organisations.

Syllabus

Definition, roles and functions of a manager, management and its science and art perspectives, management challenges and the concepts like, competitive advantage, entrepreneurship and innovation. Early contributors and their contributions to the field of management. Corporate Social Responsibility. Planning, Organizing, Staffing and HRD functions, Leading and Controlling. Decision making under certainty, uncertainty and risk, creative process and innovation involved in decision making.

Expected outcome.

A student who has undergone this course would be able to

i. manage people and organisations
ii. critically analyse and evaluate management theories and practices
iii. plan and make decisions for organisations
iv. do staffing and related HRD functions

Text Book:

Harold Koontz and Heinz Weihrich, *Essentials of Management*, McGraw Hill Companies, 10th Edition.

References:

1. Daft, *New era Management*, 11th Edition, Cengage Learning
2. Griffin, *Management Principles and Applications*, 10th Edition, Cengage Learning
3. Heinz Weirich, Mark V Cannice and Harold Koontz, *Management: a Global, Innovative and Entrepreneurial Perspective*, McGraw Hill Education, 14th Edition
4. Peter F Drucker, *The Practice of Management*, McGraw Hill, New York
5. Robbins and Coulter, *Management*, 13th Edition, 2016, Pearson Education

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Management: definitions, managerial roles and functions; Science or Art perspectives- External environment-global, innovative and entrepreneurial perspectives of Management (3 Hrs.)– Managing people and organizations in the context of New Era- Managing for competitive advantage - the Challenges of Management (3 Hrs.)	6	15%

II	**Early Contributions and Ethics in Management**: Scientific Management- contributions of Taylor, Gilbreths, Human Relations approach-contributions of Mayo, McGregor's Theory, Ouchi's Theory Z (3 Hrs.) Systems Approach, the Contingency Approach, the Mckinsey 7-S Framework Corporate Social responsibility- Managerial Ethics. (3 Hrs)	6	15%
FIRST INTERNAL EXAMINATION			
III	**Planning:** Nature and importance of planning, -types of plans (3 Hrs.)- Steps in planning, Levels of planning - The Planning Process. – MBO (3 Hrs.).	6	15%
IV	**Organising for decision making:** Nature of organizing, organization levels and span of control in management Organisational design and structure –departmentation, line and staff concepts (3 Hrs.) Limitations of decision making- Evaluation and selecting from alternatives- programmed and non programmed decisions - decision under certainty, uncertainty and risk-creative process and innovation (3 Hrs.)	6	15%
SECOND INTERNAL EXAMINATION			
V	**Staffing and related HRD Functions:** definition, Empowerment, staff – delegation, decentralization and recentralisation of authority – Effective Organizing and culture-responsive organizations –Global and entrepreneurial organizing (3 Hrs.) Manager inventory chart-matching person with the job-system approach to selection (3 Hrs.) Job design-skills and personal characteristics needed in managers-selection process, techniques and instruments (3 Hrs.)	9	20%
VI	**Leading and Controlling:** Leading Vs Managing – Trait approach and Contingency approaches to leadership - Dimensions of Leadership (3 Hrs.) - Leadership Behavior and styles – Transactional and Transformational Leadership (3 Hrs.) Basic control process- control as a feedback system – Feed Forward Control – Requirements for effective control – control techniques – Overall controls and preventive controls – Global controlling (3 Hrs.)	9	20%
END SEMESTER EXAM			

Question Paper Pattern

Max. marks: 100, Time: 3 hours .
The question paper shall consist of three parts

Part A: 4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)
Part B : 4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)
Part C: 6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC365	Biomedical Engineering	3-0-0-3	2016

Prerequisite: Nil

Course objectives:

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:

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. 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 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 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.

Course code	Course Name	L-T-P - Credits	Year of Introduction
**341	DESIGN PROJECT	0-1-2-2	2016

Prerequisite : Nil

Course Objectives

- To understand the engineering aspects of design with reference to simple products
- To foster innovation in design of products, processes or systems
- To develop design that add value to products and solve technical problems

Course Plan

Study : Take minimum three simple products, processes or techniques in the area of specialisation, study, analyse and present them. The analysis shall be focused on functionality, strength, material, manufacture/construction, quality, reliability, aesthetics, ergonomics, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality, design for strength is not expected.

Note : The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.

Expected outcome.

The students will be able to

i. Think innovatively on the development of components, products, processes or technologies in the engineering field
ii. Analyse the problem requirements and arrive workable design solutions

Reference:

Michael Luchs, Scott Swan, Abbie Griffin, 2015. Design Thinking. 405 pages, John Wiley & Sons, Inc

Evaluation

First evaluation (Immediately after first internal examination) 20 marks
Second evaluation (Immediately after second internal examination) 20 marks
Final evaluation (Last week of the semester) 60 marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

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:

- 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)

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 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:

- 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 students will be 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.