Faculty of Engineering

DEPARTMENT OF ELECTRICAL ENGINEERING

Scheme and Syllabi
of
M.E. (ELECTRICAL ENGG.)
( Full-Time )

Power Electronic Systems
(With effect from the Academic Year 2015-2016)

August 2015
Osmania University
Hyderabad - 500 007
## SCHEME OF INSTRUCTION & EXAMINATION

M.E. (Electrical) 4 Semesters (Full Time)

<table>
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<tr>
<th>S.No.</th>
<th>Course Title</th>
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CIE: Continuous Internal Evaluation; SEE: Semester End Evaluation

**Note:** Six Core subjects, Six Elective subjects, Two Laboratory Courses and Two Seminars should normally be completed by the end of semester II

* One Dissertation seminar presentation.

** 50 marks to be awarded by Supervisor and 50 marks to be awarded by viva-voice committee comprising Supervisor and two internal faculty members
## M. E. (Power Electronic Systems)

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EE3301  Power Electronic Converters
(Core-IDC & PES)

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

UNIT-I

UNIT-II
Rectifiers - Uncontrolled Rectifier, Rectifier circuits-Single-phase & Three-Phase circuits, Controlled Rectifiers- Single-phase & Three-Phase controlled Rectifier circuits.

UNIT-III
DC-DC Linear Regulators, DC-DC Switched mode Converters- Buck, Boost, Buck-Boost, Cuk, Flyback, Forward, Push-Pull, Half & Full-bridge .

UNIT-IV

UNIT V
AC to AC power conversion using voltage regulators, cyclo-converters and Matrix converters.

Suggested Reading:
With effect from the academic year 2015-2016

EE3302  Industrial Controllers  
(Core PES & Elective IDC)

Instruction : 3 Periods / Week  
Duration of Univ. Examination : 3 Hours  
SEE : 70 Marks  
CIE : 30 Marks

Unit-I  

Unit-II  
TMSLF2407 DSP Controller: Introduction, brief introduction to peripherals, types of physical memory, software tools. C2XX DSP CPU and instruction set: C2xx DSP Core and code generation, mapping external devices to the C2xx DSP core and the peripherals, memory, Addressing modes, assembly programming using C2xx DSP instruction set.

Unit III  
GPIO functionality: Pin multiplexing (MUX) and GPIO Overview, multiplexing and GPIO control registers. Interrupts on the TMS320LF2407: Introduction, Interrupt Hierarchy and its Control Registers.

Unit IV  
ADC: Overview, Operation and programming modes. Event managers: Overview, Interrupts, Timers, Compare Units, Capture units and QEP circuitry PWMSignal Generation with Event Managers.

Unit-V  
Programmable Logic Controller (PLC) Basics: Definitions and history of PLCs – Advantages and disadvantage of PLC – overall PLC Systems, CPUs and Programmer/Monitors – Programming procedures – programming equipment – Programming formats Ladder diagrams, Basic PLC programming and Basic PLC functions: Programming on/off inputs to produce on/off outputs, PLC programming examples.

Suggested Reading:  
2. Hamid A Toliyat, DSP based Electromechanical Motion Control, Steven Campbell 2004, CRC Press.
EE3303  Industrial Electronic Systems  
(Core PES)

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

UNIT I
Power Supplies: UPS - Offline, Online & Hybrid types of UPS, Parallel redundancy, Dual redundancy, AC Power conditioner - power supply noise-servo system – servo controlled voltage stabilizer - AC generator voltage regulator – Constant voltage transformer SMPS - Fly back, feed forward, Push pull and Bridge types.

UNIT II

UNIT III
Closed loop Industrial Systems: Thermistor control of quench oil temperature Proportional mode pressure control system Strip tension controller – Edge guide control for a strip recorder – Control of relative humidity in a textile moisturizing process. Closed loop industrial systems warehouse humidity controller.

UNIT IV

UNIT V

Suggested Reading:
5. P.C Sen, Modern Power Electronics, S.Chand& Co.
EE3304  Power Electronic Converters for Renewable Energy
(Elective IDC& Core PES)

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30Marks

UNIT I

Introduction to renewable sources: world energy scenario, Wind, solar, hydro, geothermal, availability and power extraction.
Introduction to solar energy: Photovoltaic effect, basics of power generation, P-V & I-V characteristics, effect of insolation, temperature, diurnal variation, shading, Modules, connections, ratings, Power extraction (MPP) tracking and MPPT schemes; standalone systems, grid interface, storage, AC-DC loads.

UNIT II


UNIT III

Grid connected Inverters: 1ph, 3ph inverters with & w/o x’mer, Heric, H6, Multilevel Neutral point clamp, Modular multilevel, CSI; Control schemes: unipolar, bipolar, PLL and synchronization, power balancing / bypass, Parallel power processing; Grid connection issues: leakage current, Islanding, harmonics, active/reactive power feeding, unbalance.

UNIT IV

Introduction to wind energy: P-V, I-V characteristic, wind power system: turbine-generator-inverter, mechanical control, ratings; Power extraction (MPP) and MPPT schemes. Generators for wind: DC generator with DC to AC converters; Induction generator with & w/o converter.

UNIT V

Synchronous generator with back to back controlled/ uncontrolled converter; Doubly fed induction generator with rotor side converter topologies; permanent magnet based generators. Battery: Types, charging discharging. Introduction to AC and DC microgrids.

Suggested Reading:
Advanced Topics in Power Electronics
(Core PES)

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

Unit-I
Introduction to switches - Advanced Silicon devices - Silicon HV thyristors, MCT, BRT & EST. SiC devices - diodes, thyristors, JFETs & IGBTs. Gallium nitrate devices - Diodes, MOSFETs.

Unit-II
Pulse Width Modulated Rectifiers: Properties of ideal rectifier, realization of near ideal rectifier, control of the current waveform, single phase and three-phase converter systems incorporating ideal rectifiers and design examples. Non-linear phenomena in switched mode power converters: Bifurcation and Chaos.

Unit-III
Control of DC-DC converters- State space modeling of Buck, Boost, Buck-Boost, Cuk Fly back, Forward, Push-Pull, Half & Full-bridge converters. Closed loop voltage regulations using state feedback controllers.

Unit-IV
Advance converter topologies - Multi level converters - Cascaded H-Bridge, Diode clamped, NPC, Flying capacitor. Modular Multi-level converters(MMC), Multi-Input DC-DC Converters, Multi pulse PWM current source converters, Interleaved converters, Z-Source converters.

Unit-V

Suggested Reading:
With effect from the academic year 2015-2016

EE3306  Static Control of Electric Drives  
(Core PES)

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

UNIT I
DC Motor Control: Operation of Single phase and Three phase Full converter and Semi converter fed dc motors, Speed torque characteristics, Performance characteristics, Dual converter drives, Analysis of four quadrant chopper fed dc drive, Dynamic & Regenerative braking, Closed loop control of phase control and chopper dc drive.

UNIT II
Scalar Control: Stator voltage control, Static rotor resistance control, Slip power recovery schemes, Closed loop control, VSI & CSI fed Induction motor drives, Analysis of stepped and PWM waveform, Harmonic equivalent circuit and motor performance.

UNIT III
Vector Control: DC drive analogy, Equivalent circuit and Principle of Vector control, Direct vector control – Flux & Torque processor using Terminal voltages and Induced emf, Indirect vector control – Flow chart and Implementation.

UNIT IV
Principle of Sensor less vector control: Principle of Space vector Pulse width modulation & control, Direct torque and Flux control - Torque expression with Stator and Rotor fluxes - Control strategy of DTC.

UNIT V

Suggested Reading:
With effect from the academic year 2015-2016

EE3102  Machine Modeling and Analysis  
(Core– IDC& Elective -PES)

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**UNIT I**

**Basic Principles for Electric Machine Analysis:** Magnetically coupled circuits, Electromechanical energy conversion, Basic Two pole DC Machine – primitive 2 axis machine – Voltage and Current relationship – Torque equation.

**Theory of DC Machines:** Mathematical model of separately excited DC Motor, DC Series Motor, DC shunt motor and D.C. Compound Motor in state variable form – Transfer function of the motor.

**UNIT II**

**Reference Frame Theory:** Equations of transformation - Change of variables, Stationary circuit variables Transformed to the Arbitrary Reference Frame, Commonly used reference frames, Transformation between reference frames, Transformation of a balanced set, Balanced steady state phasor Relationships, Balanced steady state equations, Variables observed from various frames.

**UNIT III**


**UNIT IV**


**UNIT V**


**Suggested Reading:**
With effect from the academic year 2015-2016

EE3111 Special Electrical Machines
(Elective to IDC & PES)

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

UNIT -I
Stepper Motors
Constructional features, Principle of operation, Variable Reluctance (VR) stepping motor-Single Stack, Multi-Stack, Permanent Magnet Step motor, Hybrid Step Motor, Torque Equation Open Loop Drive, Open loop and closed loop control of Step Motor, Applications.

UNIT -II
Switched Reluctance Motors

UNIT-III
Permanent Magnet Synchronous Motor
Permanent magnets and their characteristics, Machine Configurations-SPM, SIPM, IPM and Interior PM with circumferential, Sensorless control, Applications.

UNIT -IV
Brushless DC Motor
Construction, Principle of Drive operation with inverter, Torque speed Characteristics, Closed loop control, Sensorless control, Applications.

UNIT-V
Linear Induction Motors and Linear Synchronous Motors
Linear induction motor, Construction details, LIM Equivalent Circuit, Steps in design of LIM, Linear Synchronous Motor: Principle and Types of LSM, LSM Control, Applications.

Suggested Reading:
2. B.K.Bose, Modern Power Electronics and AC Drives, PHI, 2005
3. Venkataratnam, Special electrical Machines, University Press, 2008
4. E.G.Janardanan, Special Electrical Machines, PHI, 2014
With effect from the academic year 2015-2016

EE3112 Microcontroller Applications to Power Electronics
(Elective to IDC & PES)

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

UNIT-I
Review of microcontrollers and digital signal processors, architecture, peripheral modules.; Typical processors for control implementation: memory organization, CPU details, addressing modes, interrupt structure, hardware multiplier, pipelining.; Fixed- and floating-point data representations , Assemblers, linkers and loaders. Binary file formats for processor executable files. Typical structure of timer-interrupt driven programs.;

UNIT-II
Implementing digital processor based control systems for power electronics: Reference frame transformations, PLL implementations, machine models, harmonic and reactive power compensation, space vector PWM.; Numerical integration methods.; Multitasking concepts for power electronics implementations: The need for multitasking, various multitasking methods.

UNIT-III

UNIT-IV

UNIT-V
Introduction to MPLAB IDE and PICSTART plus – Device Programming using MPLAB and PICSTART plus – generation of firing / gating pulses for typical power converters. Example of DSP system A to D signal conversion - DSP Support tools- code composer studio - compiler, assembler and linker
Suggested Reading:

With effect from the academic year 2015-2016

EE3113 Neural Networks and Fuzzy Logic
(Elective to IDC & PES)

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

UNIT-I
Neural and Fuzzy Intelligence: Fuzziness as multi-valence - Bivalent paradoxes as fuzzy midpoints, Sets as points in cubes - Subset hood and probability, The dynamical system approach to machine intelligence, Brain as a dynamical system – Neural networks as trainable dynamical system, Intelligent behavior as adaptive model free estimation, Generalization and creativity - Learning as change-Rules vs. principles - Symbolic vs. numeric processing, Structured numerical estimators

UNIT-II
Neural Network Theory: Neurons as functions - Signal monotonicity Biological activities and signals, Neuron fields - Neuronal dynamic systems - Common signal, functions - Pulse coded signal functions, Additional neuron dynamics - Additive neural feedback - Additive activation models Bivalent BAM theorem, Hopfield model

UNIT-III

UNIT-IV

UNIT-V

Suggested Reading
4. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley
With effect from the academic year 2015-2016

EE3212  Power Quality Engineering  
(Elective)

Instruction : 3 Periods / Week  
Duration of Univ. Examination : 3 Hours  
SEE : 70 Marks  
CIE : 30 Marks

UNIT I
Introduction: Power Quality (PQ), PQ problems, Sags, Swells, Transients, Harmonics, Interruptions, Flicker, Voltage fluctuations, Notch. Transient Overvoltages — Sources of Transient Overvoltages.
Wiring and Grounding: Resources, Definitions, Reasons for Grounding, Typical wiring and grounding problems, Solutions to wiring and grounding problems.

UNIT II
Voltage Sag Analysis: Voltage sag characteristics - Methodology for computation of voltage sag magnitude and occurrence — Accuracy of sag analysis — Duration & frequency of sags — Faults behind transformers — Effect of pre-fault voltage — Simple examples — Voltage dip problems, fast assessment methods for voltage sags in distribution systems.

UNIT III
PQ Consideration in Industrial Power Systems: Adjustable speed drive (ASD) systems and applications — Sources of power system harmonics — Mitigation of harmonics — Characterization of voltage sags experienced by three-phase ASD systems — Types of sags and phase angle jumps — Effects of momentary voltage dips on the operation of induction and synchronous motors.

UNIT IV
Harmonics: Harmonic distortion, Voltage versus current distortion, Harmonics versus Transients, Harmonic Indices, Harmonic sources from commercial loads, Harmonic sources from industrial loads, Locating Harmonic sources, System response characteristics, Effects of Harmonic distortion, Inter harmonics, Devices for controlling harmonic distortion.

UNIT V
Power quality monitoring — Monitoring considerations, Historical Perspective of PQ Measuring Instruments, PQ measurement equipment, Assessment of PQ measurement data, Application of intelligent systems, PQ monitoring standards

Suggested Reading:
(Common Electives for IDC, PS & PES)

EE3001  Power Electronic Applications to Power Systems

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UNIT - I
Facts concepts: Reactive power control in electrical power transmission, principles of conventional reactive power compensators. Introduction to FACTS, flow of power in AC parallel paths, meshed systems, basic types of FACTS controllers, definitions of FACTS controllers, brief description of FACTS controllers.

UNIT - II
Static shunt and series compensators:
Shunt compensation - objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators - SVC, STATCOM, SVC and STATCOM comparison. Series compensation - objectives of series compensation, thyristor switched series capacitors (TCSC), static series synchronous compensator (SSSC), power angle characteristics, and basic operating control schemes.

UNIT - III
Combined compensators: Unified power flow controller (UPFC) - Introduction, operating principle, independent real and reactive power flow controller and control structure. Interline power flow controller (IPFC), Introduction to Active power filtering, Concepts relating to Reactive power compensation and harmonic current compensation using Active power filters.

UNIT IV
Hvdc transmission: HVDC Transmission system: Introduction, comparison of AC and DC systems, applications of DC transmission, types of DCLinks, Layout of HVDC Converter station and various equipments. HVDC Converters, analysis of bridge converters with and without overlap, inverter operation, equivalent circuit representation of rectifier and inverter configurations.

UNIT V
Control of HVDC system: Principles of control, desired features of control, converter control characteristics, power reversal, Ignition angle control, current and extinction angle control. Harmonics-introduction, generation, ac filters and dc filters. Introduction to multiterminal DC systems and applications, comparison of series and parallel MTDC systems.

Suggested Reading:
With effect from the academic year 2015-2016

EE3002  **Renewable Energy Sources**

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

UNIT I

UNIT II

UNIT III
Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS - Classification of WECS - Site selection considerations - Advantages and disadvantages of WECS - Wind energy collectors - Wind electric generating and control systems - Applications of Wind energy - Environmental aspects.

UNIT IV

UNIT V
Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation - Thermal gasification of biomass - Biomass gasifiers.

**Suggested Reading:**
EE3003 Electric and Hybrid Electrical Vehicles

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

Unit I

Unit II

Unit III
Introduction to electric vehicle batteries - electric vehicle battery efficiency - electric vehicle battery capacity - electric vehicle battery charging - electric vehicle battery fast charging - electric vehicle battery discharging - electric vehicle battery performance – testing.

Unit IV

Unit V
Advanced topics - Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles - The Impact of Plug-in Hybrid Electric Vehicles on Distribution Networks - Sizing Ultracapacitors for Hybrid Electric Vehicles.

Suggested Reading:

6. Research Papers:
   iii) Review of Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles - Murat Yilmaz, and Philip T. Krein, - IEEE transactions on power electronics, vol. 28, no. 5, may 2013.
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With effect from the academic year 2015-2016

EE 3004  Modern Control Theory

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30Marks

UNIT I
Review of state variable representation of systems - Controllability and Observability –Model control of single input – single output systems (SISO), Controllable and Observable companion forms – Effect of state feedback on Controllability and Observability, Pole placement by state feedback.

UNIT II

UNIT III

UNIT IV

UNIT V
Introduction to adaptive control, types of adaptive control systems. Design of model reference adaptive control systems using M/T rule and Lyapunov stability theorem.

Suggested Reading:
With effect from the academic year 2015-2016

EE3005 Reliability Engineering

Instruction: 3 Periods / Week
Duration of Univ. Examination: 3 Hours
SEE: 70 Marks
CIE: 30 Marks

UNIT I
Discrete and Continuous Random Variables - Binomial, Poisson, Normal, Lognormal, Exponential and Weibull distributions - Causes of failure - Failure rate and Failure density - Reliability and MTTF.

UNIT II
Maintainability and Availability - MTBF and MTTR - Reliability block diagram - Series and parallel systems - Redundancy - Standby system with and without imperfect switching device - r out of n configuration.

UNIT III
Markov models - Reliability models of single unit, Two unit, Load shared and Standby systems - Reliability and availability models of the above systems with repair. Frequency of failures - State transition matrices and solutions - Accelerated life testing.

UNIT IV
Chi-square distribution - Confidence limits for Exponential and Normal distributions - Applications of Weibull distribution and ML estimates - Goodness of fit test - Preventive maintenance - Reliability and MTTF - Imperfect maintenance - Age replacement policy.

UNIT V
Power system reliability - Outage definitions - Markov model of a generating plant with identical units and un-identical units - Capacity outage probability table – Cumulative frequency -LOLP and LOLE.

Suggested Reading:
With effect from the academic year 2015-2016

EE3006 Optimization Methods

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

Unit I
Classical Optimization techniques: Introduction to optimization and design optimization, optimum design problem formulation, Single variable optimization-Multivariable optimization with and without constraints – Multi variable optimization with inequality constraints – Solution by Lagrangian multipliers - Kuhn-Tucker conditions.

Unit II

Unit III

Unit IV
Evolutionary computations: Introduction – Genetic algorithms – Terminologies and operations of GA – Advanced operators and techniques in GA – Introduction to particle swarm optimization and Ant colony optimization.

Unit V

Suggested Reading:

Advanced Microprocessors

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30Marks

UNIT I
Review of Basic I/O Interfaces: Programmable Interval Timer 8253 - Programmable peripheral Interlace 8255 — Programmable Interrupt Controller 8259 Microprocessor 8085 applications.

UNIT II

UNIT III
Assembler Language Programming: Incorporating Data Transfer -Branch Arithmetic -Loop -NOP and HLT - Flag manipulation, Logical Shift and Rotate Instructions — Directives and Operators.

UNIT IV

UNIT V
8087 Numeric Data Processor: NDP -Data types -Processor architecture -Instruction set.

Suggested Reading:

With effect from the academic year 2015-2016

EE3008  Artificial Intelligence & Expert Systems

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

UNIT I

UNIT II
Computer vision: Perception - Early processing - Representation and recognition at senses Guzman’s algorithms of spurting objects in a scene - Waltz algorithm.

UNIT III
Natural Language understanding problems - Syntactic analysis - Semantic analysis - Augmented transition networks.

UNIT IV
Knowledge representation (Logic) - Representing facts in logic predicate logic — Resolution — Unification - Question answering - Mathematical theorem providing knowledge representation (structured) - Declarative representation - Semantic nets - Procedural representation.

UNIT V
Learning: Learning as Induction - Failure drive earning - Learning by teaching - Learning through examples (Winston’s program) - Skill acquisition.

Suggested Reading:
Programmable Logic Controllers

Instruction: 3 Periods / Week
Duration of Univ. Examination: 3 Hours
SEE: 70 Marks
CIE: 30 Marks

UNIT I
PLC Basics: Definition and History of PLC - PLC advantages and disadvantages - Over all PLC Systems - CPUs and Programmer Monitors - PLC input and output models - Printing PLC Information - Programming Procedures - Programming Equipment - Programming Formats - Proper Construction of PLC Diagrams - Devices to which PLC input and output modules are connected - Input on/off switching devices - Input analog devices - Output analog on/off devices and output analog devices.

UNIT II
Basic PLC Programming: Programming on/off inputs to produce on/off outputs - PLC input instructions - Outputs - Operational procedures - Contact and coil input/output programming examples - Relation of digital gate logic contact / coil logic - PLC programming and conversion examples - Creating ladder diagrams from process control descriptions - Sequence listings - Large process ladder diagram constructions.

UNIT III
Basic PLC Functions: General Characteristics of Registers - Module addressing - Holding registers - Input registers - output registers - PLC timer functions - examples of timer functions. Industrial applications - PLC counter functions.

UNIT IV
Intermediate Functions: PLC Arithmetic functions - PLC additions and subtractions - The PLC repetitive clock - PLC Multiplications, Division and Square Root - PLC trigonometric and log functions - Other PLC arithmetic functions - PLC number comparison functions. PLC basic comparison functions and applications - Numbering systems and number conversion functions - PLC conversion between decimal and BCD-Hexadecimals numbering systems.

UNIT V
Data Handling Functions: The PLC skip and master control relay functions - Jump functions - Jump with non return - Jump with return. PLC data move Systems - The PLC functions and applications. PLC functions working with bits - PLC digital bit functions and applications - PLC sequence functions - PLC matrix functions.

Suggested Reading:
With effect from the academic year 2015-2016

EE3010

Digital Signal Processing

Instruction : 3 Periods / Week
Duration of Univ. Examination : 3 Hours
SEE : 70 Marks
CIE : 30 Marks

UNIT I
Introduction to Digital Signal Processing: Discrete time signals & sequences - Linear shift Invariant systems - Stability and causality - Linear constant coefficient difference equations - Frequency domain representation of discrete time signals and systems.

UNIT II

UNIT III

UNIT IV

UNIT V
Introduction to digital signal processors: TMS320C5X architecture – CALU, ARAU, PLU, MMR, on chip memory, on chip peripherals, Digital signal processing applications.

Suggested Reading:
With effect from the academic year 2015-2016

EE3011  Digital Circuits and Logic Design

Instruction :  3 Periods / Week
Duration of Univ. Examination :  3 Hours
SEE :  70 Marks
CIE :  30 Marks

UNIT I
Relay contacts-Analysis and synthesis of contact networks - Symmetric networks - Identification of symmetric functions - Combinational circuit design with Programmable Logic Array, Programmable Read-Only Memory and Programmable Array Logic.

UNIT II
Synchronous sequential circuit - Mealy and Moore models - Sequential circuit analysis - Synthesis of synchronous sequential circuits - Incompletely specified circuits.

UNIT III

UNIT IV

UNIT V
Introduction to Races, Cycles and Hazards - Avoidance of race conditions – Race-free state assignments and sequential logic circuit testing.

Suggested Reading:

With effect from the academic year 2015-2016

**ME2001**

**Engineering Research Methodology**

Instruction : 3 Periods / Week  
Duration of Univ. Examination : 3 Hours  
SEE : 70 Marks  
CIE : 30 Marks

**UNIT I**


**Defining Research problem:** Definition of research Problem – Problem formulation – Necessity of Defining the Problem – Techniques involved in defining a problem

**UNIT II**

**Literature survey:** Importance of Literature survey – Sources of information – Assessment of Quality of journals and articles – Information through internet.  

**UNIT III**

**Research Design:** Meaning of research Design – Need of research design – Features of a good design – Important concepts relating to Research Design – Different research designs- Basic Principles of experimental designs - Developing a Research plan – Design of experimental set-up – Use of standards and codes

**UNIT IV**


**Data Analysis:** Deterministic and random data – Uncertainty analysis- Tests for significance – Chi-square test – Student’s ‘t’ test – Regression modeling – ANOVA-F test – Time series analysis – Autocorrelation and Autoregressive modeling.

**UNIT V**


**Suggested Reading:**
3. DR.Vijay Upagade and Dr.Arvind Shende; *Research Methodology*, S.Chand& Company Ltd. New Delhi;2004
4. P. Ramdass and A. Wilson Aruni; Research and Writing across the disciplines; MJP Publishers; Chennai 2009.