BE VI SEMESTER						
COURSE CONTENTS						
EE6301	Control Systems	L	T	P	Max. Marks	Min. Marks
Duration in hrs.		3	1	2	70	22

Course Objective:

UNIT – I : Control system modeling & component:

Modeling of dynamic systems: Electrical, Mechanical and hydraulic systems, Concept of transfer function, Simulation of differential equations in analog computer, State space description of dynamic systems: Open and closed loop systems, Signal flow graph, Mason's formula, Components of control systems: Error detectors (Synchros & Potentiometer), Servomotors (AC & DC), techo generators, power amplifier, steeper motors

UNIT – II : Time domain analysis:

Time – domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, Steady state error & error constants, Feedback control actions: Proportional, derivative and integral control.

UNIT – III : State Space analysis:

Solution of state equation: Eigen values & eigenvectors, digitalization state matrix.

UNIT – IV : Root Locus and stability:

Characteristics equation of closed loop system, root loci, construction of loci, Effect of adding poles and Zeros on the loci, Stability by root loci, Routh-Hurwit

UNIT – V : Frequency domain analysis:

Frequency domain analysis, Bode plots, Effect of adding poles and Zeros, Polar plot, Nyquist stability analysis, Relative stability : Gain and phase margins.

Compensator design: Frequency domain compensation: Lead-lag, Lag-lead compensation, Design of compensating networks

References-

1. Nagrath Gopal Kothari - Control system
2. Kuo - Automatic Control
3. K. Ogata - Modern control system

BE VI SEMESTER						
COURSE CONTENTS						
EE 6302	Power System - III	L	T	P	Max. Marks	Min. Marks
Duration in hrs.		3	1	0	70	22

Course Objective:

UNIT – I : Power system stability:

Introduction, Dynamics of a synchronous machine, power angle equation, steady state stability, transient stability, swing equation and its solution Equal area criterion, sectors affecting transient stability methods of improving system stability.

UNIT – II : Power frequency control:

Fundamental characteristics of power control mechanism of individual generator prime mover control, turbine model concept of area control, area control of interconnected system.

UNIT – III : Reactive power control:

Generation and absorption of reactive power, reactive power compensation techniques, methods of voltage control, STATCON, static methods of reactive power compensation, UPFC

UNIT – IV: Interconnected system:

Interconnected system, advantages of interconnected system, excitation and phase angle control, economic loading and parallel operation of interconnect, problems associated with modern interconnected power systems, deregulation, power system restructuring. SCADA systems.

UNIT – V : Fault Analysis:

Faults in power system, single line diagram , equivalent impedance diagrams, percent and per unit reactances, symmetrical and unsymmetrical fault analysis by symmetrical components, sequence networks and their interconnections for different types of faults.

References-

3. Elgerd O.I., "Electric Energy Systems Theory", TMH, New Delhi, Second Edition 1983.
4. Weedy B.M. "Electric Power System" John Wiley and Sons, 3rd edition.
5. P.S.R. Murthy, "Power System Operation and Control", Tata Mc-Graw Hill, New Delhi 1984. w.e.f Academic session 2010 Page 25 of 35
6. Power Systems Analysis- by A.R. Bergen Prentice Hali Inc.
7. Economic Operation of Power Systems- by L.K. Kirchmayer Wiley Eastern Ltd.

BE VI SEMESTER						
EE6303	COURSE CONTENTS					
	Power Electronics	**L**	**T**	**P**	**Max. Marks**	**Min. Marks**
Duration in hrs.		3	1	2	70	22

UNIT – I : Power Semiconductor Devices:
Power Diodes, Transistors, Power Mosfet, IGBT, Thyristors, Triaes, GTO thyristors, Thyristor characteristics, Two-Transistor equivalent model, Turn on and Turn off di/dt protection. Thyristor performance parameters, Thyristor types, Protection thennal design of thyristors, Communication techniques - forced and natural, SCR firing techniques, use of transformer and apto isolator in firing, Resistance firing, resistance-capacitance firing, UJT firing circuit, Ramp triggering, firing for 3-phase circuit.

UNIT – II : Controlled Rectifiers:
Principle of phase controlled converter operation, Single-phase half wave, Full wave and semi-converters, Three phase half wave, Full wave and semi converters and inverters, Dual converters, Power factor Improvement, Symmetrical angle control, Pulse width modulation control, Effect of load and source Inductance, Design of converter circuits, Regulated DC power supplies.
Cycloconverter: Principles of operation of single and three phase cycloconverters.

UNIT – III : AC Voltage Controllers:
Principle of phase control, Single phase ac controllers with resistance and inductance loads, Three phase voltage controllers with resistive and inductive loads, temperature and pan controllers, Lag Var controllers, Unity power factor controllers.

UNIT – IV : DC Chopper:
Principles of step down & step up choppers, Operation with R-L Load, Four quadrant choppers, Thyristor chopper circuits, Impulse commutation, Effect of source inductance, Chopper circuit design,Switched mode power suppliers, Buck-Boost regulators, DC to DC converter (Boost-Buck, Buck-Boost etc.)

UNIT – V : Inverter Circuits:
Principle of operation of voltage source inverter, Single phase and three phase inverters, Voltage control using PWM technique, Forced commutated thyristers, Current source inverters, Inverter circuit design. Space vector PWM inverter, Introduction to multilevel inverters, Harmonic mitigation.

References-

1. M.H. Rashid, Pearson - Power Electronics Circuits, Devices and Applications.
2. Education, Singapore, 1993.
3. M Ramsmoorthy, Affiliated East-West Press - An Introduction to transistor and their application.
4. P.C. Sen, TMH - Power Electronics.
5. M.D. Singh, K.B. Khanchandani, TMH, Delhi, 2001 - Power Electronics.
6. Chakravarti A., Dhanpat Ray & Co. - Fundamental of Power Electronics and Drives.
7. Dr. P.S. Bhimbhra, Khanna Pub - Power Electronics.

BE VI SEMESTER						
COURSE CONTENTS						
PEC EE6311	Electrical Machine Design	L	T	P	Max. Marks	Min. Marks
Duration in hrs.		3	1	2	70	22

Course Objective:

UNIT – I :

General concepts & considerations of electrical machine design: Factors affecting design and limitations, typical problems giving insight of machine design, nameplate specifications of electrical machines. Heat generation in electrical machines, modes of heat dissipation, Equations for temperature rise in electrical machines under steady state conditions. Heating and cooling time constants, ratings of machine, significance of rating of the design aspects, types of enclosures and their effect on design. Insulation classes & materials.

UNIT – II : D.C. Machine:

Laws of magnetic circuit, magnetization curves, Calculation of magnetic circuit for a D.C. Machine (air gap irregularities, M.M.F. of tooth section etc.), output equation, calculation of main dimensions, design of armature winding.

UNIT – III : Transformer:

Features regarding construction of transformer, choice of flux densities for yoke and core, current density, window space factor etc., determination of the main dimensions of the magnetic frame, design of low and high voltage windings, insulation details, calculation of resistance and leakage reactance. Performance calculations related to design.

UNIT – IV : Induction Motor:

Main dimensions of the stator, Design of stator winding, Stator core, length of air gap, squirrel cage rotor, wound rotor. Performance calculations relating to design.

UNIT – V : Synchronous Machines:

Main dimensions of the stator, short circuit ratio, length of air gap, Design of stator winding, stator core, field system for salient pole alternator. Introduction to computer aided design.

References-

1. Design of DC Machines : By Clayton
2. Performance and Design of A.C.Machines : By M.G.Say
3. Synchronous machine design : By G.C.Jain
4. Computer aided design : By Say & Sinha

Bhupta

BE VI Semester Electrical Engg.							
EC6351 **COURSE CONTENTS (UEC SCHEME)**							
OEC	Microprocessor	L	T	P	C	Max. Marks	Min. Marks
Duration	3 Hours	3	0	2	5	70	22

Unit – I

Microprocessor 8086:

Introduction to 16-bit 8086 microprocessors, architecture of 8086, Pin configuration, interrupts, minimum mode and maximum mode, timing diagram, Memory interfacing, comparative study of salient features of 8086, 80286 and 80386Instruction set of 8086, Addressing mode, Assembler directives and operations, assembly and machine language programming, subroutine call and returns. Concept of stack, stack structure of 8086, timing and delays.

Unit – II

Input-Output interfacing:

Memory mapped I/O and peripherals I/O, PPI 8255 architecture and modes of operation, Interfacing to 16-bit microprocessor and programming, DMA controller 8257) architecture, Programmable interval timer 8254, USART 8251, 8 bit ADC/DAC interfacing and programming.

Unit – III

Microcontroller 8051:

Intel family of 8 bit microcontrollers, Architecture of 8051, Pin description, I/O configuration, Interrupts: Interrupts structures and interrupt priorities, Port structure and operation, assessing internal and external memories and different mode of operations, Memory organization, addressing mode, instruction set of 8051 and programming, introduction to 16-bit microcontrollers.

Unit – IV

8051 Interfacing, Applications and serial communication:

8051 interfacing to ADC and DAC, Stepper motor interfacing, Timer/counter functions, 8051 based thyristor firing circuit, 8051 connections to RS-232, 8051 serial communication, serial communication modes, serial communication programming, serial port programming in C

Unit - V

Embedded systems:

Understanding Embedded System, Embedded C programming - Program creation, flow charting.Algorithms for embedded control. Structured programming, Data structures and types, Program classification.Computer control: Components of embedded control systems to include terminology and components.Classification of programs, programs for sequential tasks, multitasking systems, real-time systems. Real WorldInterfacing – LCD, ADC, Sensors, Stepper motor, keyboard and DAC

References-

1. Hall Douglas V., Microprocessor and Interfacing, revised second edition 2006, Macmillan McGraw Hill.
2. A.K. Ray & K.M. Bhurchandi, Advance Microprocessors and Peripherals-Architecture, Programming and Interfacing, Tata Mcgraw Hill, 2009 TMH reprint.
3. Kenneth J. Ayala, the 8086 Mocroprocessor: Programming and Interfacing the PC, Indian edition, CENGAGE Learning.

Course Outcomes

At the end of the course the students will be able to,

CO1	Examine the architecture and memory interfacing of 8086 microprocessor
CO2	Create assembly language programs and perceive the concept of timing and delays
CO3	Develop necessary skills for interfacing different peripheral devices to 8086 microprocessor
CO4	Interpret the architecture of 8051 microcontroller and create assembly language programs for the same
CO5	Acquire proficiency in designing embedded systems