EC – 601 Industrial Electronics

Unit-I Power Supplies
Power supply, rectifiers (half wave, full wave), performance parameters of power supplies, filters (capacitor, inductor, inductor-capacitor, pi filter), bleeder resistor, voltage multipliers. Regulated power supplies (series and shunt voltage regulators, fixed and adjustable voltage regulators, current regulator), switched regulator (SMPS), comparison of linear and switched power supply, switch mode converter (flyback, buck, boost, buck-boost, cuk converters).

Unit-II Thyristors
Silicon controlled rectifiers (SCR), constructional features, principle of operation, SCR terminology, turn-on methods, turn-off methods, triggering methods of SCR circuits, types of commutation, comparison of thyristors and transistors, thermal characteristics of SCR, causes of damage to SCR, SCR overvoltage protection circuit, series and parallel operation of SCRs, Line commutated converters (half wave rectifier with inductive and resistive load, single phase and three phase full wave rectifiers).

Unit-III Other members of SCR family
Triacs, Diacs, Quadracs, recovery characteristics, fast recovery diodes, power diodes, power transistor, power MOSFET, Insulated gate bipolar transistor (IGBT), loss of power in semiconductor devices, comparison between power MOSFET, power transistor and power IGBT.

Unit-IV Applications of OP-AMP
Basics of OP-AMP, relaxation oscillator, window comparator, Op-comp as rectangular to triangular pulse converter and vice versa, Wien bridge oscillator, function generator, frequency response of OP-AMP, simplified circuit diagram of OP-AMP, power supplies using OP-AMP, filters (low-pass, high pass) using OP-AMP.

Unit-V Programmable Logic Controller (PLC)
Functions, applications, advantages and disadvantages of PLC over conventional relay controllers, comparison of PLC with process control computer system, factors to be considered in selecting PLC, functional block diagram of PLC, microprocessor in PLC, memory, input and output modules (interface cards), sequence of operations in a PLC, status of PLC, event driven device, ladder logic language, simple process control applications of PLC, Programming examples.

References:
2. Rashid: Power Electronics- Circuits, devices and applications, Pearson Education.
3. Singh and Khanchandani: Power Electronics, TMH
7. Petruzulla: Programmable Logic Controllers, TMH.
Unit-I Introduction to cellular mobile system
A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning of cellular system.

Elements of cellular radio system design
General description of problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I in an omni-directional antenna system, hand off mechanism, cell splitting, components of cellular systems.

Unit-II Cell coverage for signal and traffic
General introduction, mobile point-to-point model, propagation over water or flat open area, foliage loss, propagation in near- in distance, long distance propagation, path loss from point-to-point prediction model, cell site antenna heights and signal coverage cells, mobile-to-mobile propagation.

Cell site antennas and mobile antennas
Equivalent circuits of antennas, gain and pattern relationship, sum and difference patterns, antennas at cell site, unique situations of cell site antennas, mobile antennas.

Unit-III Cochannel interference reduction
Cochannel interference, real time cochannel interference measurement at mobile radio transceivers, design of antenna systems - omni directional and directional, lowering the antenna height, reduction of cochannel interference, umbrella- pattern effect, diversity receiver, designing a system to serve a predefined area that experiences cochannel interference.

Types of Noncochannel interference
Adjacent channel interference, near-end-far-end interference, effect on near-end mobile units, cross-talk, effects of coverage and interference by applying power decrease, antenna height decrease, beam tilting, effects of cell site components, interference between systems, UHF TV interference, long distance interference.

Unit-IV Frequency management and Channel Assignment
Frequency management, frequency spectrum utilization, setup channels, channel assignment, fixed channel assignment, non-fixed channel assignment algorithms, additional spectrum, traffic and channel assignment, perception of call blocking from the subscribers

Handoffs and dropped calls
Value of implementing handoffs, initiation of handoff, delaying a handoff, forced handoff, queuing of handoff, power- difference handoff, mobile assisted handoff and soft handoff, cell-site handoff and intersystem handoff, dropped call rate formula.

Unit-V Digital Cellular Systems
GSM- architecture, layer modeling, transmission, GSM channels and channel modes, multiple access scheme.
CDMA- terms of CDMA systems, output power limits and control, modulation characteristics, call processing, hand off procedures.
Miscellaneous mobile systems- TDD systems, cordless phone, PDC, PCN, PCS, non cellular systems.

References:
1. Lee: Cellular and Mobile Telecommunication- Analog & digital systems, TMH.
3. Lee: Mobile communications design fundamentals, Wiley India.
EC – 603 Digital Signal Processing

Unit – I
Discrete-Time Signals and Systems
Discrete-time signals, discrete-time systems, analysis of discrete-time linear time-invariant systems, discrete time systems described by difference equation, solution of difference equation, implementation of discrete-time systems, stability and causality, frequency domain representation of discrete time signals and systems.

Unit - II
The z-Transform
The direct z-transform, properties of the z-transform, rational z-transforms, inversion of the z transform, analysis of linear time-invariant systems in the z-domain, block diagrams and signal flow graph representation of digital network, matrix representation.

Unit - III
Frequency Analysis of Discrete Time Signals
Discrete fourier series (DFS), properties of the DFS, discrete Fourier transform (DFT), properties of DFT, two dimensional DFT, circular convolution.

Unit - IV
Efficient Computation of the DFT
FFT algorithms, decimation in time algorithm, decimation in frequency algorithm, decomposition for ‘N’ composite number.

Unit - V
Digital filters Design Techniques
Design of IIR and FIR digital filters, Impulse invariant and bilinear transformation, windowing techniques- rectangular and other windows, examples of FIR filters, design using windowing.

References:

List of Experiments:
2. Implementation of operations on sequences (addition, multiplication, scaling, shifting, folding etc).
3. Implementation of Linear time-invariant (LTI) systems and testing them for stability and causality.
4. Computation and plot of DTFT of sequences, verification of properties of DTFT.
5. Computation and plots of z-transforms, verification of properties of z-transforms.
6. Computation and plot of DFT of sequences, verification of properties of DFT.
9. Implementation of IIR and FIR filter structures (direct, cascade, parallel etc).
10. Implementation of various window design techniques (Rectangular, Bartlett, Hann, Hamming etc).
EC – 604 Antennas and Wave Propagation

Unit I Radiation
Potential function and the Electromagnetic field, potential functions for Sinusoidal Oscillations, retarded potential, the Alternating current element (or oscillating Electric Dipole), Power radiated by a current element, Application to short antennas, Assumed current distribution, Radiation from a Quarter wave- monopole or Half wave dipole, sine and cosine integral, Electromagnetic field close to an antenna, Solution of the potential equations, Far-field Approximation.

Unit II
Antenna Fundamentals
Introduction, network theorems, directional properties of dipole antennas, travelling –wave antennas and effect of feed on standing-wave antennas, two –element array, horizontal patterns in broad-cast arrays, linear arrays, multiplication of patterns, effect of earth on vertical patterns, Binomial array, antenna gain, effective area.

Unit III
Types of antennas
Babinet’s principles and complementary antenna, horn antenna, parabolic reflector antenna, slot antenna, log periodic antenna, loop antenna, helical antenna, biconical antenna, folded dipole antenna, Yagi-Uda antenna, lens antenna, turnstile antenna. Long wire antenna: resonant and travelling wave antennas for different wave lengths, V-antenna, rhombic antenna, beverage antenna, microstrip antenna.

Unit IV
Antenna array synthesis
Introduction, retarded potentials, array structures, weighting functions, linear array analysis, different forms of linear arrays, Schelknoff unit circle, linear array synthesis, sum and difference patterns, Dolph- Chebychev synthesis of sum pattern, Taylor synthesis of sum patterns, Bayliss synthesis of difference patterns, planar arrays, arrays with rectangular boundary.

Unit V
Propagation of radio waves
Fundamentals of electromagnetic waves, effects of the environment, modes of propagation.
Ground wave propagation- Introduction, plane earth reflection, space wave and surface wave, transition between surface and space wave, tilt of wave front due to ground losses.
Space wave propagation- Introduction, field strength relation, effects of imperfect earth, curvature of earth and interference zone, shadowing effect of hills and buildings, absorption by atmospheric phenomena, variation of field strength with height, super refraction, scattering, tropospheric propagation, fading, path loss calculations.
Sky wave propagation- Introduction, structural details of the ionosphere, wave propagation mechanism, refraction and reflection of sky waves by ionosphere, ray path, critical frequency, MUF, LUF, OF, virtual height, skip distance, relation between MUF and skip distance.

References:
2. Krauss: Antennas and wave propagation, TMH.
5. Raju: Antennas and Wave Propagation, Pearson Education.
List of Experiments:

1. To Plot the Radiation Pattern of an Omni Directional Antenna.
2. To Plot the Radiation Pattern of a Directional Antenna.
3. To Plot the Radiation Pattern of a Parabolic Reflector Antenna.
4. To Plot the Radiation Pattern of a Log Periodic Antenna.
5. To Plot the Radiation Pattern of a Patch Antenna.
6. To Plot the Radiation Pattern of a Dipole/ Folded Dipole Antenna.
7. To Plot the Radiation Pattern of a Yagi (3-EL/4EL) Antenna.
8. To Plot the Radiation Pattern of a Monopole/ WHIP/ Collinear Antenna.
9. To Plot the Radiation Pattern of a Broad site Antenna.
10. To Plot the Radiation Pattern of a Square Loop Antenna.
EC – 605 VLSI Circuits and Systems

Unit I Introduction
Introduction to CMOS VLSI circuit, VLSI design flow, Design strategies, Hierarchy, regularity, modularity, locality, MOS Transistor as a Switches, CMOS Logic, Combinational circuit, latches and register, Introduction of CAD Tool, Design entry, synthesis, functional simulation.

Unit II
Specification of sequential systems
Characterizing equation & definition of synchronous sequential machines. Realization of state diagram and state table from verbal description, Mealy and Moore model machines state table and transition diagram. Minimization of the state table of completely and incompletely specified sequential machines.

Unit III
Asynchronous Sequential Machine
Introduction to asynchronous sequential machine, Fundamental mode and Pulse mode asynchronous sequential machine, Secondary state assignments in asynchronous sequential machine, races and hazards.

Unit IV
State Machine
Algorithmic state machine and fundamental concept of hardware/firmware algorithms. Controllers and data system designing.

Unit V
Fault Detection in combinational circuit
Types of faults, Fault detection using Boolean Difference and path sensitization method. Concept of PROM, PLA, PAL, CPLD and FPGA, PALASM software applications.

References:
2. Kohavi: Switching & Finite Automata Theory, TMH.
VHDL
Hardware abstraction, Basic language elements: identifiers, data objects, data types, operators, behavioral modeling, data flow modeling, structural modeling, simulation and analysis.

VERILOG
Overview of digital design with Verilog, Hierarchical Modeling: basic concepts, models and ports, gate level modeling, data flow modeling, behavioral modeling, logic synthesis with Verilog HDL, simulation.

Experiments:
Design and simulation of following using Verilog/ VHDL. Logic gates: NAND, NOR, XOR, XNOR. Half adder, full adder, subtractor, latches, multiplexers- 2:1, 4:1, 8:1, comparators, decoders- 2:4, 3:8, 4:16. 4-bit ripple carry full adder, 4-bit Ripple carry counter, parity generator, up/down counters.

References:
2. Bhasker: A Verilog HDL Primer –synthesis, Pearson Education
4. Perry: VHDL- Programming by example, TMH.