



**Raffles University, Neemrana**  
**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

**B.Tech. (2014-2018)**

**Semester III**

**EC- 301: ENGINEERING MATHEMATICS-III**

**UNIT 1: LAPLACE TRANSFORM** - Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficient with special reference to the wave and diffusion equations.

**UNIT 2: FOURIER SERIES & Z TRANSFORM** – Expansion of simple functions in Fourier series. Half range series, Change of intervals, Harmonic analysis. Z TRANSFORM - Introduction, Properties, Inverse Z Transform.

**UNIT 3: FOURIER TRANSFORM** - Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant co-efficient with special reference to heat equation and wave equation.

**UNIT 4: COMPLEX VARIABLES** - Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy's theorem. Cauchy's integral formula.

**UNIT 5: COMPLEX VARIABLES** -Taylor's series Laurent's series poles, Residues,Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.

**TEXT BOOKS**

1. Engineering Mathematics, T Veerarajan, TMH
2. Mathematical Techniques, Jordan, Oxford
3. Advance Engineering Mathematics, Potter, Oxford

**REFERENCE BOOKS**

1. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley
2. Mathematical Methods, Dutta, D., New Age
3. Text BOOK Of Engineering Mathematics, Dutta, New Age



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**EC- 302 : OBJECT ORIENTED PROGRAMMING USING C++**

**UNIT 1: OOP FUNDAMENTALS:** Concept of class and object, attributes, public, private and protected members, derived classes, single & multiple inheritance,

**UNIT 2: PROGRAMMING IN C++:** Enhancements in C++ over C, Data types, operators and functions. Inline functions, constructors and destructors. Friend function, function and operator overloading. Working with class and derived classes. Single, multiple and multilevel inheritances and their combinations, virtual functions, pointers to objects. Input output flags and formatting operations. Working with text files.

**UNIT 3: JAVA:** Variation from C++ to JAVA. Introduction to Java byte code, virtual machine, application & applets of Java, integer, floating point, characters, Boolean, literals, and array declarations.

**UNIT 4: OPERATORS AND CONTROL STATEMENTS:** Arithmetic operators, bit wise operators, relational operators, Boolean logic operators, the assignment operators, operators, operator precedence. Switch and loop statements.

**UNIT 5: PACKAGE AND INTERFACES:** Packages, access protection, importing & defining packages. Defining and implementing interfaces.

**TEXT BOOKS**

1. Object Oriented Programming With C++, Sahay,
2. Object Oriented Programming With C++, Josuttis, Oxford
3. An Introduction To Programming & Oo Design Using Java, J.Nino & F.A.Hosch, Wiley
4. Object Oriented Programming With C++, Shukla, Wiley

**REFERENCE BOOKS**

1. OOP, Timothy Budd, Wiley
2. Object Oriented Programming With C++, Balagurusamy, Pearson
3. Programming With C++ (Sie) (Schaum's Outline Series), Hubbard, TMH
4. Mastering C++, Venugopal, TMH
5. Programming With C++, Ravichandran, TMH



### **EC- 303: ANALOG ELECTRONICS**

**UNIT 1: FEEDBACK AMPLIFIERS:** Classification, Feedback concept, Transfer gain with feedback, General characteristics of negative feedback amplifiers. Analysis of voltage-series, voltage-shunt, current-series and current-shunt feedback amplifier. Stability criterion.

**UNIT 2: OSCILLATORS:** Classification. Criterion for oscillation. Tuned collector, Hartley, Colpitts, RC Phase shift, Wien- Bridge and crystal oscillators, Astable, monostable and bistable multivibrators. Schmitt trigger. Blocking oscillators.

**UNIT 3: HIGH FREQUENCY AMPLIFIERS:** Hybrid Pi model, conductance and capacitances of hybrid Pi model, high frequency analysis of CE amplifier, gain-bandwidth product. Emitter follower at high frequencies.

**UNIT 4: TUNED AMPLIFIER -** Band Pass Amplifier, Parallel resonant Circuits, Band Width of Parallel resonant circuit. Analysis of Single Tuned Amplifier, Primary & Secondary Tuned Amplifier with BJT & FET. Double Tuned Transformer Coupled Amplifier. Stagger Tuned Amplifier. Pulse Response of such Amplifier. Shunt Peaked Circuits for Increased Bandwidth.

**UNIT 5: POWER AMPLIFIERS:** Power amplifier circuits, Class A output stage, class B output stage and class AB output stages, class C amplifiers, pushpull amplifiers with and without transformers. Complementary symmetry & quasi complementary symmetry amplifiers

#### **TEXT BOOKS:**

1. Millman's Integrated Electronics, Millman & Parekh, TMH
2. Electronic Devices And Circuits, Salivahanan, TMH
3. Millman's Electronic Devices And Circuits (Special Indian Edition), Millman & Halkias, TMH
4. Electronic Devices And Circuit Theory, Boylested, Pearson

#### **REFERENCE BOOKS**

1. Electronic Devices, Floyd, Pearson
2. Electronic Devices And Integrated Circuits, Singh, Pearson
3. Electronic Devices And Circuits, 5e, Bell, Oxford
4. Microelectronic Circuits, 5e (Intl. Version), Sedra, Oxford



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**EC- 304 : DIGITAL ELECTRONICS & LOGIC DESIGN**

**UNIT 1: NUMBER SYSTEM & CODES**

Number systems and their inter-conversion, Binary Arithmetic (Addition, Subtraction, Multiplication and Division), Diminished radix and radix compliments, BCD codes, Excess-3 code, Gray code, Hamming code, error detection and correction.

**UNIT 2: LOGIC GATES & LOGIC FAMILIES**

Digital Logic Gates, Various Logic Families like RTL, DTL, TTL and ECL, I<sup>2</sup>L, working and their characteristics, MOS and CMOS devices, TTL CMOS Interfacing, IEEE/ANSI representation of Logic Families.

**UNIT 3: COMBINATIONAL LOGIC DESIGN**

Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Canonical and Standard forms-map method, Two, Three, Four and Five variable maps, Sum of products and Product of Sums Simplification, NAND and NOR implementation, incompletely specified functions, Ex-OR functions, The tabulation method, Determination of Prime implicants, Selection of Essential Prime implicants, The cube notation, Sharp operation, Iterative Consensus, Generalized Consensus, Minimization of Multiple output switching functions, Determining Prime implicants using Generalized Consensus, Finding a Minimum cover, Breaking cyclic and similar structures, Standard IC's and their applications

**UNIT 4: MSI AND PLD COMPONENTS**

Binary adder and subtractor, Multiplexers, Decoders/Demultiplexers, Read Only Memory, Programmable Logic Arrays, Programmable Array Logic, Implementation of Combinatorial Logic using these devices.

**UNIT 5: SEQUENTIAL LOGIC DESIGN**

Introduction, S-R Flip-flops, JK flip-flop, D flip-flop, T flip-flop, master slave flip-flop. Flip-flop excitation table, Inter-conversion of flip-flop, Classification of sequential circuits, Register and Counter circuits. A to D and D to A converter circuits.

**TEXT BOOKS:**

1. Digital Design: M. Morris Mano, Prentice Hall of India.
2. Modern Digital Electronic: R.P.Jain (TMH)

**REFERENCE BOOKS:**

1. Digital Principle and Applications Malvino and Leach- (TMH)
2. Modern Digital Systems Design: Cheung (WPC)
3. Fundamentals of Digital Electronics: Anand Kumar (PHI)



## **EC- 305 : NETWORK ANALYSIS & SYNTHESIS**

### **UNIT 1: INTRODUCTION**

Review of circuit analysis using Kirchhoff's laws, nodal and mesh analysis, solution by classical method and Laplace transform, concept of independent and dependent sources, analysis of special signal waveforms, and duality of networks, Brief review of Signals and Systems.

### **UNIT 2: NETWORK THEOREMS**

Superposition and Reciprocity theorem, Thevenin's and Norton's theorem, Millman's theorem, maximum power transfer theorem, compensation, Tellegan's theorem, analysis of circuits using theorems.

### **UNIT 3: TRANSIENT ANALYSIS OF NETWORKS**

Network elements, Transient response of R-L, R-C, R-L-C for DC and sinusoidal excitation, Initial condition, Solution using differential equation approach and Laplace transform method.

### **UNIT 4: NETWORK ANALYSIS**

State variable method, Analytic and numerical solutions, Two Port Networks, Graph theoretic analysis for large scale networks, Formulation and solution of network graph of simple networks, State space representation, Analysis using PSPICE.

### **UNIT 5: NETWORK SYNTHESIS**

Network realizability, Hurwitz Polynomials, Positive real functions, Properties of RC, RL & LC networks, Foster and Cauer forms of realization, Transmission zeroes, Synthesis of transfer functions.

### **TEXT BOOKS:**

1. Network and systems by D.Roy - Choudhary
2. Someshwar C. Gupta, Jon W. Bayless, BehrouzPeikari ", Circuit Analysis - with computer applications to problemsovling".

### **REFERENCE BOOKS:**

1. Franklin F. Kuo, "Network Analysis and Synthesis ", John Wiley.
2. Vanvalkenburg, "Network Analysis ", Printice Hall of India Pvt. Ltd., New Delhi, 1994.



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**EC- 306 : SIGNAL & SYSTEMS**

**UNIT 1: INTRODUCTION:** Continuous time and discrete time systems, Properties of systems. Linear time invariant systems - continuous time and discrete time. Properties of LTI systems and their block diagrams. Convolution, Discrete time systems described by difference equations.

**UNIT 2: FOURIER SERIES REPRESENTATION OF SIGNALS:** Fourier series representation of continuous periodic signal & its properties, Fourier series representation of Discrete periodic signal & its properties, Continuous time filters & Discrete time filters described by Diff. equation.

**UNIT 3: FOURIER TRANSFORM:** The continuous time Fourier transform for periodic and aperiodic signals, Properties of CTFT. Discrete time Fourier transform for periodic and aperiodic signals. Properties of DTFT. The convolution and modulation property.

**UNIT 4: Z-TRANSFORM & LAPLACE TRANSFORM:** Introduction. The region of convergence for the Z-transform. The Inverse Z-transform. Two dimensional Ztransform. Properties of Z transform. Laplace transform, Properties of Laplace Transform, Application of Laplace transform to system analysis.

**UNIT 5: SAMPLING:** Mathematical theory of sampling. Sampling theorem. Ideal & Real sampling. Interpolation technique for the reconstruction of a signal from its samples. Aliasing. Sampling in frequency domain. Sampling of discrete time signals.

**TEXT BOOKS**

1. Principles Of Linear Systems And Signals, 2e (Intl. Version), Lathi 2nd, Oxford
2. Signal & Systems 3e, Chen 3rd, Oxford
3. Fundamentals Of Signals And Systems, Wiley

**REFERENCE BOOKS**

1. Signals And Systems, P Rao, TMH
2. Signals And Systems: A Simplified Approach, Ganesh Rao, 4e, Pearson
3. Signals And Systems: Continuous And Discrete, Roger E Ziemer, 4e, PHI
4. Signals And Systems, Ravi Kumar, PHI



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**EC-P-307: COMPUTER PROGRAMMING LAB**

**LIST OF EXPERIMENTS:**

1. Simple array and sorting algorithm implementations.
2. Addition, multiplication and transpose of sparse matrices represented in array form.
3. Polynomial addition, multiplication (8th degree polynomials), using array & linked lists.
4. Implementation of stack and queue using array & linked lists.
5. Implementation of circular queue using array.
6. Infix to postfix/prefix conversion.
7. Binary search tree creation and traversing.
8. Generation of spanning trees for a given graph using BFS & DFS algorithms.
9. AVL tree implementation (creation, insertion, deletion).
10. Symbol table organization (Hash Table).



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**EC-P-308 ANALOG ELECTRONICS LAB**

**LIST OF EXPERIMENTS:-**

1. Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1kHz with and without negative feedback.
2. Study of series and shunt voltage regulators and measurement of line and load regulation and ripple factor.
3. Plot and study the characteristics of small signal amplifier using FET.
4. Study of push pull amplifier. Measure variation of output power & distortion with load.
5. Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency.
6. Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.
7. Study the following oscillators and observe the effect of variation of C on oscillator frequency: (a) Hartley (b) Colpitts.
8. Design Fabrication and Testing of k-derived filters (LP/HP).
9. Study of a Digital Storage CRO and store a transient on it.
10. To plot the characteristics of UJT and UJT as relaxation.
11. To plot the characteristics of MOSFET and CMOS.



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**EC-P-309 DIGITAL ELECTRONICS LAB**

**LIST OF EXPERIMENTS:-**

1. To verify the truth table of logic gates realize AND, OR, NOT gates.
2. To realize AND, OR gates using diodes and resistors
3. To verify the Boolean algebra function using digital IC gates (consensus theorem)only
4. To realize the function  $F(A, B, C, D) = (C+D)(A+B)(B+D)$  using NOR gates only
5. Design a half/full adder circuit using FF for 2 bits
6. Design a half/full sub tractor circuit using FF for 2 bits
7. Use Quine Mclusky method for designing  $F(A,B,C,D) = \Sigma m(1,3,5,7,9,15) + d(4,6,12,13)$  realize it NOR-OR implementation.
8. Design a binary to gray code converter.
9. Design a function using K-map and verify its performance using SOP and POS form
10. Design BCD to seven-segment display using 7447 IC
11. Implement  $F(A, B, C) = \Sigma(1, 3, 4, 5, 6)$  with a multiplexer.
12. Design a modulus N counter and a ring counter.
13. Design a shift register using flip-flops



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**EC-P-310 SIGNAL & SYSTEM LAB**

**LIST OF EXPERIMENT Using MATLAB:-**

1. Generation of continuous and Discrete Unit step signal.
2. Generation of exponential and Ramp Signal in Continuous and Discrete Domain.
3. Continuous and Discrete time Convolution.
4. Adding and subtracting two Given Signals (Continues as well as Discrete Signals)
5. To generate a random binary wave.
6. To Generate a Random Sequences with arbitrary distribution, means and Variances for following (1) Rayleigh Distribution (b) Uniform distribution (c) Gaussian distribution.
7. To Plot Probability density functions.
8. Find Mean and Variance for the above distribution
9. To study Power Spectrum Density
10. To study Difference Equation to develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
11. To develop program modules based on operation on sequences like signal shifting, signal folding, signal addition and signal multiplication.
12. To develop program for discrete convolution and correlation .
13. To develop program for finding response of the LTI system described by the difference equation.
14. To develop program for computing inverse Z-transform.



## **Semester -IV**

### **EC - 402: DATA STRUCTURES**

**UNIT 1: INTRODUCTION:** Basic Terminology, Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh, time-Space trade-off, Abstract Data Types (ADT) **Arrays:** Definition, Single and Multidimensional Arrays, Representation of Arrays: Row major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List, Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List.

**UNIT 2: STACKS:** Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of Postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion. **Queues:** Operations of Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue

**UNIT 3: TREES:** Basic terminology, Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: In-order, Pre-order and Post-order, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.

**UNIT 4: GRAPHS:** Terminology, Sequential and linked Representations, of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal: Depth First Search and Breadth first Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kurskalalgorithm, Transitive Closure and Shortest Path algorithm: WarshalAlgorithm and Dijkstra Algorithm, Introduction to Activity Networks.

**UNIT 5: SEARCHING:** Sequential search, Binary search, Comparison and Analysis, Internal Sorting: Insertion Sort, selection, Bubble Sort, Quick Sort, Two Way Merge Sort, Heap Sort, Radix Sort, Practical consideration for Internal Sorting. Search Trees: Binary Search Trees (BST), Insertion and Deletion in BST, Complexity of search Algorithm, AVL



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trees, Introduction to m-way Search Trees, B Trees & B+ Trees Storage Management: Garbage Collection and Compaction.

**TEXT BOOKS**

1. Aaron M. Tenenbaum, YedidyahLangsam and Moshe J. Augenstein “Data structures Using C and C++”, PHI
2. Lipschutz, “Data Structures” Schaum’s Outline Series, TMH

**REFERENCE BOOK**

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication



**EC- 403: ELECTROMAGNETIC FIELD THEORY**

**UNIT 1: INTRODUCTION:** Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's & Stoke's theorems.

**UNIT 2: ELECTROSTATICS:** Electric field intensity & flux density. Electric field due to various charge configurations. The potential functions and displacement vector. Gauss's law. Poisson's and Laplace's equation and their solution. Uniqueness theorem. Continuity equation. Capacitance and electrostatics energy. Field determination by method of images. Boundary conditions. Field mapping and concept of field cells.

**UNIT 3: MAGNETOSTATICS:** Magnetic field intensity, flux density & magnetization, Faraday's Law, Bio-Savart's law, Ampere's law, Magnetic scalar and vector potential, self & mutual inductance, Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field mapping and concept of field cells.

**UNIT 4: TIME VARYING FIELDS:** Displacement currents and equation of continuity. Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations, reflection & refraction of Uniform Plane Wave, standing wave ratio. Poynting vector and power considerations.

**UNIT 5: RADIATION, EMI AND EMC:** Retarded Potentials and concepts of radiation, Radiation from a small current element. Radiation resistance: Introduction to Electromagnetic Interference and Electromagnetic compatibility, EMI coupling modes, Methods of eliminating interference, shielding, grounding, conducted EMI, EMI testing: emission testing, susceptibility testing.

**TEXT BOOKS**

1. Engineering Electromagnetics, (With Cd), Hayt, TMH
2. Electromagnetics (Sic) (Schaum's Outlines Series), Edminister, TMH
3. Electromagnetics With Applications, Jd Kraus, TMH
4. Electromagnetic Field Theory And Transmission Lines, Raju, Pearson

**REFERENCES BOOKS**

1. Field & Wave Electromagnetic, Cheng, Pearson
2. Elements Of Engineering Electromagnetics, Rao, Pearson
3. Electromagnetic For Engineers, Ulaby, Pearson



## **EC- 404 : ELECTRONIC MEASUREMENT & INSTRUMENTATION**

**UNIT 1: THEORY OF ERRORS:** Accuracy & precision, Repeatability, Limits of errors, Systematic & random errors Modeling of errors, Probable error & standard deviation, Gaussian error analysis, Combination of errors.

**UNIT 2: ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS:** Electronic Voltmeter, Electronic Multimeters, Digital Voltmeter, Component Measuring Instruments, Q meter, Vector Impedance meter, RF Power & Voltage Measurements. Measurement of frequency. Introduction to shielding & grounding.

**UNIT 3: OSCILLOSCOPES:** CRT Construction, Basic CRO circuits, CRO Probes, Oscilloscope Techniques of Measurement of frequency, Phase Angle and Time Delay, Multibeam, multi trace, storage & sampling Oscilloscopes. Curve tracers.

**UNIT 4: SIGNAL GENERATION:** - Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators. Signal Analysis –Measurement Technique, Wave Analyzers, Frequency - selective wave analyser, Heterodyne wave analyser, Harmonic distortion analyzer, Spectrum analyser.

**UNIT 5: TRANSDUCERS** - Classification, Selection Criteria, Characteristics, Construction, Working Principles, Application of following Transducers- RTD, Thermocouples, Thermistors, LVDT, RVDT, Strain Gauges, Bourdon Tubes, Bellows. Diaphragms, Seismic Accelerometers, Tachogenerators, Load Cell, Piezoelectric Transducers, Ultrasonic Flow Meters.

### **TEXT BOOKS**

1. Electronic Instrumentation, H S Kalsi, TMH
2. Electronic Measurements & Instrumentation, Bernard Oliver, TMH
3. Instrumentation Measurement & Analysis, B.C.Nakra, K.K. Chaudhry, TMH
4. Electronic Measurements & Instrumentation, Bernard Oliver, John Cage, TMH

### **REFERENCE BOOKS**

1. Electronic Instrument And Measurement, Bell, Oxford
2. Electronic Measurements And Instrumentation, Dally, Wiley
3. Theory And Design For Mechanical Measurements, Figliola, Wiley
4. A Course In Electrical & Electronic Measurement & Instrumentation, A.K.Sawhney, Dhanpatra



## **EC- 405: ANALOG COMMUNICATION SYSTEM**

**UNIT1. MODULATION TECHNIQUES:** Various frequency bands used for communication, Types of Communication and need of modulation. Introduction to AM, FM, PM, frequency spectrum of AM Waves, Representation of AM, Power relation in AM waves, Need and description of SSB, Suppression of carrier, Suppression of unwanted side-bands, Independent sideband system, Vestigial sideband system, Mathematical representation of FM, Frequency spectrum of AM waves, Phase Modulation, Comparison between analog and digital modulation, wideband and narrow band FM.

**UNIT 2. AM TRANSMITTERS AND RECEIVERS:**AM Transmitters: Generation of AM, low level and high level modulation, comparison of levels, AM transmitter block diagram, collector class C modulator, Base Modulator, Transistor Vander Bil modulator, DSB S/C modulator. AM Receiver: Tuned radio frequency (TRF) receiver.Super heterodyne receiver, RF section and characteristics, mixers, frequency changing and tracking, IF rejection and IF amplifiers. Detection and automatic gain control (AGC), AM receiver characteristics.

**UNIT 3. FM TRANSMITTERS AND RECEIVERS:**FM Transmitters: Basic requirements and generation of FM, FM Modulation methods: Direct methods, Variable capacitor Modulator, Varactor Diode Modulator, FET Reactance Modulator, Transistor Reactance Modulator, Pre-emphasis, Direct FM modulator, AFC in reactance modulator, Disadvantages of direct method, Indirect modulators, RC-phase shift modulators, Armstrong FM systems. FM Receivers: Limiters, single and double-tuned demodulators, balanced slope detector, Foster-Seely or Phase Discriminator, De-emphasis, ratio Detector, Block diagram of FM Receivers, RF Amplifiers, FM Receiver characteristics.

**UNIT 4. SSB TRANSMITTERS AND RECEIVERS:**Generator of SSB, balanced modulator circuit, filter method, phase shift method, third method, Phase cancellation method, Demodulation of SSB, product demodulator, Diode detection technique of SSB.

**UNIT 5. PULSE MODULATION TECHNIQUES:** Pulse amplitude modulation and demodulation, Pulse width modulation and demodulation, Pulse position modulation and demodulation, Sampling theorem, TDM and FDM.

### **TEXTBOOKS**

1. Electronic communication systems by George Kennedy.
2. Principle of communication systems by Taub and schilling

### **REFERENCE BOOKS**

1. Electronic communication systems by Tomasi.



**EC- 406: LINEAR INTEGRATED CIRCUITS**

**UNIT 1: OPERATIONAL AMPLIFIERS:** Basic differential amplifier analysis, Single ended and double ended configurations, Op-amp configurations with feedback, Op-amp parameters, Inverting and Non-Inverting configuration, Comparators, Adder.

**UNIT 2: OPERATIONAL AMPLIFIER APPLICATIONS:**

Integrator, Differentiator, Voltage to frequency & Frequency to voltage converters. Oscillators: Phase shift, Wien bridge, Quadrature, square wave, triangular wave, sawtooth oscillators. Voltage controlled oscillators.

**UNIT 3: ACTIVE FILTERS:** Low pass, high pass, band pass and band reject filters, Allpass filter, Switched capacitor filter, Butterworth filter design, Chebyshev Filter design.

**UNIT 4: PHASE-LOCKED LOOPS:** Operating Principles of PLL, Linear Model of PLL, Lock range, Capture range, Applications of PLL as FM detector, FSK demodulator, AM detector, frequency translator, phase shifter, tracking filter, signal synchronizer and frequency synthesizer, Building blocks of PLL, LM 565 PLL.

**UNIT 5: LINEAR IC's:** Four quadrant multiplier & its applications, Basic blocks of linear IC voltage regulators, Three terminal voltage regulators, Positive and negative voltage regulators. The 555 timer as astable and monostable multivibrators. Zero crossing detector, Schmitt trigger.

**TEXT BOOKS**

1. Linear Circuits (Includes Cd), Ramakalyan-, Oxford
2. Linear Circuit Analysis, Decarlo, Oxford
3. Linear Integrated Circuits, Nair, Wiley
4. Analysis And Design Of Analog Integrated Circuits, Gray, 5e, Wiley

**REFERENCE BOOKS**

1. Linear Integrated Circuits, S Salivahanan, TMH
2. Electronic Circuits: Discrete And Integrated, Donald Schilling, TMH
3. Op-Amps And Linear Integrated Circuits, Gayakwad, Ramakant A, PHI



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**EC-P-407 DATA STRUCTURE LAB**

**Programs in C++**

1. Write a program to perform the complex arithmetic.
2. Write a program to perform the rational number arithmetic.
3. Write a program to perform the matrix operations. (Transpose, addition, subtraction, multiplication, test if a matrix is symmetric/ lower triangular/ upper triangular)
4. Implement Morse code to text conversion and vice-versa.
5. To calculate Greatest Common Divisor of given numbers.
6. To implement tower of Hanoi problem.

**Program in Java**

7. To implement spell checker using dictionary.
8. To implement a color selector from a given set of colors.
9. To implement a shape selector from a given set of shapes.
10. By mapping keys to pens of different colors, implement turtle graphics.
11. To implement a calculator with its functionality.
12. To implement a graph and display BFS/DFS order of nodes



**EC-P-408 ELECTRONICS MEASUREMENT AND INSTRUMENTATION LAB**

**LIST OF EXPERIMENTS:-**

1. To measure the unknown inductance in terms of capacitance and resistance by using Maxwell's Inductance bridge.
2. To measure unknown capacitance of small capacitors by using Wein's bridge.
3. To measure unknown frequency using Wein's frequency bridge.
4. To measure unknown low resistance by Portable Kelvin's Double bridge.
5. To measure self Inductance of a coil using Anderson bridge.
6. Measurement of displacement with the help of LVDT kit.
7. Draw the characteristics of the following temperature, Transducer: RTD (pt-100) Thermistors, Thermocouple kit.
8. To plot the B-H curve of different magnetic materials.
9. To convert the voltmeter into Ammeter using potentiometer.
10. Insulation testing of cables using digital insulation tester.
11. Use of load cell for counting of small objects.
12. Use of load cell for strain gauge transducer.
13. Study of h parameters.



**EC-P-409 ANALOG COMMUNICATION LAB**

**LIST OF EXPERIMENTS:-**

1. To study DSB/ SSB amplitude modulation & determine its modulation factor & power in side bands.
2. To study amplitude demodulation by linear diode detector
3. To study frequency modulation and determine its modulation factor
4. To study PLL 565 as frequency demodulator.
5. To study sampling and reconstruction of Pulse Amplitude modulation system.
6. To study the Sensitivity, Selectivity, and Fidelity characteristics of super heterodyne receiver.
7. To study Pulse Amplitude Modulation using switching method by sample and hold circuit
8. To demodulate the obtained PAM signal by 2nd order LPF.
9. To study Pulse Width Modulation and Pulse Position Modulation.
10. To plot the radiation pattern of a Dipole, Yagi-uda and calculate its beam width.
11. To plot the radiation pattern of Horn, Parabolic & helical antenna. Also calculate beam width & element current.
12. Design and implement an FM radio receiver in 88-108 MHz



**EC-P- 410 LINEAR INTEGRATED CIRCUITS LAB**

**LIST OF EXPERIMENTS:**

1. To study differential amplifier configurations.
2. To measure the performance parameters of an Op amp.
3. Application of Op amp as Inverting and Non Inverting amplifier.
4. To study frequency response of an Op Amp
5. To use the Op-Amp as summing, scaling & averaging amplifier.
6. To use the Op-Amp as Instrumentation amplifier
7. Design differentiator and Integrator using Op-Amp.
8. Application of Op Amp as Log and Antilog amplifier. Design Low pass, High pass and Band pass 1st order butterworth active filters using Op Amp.
9. Design Phase shift oscillator using Op-Amp.
10. Design Wein Bridge oscillator using Op-Amp.
11. Application of Op Amp as Sawtooth wave generator.
12. Application of Op Amp as Zero Crossing detector and window detector.
13. Application of Op Amp as Schmitt Trigger.
14. Design a series regulators with an error amplifier to provide an output voltage of 5 volt at a load current of 1.5 Amp. Use a 741 Op-Amp and specify the Zener voltage necessary transistor gain and the maximum power dissipation of the transistor.
15. Design a delay circuit using 555.
16. To examine the operation of a PLL and to determine the free running frequency, the capture range and the lock in range of PLL.
17. Verification of hardware results obtained using SPICE.



## **Semester V**

### **EC- 501: OPERATING SYSTEM**

**UNIT 1.INTRODUCTION:**Operating system, Role of Operating System as resource manager, function of kernel and shell, operating system structures, views of an operating system.

**UNIT 2. PROCESS MANAGEMENT:** CPU scheduling, Scheduling Algorithms, PCB, Process synchronization, Deadlocks, Prevention, Detection and Recovery

**UNIT 3. MEMORY MANAGEMENT:** Overlays, Memory management policies, Fragmentation and its types, Partitioned memory managements, Paging, Segmentation, Need of Virtual memories, Page replacement Algorithms, Concept of Thrashing

**UNIT 4. DEVICE MANAGEMENT:** I/O system and secondary storage structure, Device management policies, Role of I/O traffic controller, scheduler

**UNIT 5. FILE MANAGEMENT:** File System Architecture, Layered Architecture, Physical and Logical File Systems, Protection and Security:

#### **TEXT BOOKS:**

1. A Silberschatz and Peter B. Galvin, **“Operating System Concepts”** Addison Wesley Publishing Company
2. Dhamdhere, —**Systems Programming & Operating Systems”** Tata McGraw Hill

#### **REFERENCE BOOKS:**

1. Gary Nutt, **“Operating Systems Concepts”**, Pearson Education Ltd. 3rd Edition
2. **Operating System** by Madnick Donovan
3. **Operating System** by Stallings
4. Ida M.Flynn**Understanding Operating Systems -**, Cengage Learning



**Raffles University, Neemrana**  
**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

**EC- 502: TELECOMMUNICATION ENGINEERING**

**UNIT 1: TRANSMISSION LINE:** Types of transmission lines, general transmission line equation, line constant, equivalent circuits, infinite line, and reflection on a line, SWR of line with different type of terminations. Distortion less and dissipation less lines, Coaxial cables, Transmission lines at audio and radio frequencies, Losses in transmission line., Characteristics of quarter wave, half wave and lines of other lengths,

**UNIT 2: TRANSMISSION LINE APPLICATIONS:** Smith chart and its application. Transmission line applications, Impedance matching Network. Single & double Stub matching. Measurement of parameters of transmission line, measurement of attenuation, insertion loss, reflection coefficient and standing wave ratio.

**UNIT 3: ATTENUATORS & FILTERS:** Elements of telephone transmission networks, symmetrical and Asymmetrical two port networks. Different Attenuators, p-section & T-section attenuators, stub matching, Transmission equalizers Filters, constant K-section, Ladder type, p-section, T-section filter, m-derived filter sections, Lattices filter section.

**UNIT 4: TELEPHONE TRANSMISSION:** Telephone set, Touch tone dial types, two wire/ four wire transmission, Echo suppressors & cancellors, cross talk. Multi-channel systems: Frequency division & time division multiplexing.

**UNIT 5: AUTOMATIC TELEPHONY & TELEGRAPHY:** Trunking concepts, Grade of service, Traffic definitions, Introduction to switching networks, classification of switching systems. Principle of Electronic Exchange, EPABX and SPC Digital telephone Exchange, Numberig Plan, Fascimile services.

**TEXT BOOKS**

1. Digital Telephony, Bellamy, Wiley

**REFERENCE BOOKS**

Fields And Waves In Communication Electronics 3ed By Ramo, Wiley



**EC- 503: MICROPROCESSOR & MICROCONTROLLER**

**UNIT 1: INTRODUCTION TO 8085 MICROPROCESSOR:** History and evolution of Microprocessors, 8085 Microprocessor, Memory Interfacing, Memory mapped I/O and peripheral mapped I/O 8085 Microprocessor Programming model. Introduction to 8085 instructions, programming techniques, counters and time delays, stack and subroutines, interrupts.

**UNIT 2: 8051 MICROCONTROLLER:** Comparison of Microprocessor and Microcontroller, micro controller and embedded processors, Architecture and pin configuration of 8051

**UNIT 3: 8051 ASSEMBLY LANGUAGE PROGRAMMING:** Introduction to 8051 Assembly programming, Data Types and directives, 8051 flag bits and PSW register. Register banks and stack. Jump loop and call instructions, I/O Port programming: Addressing modes and accessing memory using various addressing modes.

**UNIT 4: INSTRUCTION TYPES:** Arithmetic instructions and programs, Logic instructions and programs, Single bit instructions and programming, Timer/counter programming in the 8051.

**UNIT 5: SERIAL COMMUNICATION:** 8051 connection to RS 232, 8051 serial communication programming, interfacing of 8051 microcontroller: LCD, ADC and DAC, Stepper motor.

**TEXT BOOKS:-**

1. Microprocessor Architecture, Programming and application with 8085 by Gaonkar

**REFERENCE BOOKS:**

1. The 8051 Microcontroller and embedded Systems by: - Ali Mazidi, Pearson Education
2. The 8051 Microcontroller by K. J. Ayala, Cengage Learning.



### **EC- 504 INDUSTRIAL ELECTRONICS**

**UNIT 1. POWER SEMICONDUCTOR DEVICES:** Thyristor: Thyristor characteristics, Thyristor turn-on methods, Thyristor protection, Series and parallel operation of thyristors, Thyristor commutation; Characteristics of Diac and Triac; Power diode; Power transistor; Power MOSFET; IGBT.

**UNIT 2. PHASE CONTROLLED CONVERTERS:** Principle of phase control, Single-phase half-wave circuit with different types of load, Single-phase full-wave mid-point converter, Single-phase full-wave bridge converters, Single-phase semiconverter, Three-phase thyristor converters, Single-phase and three-phase dual converters.

**UNIT 3. DC CHOPPERS:** Principle of chopper operation and control strategies, Step-up and step-down choppers, Types of chopper circuits, Voltage-commutated chopper, Current-commutated chopper, Load-commutated chopper.

**UNIT 4. INVERTERS:** Single-phase voltage source inverters, Modified McMurray half-bridge and full-bridge inverter, McMurray-Bedford half-bridge and full-bridge inverter, Pulse-width modulated inverters, Current source inverters, Series inverters, Parallel inverter.

**UNIT 5. APPLICATIONS OF INDUSTRIAL ELECTRONICS:** Switched mode power supply (SMPS), Uninterruptible power supplies, Solid state relays.

#### **TEXT BOOKS:**

1. Power Electronics: Circuits, Devices and Applications by Muhammad H. Rashid; Pearson / PHI Publication
2. Power Electronics by Dr. P. S. Bimbhra; Khanna Publishers

#### **REFERENCE BOOKS:**

1. Power Electronics by P. C. Sen; Tata McGraw Hill Publication
2. Power Electronics by C. W. Lander; McGraw Hill Publication



**Raffles University, Neemrana**  
**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

**EC- 505: MICROWAVE ENGINEERING**

**UNIT 1:** Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant TE<sub>10</sub> mode, Field Distribution, Power, Attenuation. Circular Waveguides: TE, TM modes. Wave Velocities, Micro strip Transmission line (TL), Coupled TL, Strip TL, Coupled Strip Line, Coplanar TL, Microwave Cavities,

**UNIT 2:** Scattering Matrix, Passive microwave devices: Microwave Hybrid Circuits, Terminations, Attenuators, Phase Shifters, Directional Couplers: Two Hole directional couplers, S Matrix of a Directional coupler, Hybrid Couplers, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circulators. S parameter analysis of all components

**UNIT 3:** Microwave Tubes: Limitation of Conventional Active Devices at Microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, Traveling Wave Tube, Backward Wave Oscillators: Their Schematic, Principle of Operation, Performance Characteristic and their applications.

**UNIT 4:** Solid state amplifiers and oscillators: Microwave Bipolar Transistor, Microwave tunnel diode, Microwave Field-effect Transistor, Transferred electron devices, Avalanche Transit-time devices: IMPATT Diode, TRAPPAT Diode.

**UNIT 5:** Microwave Measurements: General set up of a microwave test bench, Slotted line carriage, VSWR Meter, microwave power measurements techniques, Crystal Detector, frequency measurement, wavelength measurements, Impedance and Reflection coefficient, VSWR, Insertion and attenuation loss measurements, measurement of antenna characteristics, microwave link design.

**TEXT BOOKS:**

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd Ed, Pearson Education.
2. A. Das and S. K. Das, "Microwave Engineering", TMH.

**REFERENCE BOOKS:**

1. R.E Collin, "Foundation for Microwave Engineering", 2nd Ed., John Wiley India.



**Raffles University, Neemrana**  
**School of Engineering and Technology**

**Department of Electronics and Communication Engineering**

**EC- 506: DIGITAL COMMUNICATIONS**

**UNIT-1** Digital Data transmission, Line coding review, Pulse shaping, Scrambling, Digital receivers, Eye diagram, Digital carrier system, Method of generation and detection of coherent & non-coherent binary ASK, FSK & PSK, Differential phase shift keying, quadrature modulation techniques. (QPSK and MSK ),M-ary Digital carrier Modulation.

**UNIT-2** Concept of Probability, Random variable, Statistical averages, Correlation, Sum of Random Variables, Central Limit Theorem, Random Process, Classification of Random Processes, Power spectral density, Multiple random processes,

**UNIT-3** Performance Analysis of Digital communication system: Optimum linear Detector for Binary polar signaling, General Binary Signaling, Coherent Receivers for Digital Carrier Modulations, Signal Space Analysis of Optimum Detection, Vector Decomposition of White Noise Random processes, General Expression for Error Probability of optimum receivers,

**UNIT 4** Spread spectrum Communications: Frequency Hopping Spread Spectrum(FHSS) systems, Direct Sequence Spread Spectrum, Code Division Multiple Access of DSSS, Multiuser Detection, OFDM Communications

**UNIT 5** Measure of Information, Source Encoding, Error Free Communication over a Noisy Channel capacity of a discrete and Continuous Memory less channel Error Correcting codes: Hamming sphere, hamming distance and Hamming bound, relation between minimum distance and error detecting and correcting capability , Linear block codes, encoding & syndrome decoding; Cyclic codes, encoder and decoders for systematic cycle codes; convolution codes, code tree & Trellis diagram, Viterbi & sequential decoding, burst error correction, Turbo codes.

**TEXT BOOKS:**

1. B.P. Lathi, "Modern Digital and Analog communication Systems", 4th Edition, Oxford University Press, 2010.

**REFERENCE BOOKS:**

- 1.H. Taub, D L Schilling, GoutomSaha, "Principles of Communication", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd.
2. John G. Proakis, "Digital Communications", 4th Edition, McGraw-Hill International.
3. Simon Haykin, "Communication Systems", 4th Edition, Wiley India.



**EC-P-507 MICROPROCESSOR& MICROCONTROLLER LAB**

**LIST OF EXPERIMENT**

1. Study the hardware, functions, memory structure and operation of 8085 microprocessor kit.
2. Program to perform integer division: (i) 8-bit by 8-bit (ii) 16-bit by 8-bit.
3. Transfer of a block of data in memory to another place in memory in the direct and reverse order.
4. Searching a number in an array and finding its parity.
5. Sorting of array in: (i) Ascending (ii) Descending order
6. Programme to perform following conversion: (i) BCD to ASCII (ii) BCD to Hexadecimal
7. Programme to multiply two 8-bit numbers.
8. Programme to generate and sum 15 fibanocci numbers.
9. Programme for rolling display of message "INDIAN".
10. To insert a number at correct place in a sorted array.
11. Serial and Parallel data transfer on output port 8155 & 8255 & designing of disco light, running light, and sequential lights on off by above hardware.
12. Generation of different waveform on 8253/ 8254 programmable timer.



**EC-P-508 INDUSTRIAL ELECTRONICS LAB**

**LIST OF EXPERIMENT:-**

1. Study the characteristics of SCR.
  - 1.1 Observe the terminal configuration.
  - 1.2 Measure the breakdown voltage.
  - 1.4 Measure latching and holding current.
  - 1.4 V-I characteristics.
2. Perform experiment on triggering circuits for SCR.
  - 2.1 R-triggering circuit.
  - 2.2 R-C triggering circuit.
  - 2.3 UJT triggering circuit.
3. Study and obtain the characteristics of Diac
4. Study and obtain the waveforms for single-phase half-wave controlled converter.
5. Study and obtain the waveforms for single-phase half controlled symmetrical and asymmetrical bridge converters.
6. Study and obtain the waveforms for single-phase fully controlled bridge converter.
7. Study and obtain the waveforms for voltage-commutated chopper.
8. Study and obtain the waveforms for current-commutated chopper.
9. Perform experiment on single phase PWM inverter.
10. Perform experiment on buck, boost and buck-boost regulators.
11. Perform experiment on Motor control – open loop & closed loop.



**EC-P-509 DIGITALCOMMUNICATION LAB**

**LIST OF EXPERIMENT**

1. (a) To observe sampling of analog signal. Identify & solve the aliasing problem.  
(b) To observe the Transmission of two signals over a single channel using sampling methods.
2. TDM-PAM: Modulation & demodulation.
3. Operation of a PCM encoder & decoder.
4. TDM-PCM: Modulation & demodulation.
5. Observe the performance of a Delta modulation system & to derive from it a delta sigma modulation system.
6. To generate and study the various data formatting schemes (Unipolar, Bipolar, Manchester, AMI etc.).
7. Generate ASK signals, with and without carrier suppression. Demodulation of these two types of modulated signal.
8. Generate the FSK wave forms & demodulate the FSK signals based on the properties of  
(a) Tuned circuits (b) PLL
9. Generate the PSK signals and demodulate it.

**Simulation using any virtual Instrumentation Software:**

10. To carry out convolution in both continuous time and discrete time systems.
11. Companding and multiplexing of PCM signals.
12. Perform various keying Techniques: PSK, ASK, FSK & MSK.



## **Semester-VI**

### **EC- 602 CONTROL SYSTEM**

**UNIT 1: CONTROL SYSTEMS ANALYSIS AND COMPONENTS:** Examples and application of open loop and close loop systems. Brief idea of multivariable control system, Brief idea of Z-transform and digital control systems. Differentialequations. Determination of transfer function by block diagram reduction technique & signal flow graph method.

**UNIT 2: TIME RESPONSE ANALYSIS OF FIRST ORDER & SECOND ORDER SYSTEMS:** Transient response analysis. Steady state error & error constants. Dynamic error and dynamic error coefficient, Performance Indices.

**UNIT 3: FREQUENCY DOMAIN METHODS:** Bode plot, Design specification in frequency domain and their co-relation with time domain.

**UNIT 4: STABILITY OF THE SYSTEM:** Absolute stability and relative stability. Routh's stability criterion, Hurwitz criterion. Root locus method of analysis. Polar plots, Nyquist stability criterion. M and N loci, Nicholas charts.

**UNIT 5: STATE VARIABLE ANALYSIS:** Concepts of state, state variable and state model. State models for linear continuous time systems. Brief idea of state variable analysis in discrete time domain. Transfer functions, Solution of state equation. Concepts of controllability & observability

#### **TEXTBOOKS:**

1. Control System Engineering, S Palani, TMH
2. Control Systems, Manjita Srivastava, Mahesh Srivastava, Smriti Bhatnagar, TMH
3. Schaum's Outline Of Feedback And Control Systems, Allen Stubberud, Ivan Williams, Joseph Distefano, TMH

#### **REFERENCE BOOKS:**

1. Control Systems: Principles & Design, M. Gopal, TMH
2. Control Systems Engineering, S. K. Bhattacharya, Pearson
3. Design Feedback Control System, Stefani, Oxford
4. Systems And Control, Zak, Oxford
5. Automatic Control Systems, B. C. Kuo, Wiley
6. Control Systems Engg., Norman S. Nise, Wiley



## **EC-603: ANTENNA AND WAVE PROPAGATION**

**UNIT 1: RADIATION:** Retarded potentials, radiation from an oscillation dipole in free space, induction and radiation fields. Radiated power from a current element, radiation resistance, short antennas, radiation from a quarter wave monopole and half wave dipole.

**UNIT 2: ANTENNA FUNDAMENTALS:** Reciprocity properties of antennas, radiation patterns, directional properties of dipole antennas. Antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, antenna temperature and signal to noise ratio.

**UNIT 3: ANTENNA ARRAYS:** Various forms of arrays, Arrays of two point sources, linear arrays of n-point sources, pattern multiplication Arrays of equal amplitude and spacing (Broadside and end fire arrays), array factor, directivity and beam width, Binomial array.

**UNIT 4: PRACTICAL ANTENNAS:** VLF and LF antennas (Hertz and Marconi antennas), effects of antenna height and effect of ground on performance of antenna, medium frequency antenna and Rhombic antennas, Loop antennas, receiving antenna and radio direction finders. VHF, UHF and SHF antennas: Folded dipole antennas, Yagi-uda antenna, slotted and horn antennas, microwave dish, helical antennas, frequency independent antennas, turnstile antenna, microstrip antennas, fractal antennas.

## **UNIT 5: WAVE PROPAGATION**

Characteristics for ground wave propagation, reflection at the surface of a finitely conducting plane, earth (on ground), Attenuation Calculation of field strength at a distance, IONOSPHERE PROPAGATION: The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, Fading and Diversity reception, ordinary and extraordinary waves. SPACE WAVE



**Raffles University, Neemrana**  
**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

PROPAGATION: Space wave, range and effect of earth, Troposphere waves-reflection, refraction, duct propagation, Troposphere scatter propagation link

**TEXT BOOK**

1. J.D. Kraus, "Antennas, "McGraw Hill.
2. C.A. Balanis "Antennas Theory and Design", Willey
3. K D Prasad "Antenna & Wave Propagation"

**REFERENCE BOOK**

1. E.C. Jordan & B.C. Balmain, " Electromagnetic waves & radiating System", P.H.I.
2. R.E. Collins, 'Antennas and Radio Propagation ', McGraw-Hill, 1987



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**EC- 604 :VLSI DESIGN**

**UNIT 1.INTRODUCTION:** Introduction to Computer-aided design tools for digital systems. Hardware description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, and Logical operators. Types of delays, Entity and Architecture declaration Introduction to behavioral, dataflow and structural models

**UNIT 2.VHDL STATEMENTS:** Assignment statements, Sequential Statements and Process, Conditional Statements, Case Statements, Array and Loops, Resolution Functions, Packages & Libraries, Concurrent Statements.

**UNIT 3.APPLICATIONS OF VHDL:** Combinational Circuit Design such as such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc., Sequential Circuit Design such as Shift registers, Counters etc.

**UNIT 4.REVIEW OF MOS DEVICES:** MOS Structure, Enhancement & Depletion Transistor, Threshold Voltage, MOS device design equations MOS Transistor Models. NMOS, PMOS, CMOS.

**UNIT 5.BASIC ELECTRICAL PROPERTIES AND CIRCUIT CONCEPTS:** The NMOS Inverter and Transfer Characteristics pull up and pull down ratios of NMOS, alternative forms of pull up the CMOS Inverter and transfer characteristics. CMOS Inverter Delays. Driving large Capacitive loads, Propagation delays and effect of wiring capacitance.Circuit Characterization and Performance Estimation: Estimation of R, C, L, Switching Characteristics-delay models. Power dissipation.Scaling of MOS circuits.Effect of device scaling on circuit performance.

**TEXT BOOKS:**

1. —A VHDL Primer: Bhasker; Prentice Hall 1995.
2. Weste and Eshraghian, —Principle of CMOS VLSI Design: Pearson Education, 2001.

**REFERENCE BOOKS:**

1. Pucknell D A and Eshraghian K, —Basic VLSI Design: Prentice Hall India, New Delhi (2003).
2. Fundamentals of Digital Logic with VHDL Design: Brown and Vranesic; TMH(2000)
3. S. M. Kang, Y. Leblebici, —CMOS digital integrated circuits analysis & design: TMH, 3rd Edition.



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**Department of Electronics and Communication Engineering**

**EC- 605 :WIRELESS COMMUNICATION**

**UNIT 1. INTRODUCTION:** Evolution of wireless communication systems, Examples of wireless communication systems.

**UNIT 2. THE CELLULAR CONCEPT – SYSTEM DESIGN FUNDAMENTALS:** Concept of frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and grade of service, Improving coverage and capacity in cellular systems.

**UNIT 3. PROPAGATION MODELS:** Free space propagation model, Two-ray ground reflection model, Distance power loss, Macrocell propagation model, Micro-cell propagation model, Shadowing model, Multipath effects in mobile communication, Models for multipath reception.

**UNIT 4. EQUALIZATION, DIVERSITY AND CHANNEL CODING:** Fundamentals of equalization, Adaptive equalizers, Linear and nonlinear equalization, Algorithms for adaptive equalization, Diversity techniques, Fundamentals of channel coding, Overview of error detection and correction codes.

**UNIT 5. MULTIPLE ACCESS TECHNIQUES:** Introduction to multiple access, Frequency division multiple access, Time division multiple access, Spread spectrum multiple access, Space division multiple access, Packet radio, Orthogonal frequency division multiple access; Introduction to wireless systems and standards.

**TEXT BOOK:**

1. Wireless Communications: Principles and Practice by Theodore S. Rappaport; Pearson / PHI Publication

**REFERENCE BOOKS:**

1. Wireless Communications and Networks: 3G and Beyond by ItiSahaMisra; TataMcGraw Hill Publication

2. Mobile Cellular Telecommunications: Analog and Digital Systems by William C. Y. Lee; Tata McGraw Hill Publication



## **EC- 606.1 BIOMEDICAL ELECTRONICS**

**UNIT 1. BIOELECTRONICS SIGNAL:** Origins of Bioelectric signals, The Human Body – Overview. The heart and circulatory system. Electrodes, Sensors and Transducers, Bio electric Amplifiers Electrocardiographs Electrocardiogram (ECG), Electromyogram (EMG). Recording Electrodes: Silver/silver Electrodes, Electrodes for ECG, EEG and EMG, Physiological Transducers: Pressure Transducers, Temperature sensors, Pulse sensors.

**UNIT 2. RECORDING AND MONITORING INSTRUMENTS:** Biomedical Recorders: Block diagrams of electrocardiogram phonocardiograph, Electroencephalograph, Electromyography., measurement of heart rate, blood pressure measurement, and temperature measurement respiration rate. Foetal Monitoring System: Methods of monitoring Foetal Heart Rate, Abdomen Foetal Electrocardiogram and Foetal Phonocardiogram. Biomedical Telemetry: Introduction, block diagram and description of single channel/multi channel telemetry systems.

**UNIT 3. IMAGING SYSTEMS:** Introduction, Basic principle and block diagram of x-ray machine, x-ray computed topography (C.T. Scanner) and Nuclear Magnetic resonance (NMR) Topography, Ultrasonic Imaging System: Introduction, medical ultrasound, block diagram of pulse echo-system.

**UNIT 4. THERAPEUTIC AND PHYSIOTHERAPY EQUIPMENTS:** Type of cardiac Pacemakers, Cardiac Defibrillator, Kidney Machine, Short-wave Diathermy, Microwave Diathermy, Ultrasound Therapy unit.

**UNIT 5. PATIENT SAFETY:** Electric shock hazard, leakage currents, Test Instruments for checking safety parameters of Biomedical Equipments.

### **TEXT BOOKS:**

1. R.S.Khandpur. Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi. Simon Haykin: Communication systems - John-Wiley & sons, Inc.
2. Leslie Cromwell, Fred J. Weibell and Erich A. Pferffer. Biomedical Instrumentation and Measurements Prentice Hall of India, New Delhi.

### **REFERENCE BOOKS:**

1. Joseph J Carr & John M Brown – Introduction to Biomedical Equipment Technology, 4th edn., Pearson Education.
2. T. K. Attuwood & D J Pary Smith, Introduction to Bioinformatics, 1999, Pearson



**EC- 606.2 TV & RADAR ENGINEERING**

**UNIT 1.BASICS OF TV:** Theory of Scanning, Blanking, Synchronization, Nature of picture signals line and field frequency, Interlacing, Resolution, Introduction to Display System Technology.

**UNIT 2.TRANSMITTER & RECEIVER:** Modulation system for sound and video, Vestigial side bands, TV transmitter, Receiver response characteristics.

**UNIT 3.COLOR T.V. AND APPLICATIONS:** Operation of color T.V: Hue, Saturation and Luminance, Color signal generation , Color picture tubes (Basic principle), Color television systems, N.T.S.C., PAL and SECAM, Color TV Receiver, Video tape recording, VCR, Merits of Digital Processing, Block Diagram of Digital T.V.

**UNIT 4. BASIC PRINCIPLES OF RADAR SYSTEM:** Radar, Radar frequencies, Application of radar, Radar Equation, Prediction of range, Minimum detectable signal, Receiver noise, Transmitter power, Pulse repetition frequency, Range ambiguity, Antenna parameters, System losses and Propagation effects.

**UNIT 5. DOPPLER EFFECT AND ITS APPLICATIONS& RECEIVERS:** Doppler effect and its application to CW radar, FM CW radar, Radar altimeters, MTI and Pulse Doppler radar, Tracking radar, Navigational Aids.Receivers:Noise figure, Radar mixers, Duplexers, A scope and PPI display, Matched Filter, Modulators and Pulse Forming Networks.

**TEXT BOOKS:**

1. Introduction to Radar Systems, by Merrill. I Skolnik.
2. Monochrome & Colour T.V. by R.R.Gulati.

**REFERENCE BOOKS**

1. Basic Television by G.M.Grobe.
2. Radar Handbook by Merrill Skolnik.



**Raffles University, Neemrana**  
**School of Engineering and Technology**

**Department of Electronics and Communication Engineering**

**EC- 606.3: NEURAL NETWORKS**

**UNIT 1: INTRODUCTION:** Introduction to Neural Networks, Biological basis for NN, Human brain, Models of a Neuron, Directed Graphs, Feedback, Network architectures, Knowledge representation, Artificial intelligence & Neural Networks.

**UNIT 2: LEARNING PROCESSES:** Introduction, Error –Correction learning, Memory –based learning, Hebbian learning, Competitive learning, Boltzmann learning, Learning with a Teacher & without a teacher, learning tasks, Memory, Adaptation.

**UNIT 3: SINGLE LAYER PERCEPTRONS:** Introduction, Least-mean-square algorithm, Learning Curves, Learning rate Annealing Techniques, Perceptron, Perceptron Convergence Theorem.

**UNIT 4: MULTI LAYER PERCEPTRONS:** Introduction, Back-Propagation Algorithm, XOR Problem, Output representation and Decision rule, Feature Detection, Back-Propagation and Differentiation, Hessian Matrix, Generalization.

**UNIT 5: RADIAL-BASIS FUNCTION NETWORKS & SELF-ORGANISING MAPS:** Introduction to Radial basis function networks, Cover's Theorem on the Separability of Patterns, Interpolation Problem, Generalized Radial-Basis function networks, XOR Problem. Self-Organizing map, Summary of SOM Algorithm, Properties of the feature.

**Reference books:**

1. Artificial Neural Networks, Jacek M Zurada, Pws Pub Co
2. Neural Networks: A Classroom Approach, Satish Kumar, TMH
3. Artificial Neural Networks, Christina Ray, TMH
4. Neural Networks For Pattern Reconization, Bishop, Oxford
5. Neural Network In Soft Computing Framework, Swamy, Springer

**Text books:**

1. Fundamentals Of Neural Networks: Architectures, Algorithms And Applications., Fausett, Pearson
2. Learning And Soft Computing: Support Vector Machines, Neural Networks, And Fuzzy Logic Models, Vojislav Kacman, Pearson
3. Fuzzy Logic And Neural Networks:,Chennakesava R, New Age



**Raffles University, Neemrana**  
**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

**EC-P-607 MICROWAVE ENGINEERING LAB**

**LIST OF EXPERIMENT:-**

1. Study of various microwave components and instruments like frequency meter, attenuator, and detector & VSWR meter.
2. Draw V-I characteristics of microwave source like Gunn diode/ Reflex Klystron.
3. Measurement of frequency and wavelength in a rectangular waveguide.
4. Measurement of VSWR (small as well as large values) & reflection coefficient.
5. Measure unknown impedance with smith chart.
6. Draw the following characteristics of Gunn Diode
  - (i) Output power and frequency as a function of voltage
  - (ii) Square wave modulation by PIN diode.
7. Drawing polar pattern of Horn antenna.
8. To observe the action of directional coupler and its use in separating incident & reflected wave.
9. Study of Magic Tee, Circulator, and isolator
10. Study of spectrum analyzer & its use in observing the response of
  - (i) High frequency amplifier
  - (ii) Low pass, high pass, band pass, band reject filters.



**EC-P-608 VLSI DESIGNLAB**

**LIST OF EXPERIMENTS:**

**Combinational Design Exercises**

1. Design of basic Gates: AND, OR, NOT.
2. Design of universal gates
3. Design of 2:1 Mux using other basic gates
4. Design of 2 to 4 Decoder
5. Design of Half-Adder, Full Adder, Half Subtractor, Full Subtractor
6. Design of 3:8 Decoder
7. Design of 8:3 Priority Encoder
8. Design of 4 Bit Binary to Grey code Converter
9. Design of 4 Bit Binary to BCD Converter using sequential statement
10. Design an 8 Bit parity generator ( with for loop and Generic statements)
11. Design of 2's Complementary for 8-bit Binary number using Generate statements

**Sequential Design Exercises**

12. Design of all type of Flip-Flops using ( if-then-else) Sequential Constructs
13. Design of 8-Bit Shift Register with shift Right, Rhsift Left, Load and Synchronous reset.
14. Design of Synchronous 8-bit Johnson Counter.
15. Design of Synchronous 8-Bit universal shift register ( parallel-in, parallel-out) with 3-state output ( IC 74299)
16. Design of 4 Bit Binary to BCD Converter using sequential statement.
17. Design counters (MOD 3, MOD 5, MOD 8, MOD 16)
18. Design a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.
19. Design 3-line to 8-line decoder with address latch



**Raffles University, Neemrana**  
**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

**EC-P-609 WIRELESS COMMUNICATION**

**LIST OF EXPERIMENTS:**

1. Active and Passive Microwave and Microstrip Devices
2. Advanced Modulation Formats
3. Optical Communication
4. Line coding techniques



## **Semester VII**

### **EC- 701: INFORMATION THEORY AND CODING**

**UNIT 1. MEASURES OF INFORMATION AND CHANNEL CAPACITY:** Entropy, Relative Entropy And Mutual Information. Basic Inequalities :Jensen Inequality And Its Physical Application, Log-Sum Inequality And Its Physical Application, Fano Inequality And Its Physical Application, Data Processing Theorem And Its Physical Application, Consequences Of The Inequalities In The Field Of Information Theory.

**UNIT 2. ENTROPY RATE AND CHANNEL CAPACITY:** Stationary Markov Sources: Entropy Rate And Data Compression. Definition Of Capacity And Its Computation Of Discrete Memory Less Channels(BNC, BSC, BEC, Cascaded Channels, Noiseless Channels, Noisy Typewriter), The Channel Coding Theorem And The Physical Significance Of Capacity.

**UNIT 3. DATA COMPRESSION BY FIXED-TO-VARIABLE-LENGTH CODES:** Unique Decodability And The Prefix Condition. Kraft Inequality, Relationship Of Average Codeword Length To Source Entropy. Examples Of Coding Techniques: Huffman, Shannon-Fano-Elias, Lempel-Ziv, Universal.

**UNIT 4. DESIGN OF LINEAR BLOCK CODES:** Introduction Of Linear Block Codes, Syndrome And Error Detection, Minimum Distance Of A Block Code, Error Detecting And Error Correcting Capability Of A Block Code, Design Of Encoder And Syndrome Decoder For Linear Block Codes.

**UNIT 5. DESIGN OF CYCLIC CODES & CONVOLUTIONAL CODES:** Description Cyclic Codes, Generator And Parity Check Matrices Of Cyclic Codes, Encoding Of Cyclic Codes, Syndrome Computation And Error Detection, Decoding Of Cyclic Codes, Cyclic Hamming Codes. Convolutional Codes: Encoding Of Convolutional Codes, Structural Properties Of Convolutional Codes, Distance Properties Of Convolutional Codes, Design Of Encoder And Decoder For Convolutional Codes.

### **TEXTBOOKS**

1. T.M. Cover and J.A. Thomas, Elements of Information Theory, John Wiley (1991).
2. Shu Lin, Daniel J. Costello, Jr., Error Control Coding(2005).



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**REFERENCE BOOKS**

1. R.G. Gallager, Information Theory and Reliable Communication, Wiley (1968).For Discrete Memory less Systems, Academic Press (1981).
2. R.J. McEliece, The Theory of Information and Coding, Addison-Wesley (1977).



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**EC- 702 : DIGITAL SIGNAL PROCESSING**

**UNIT 1.DISCRETE-TIME SIGNALS AND SYSTEMS:** Basic elements of a digital signal processing system, Advantages of digital signal processing, Classification of signals, The concept of frequency in continuous-time and discrete-time domain, Discrete-time signals and systems, Analysis of discrete-time linear shift-invariant systems, Linearity, Causality and stability criterion, Discrete-time systems described by difference equations.

**UNIT 2.DISCRETE-TIME FOURIER TRANSFORM:** The Fourier transform of discrete-time signals (DTFT), Properties of the DTFT, The frequency response of an LTI discrete-time system, Sampling and reconstruction of signals.

**UNIT 3.DISCRETE FOURIER TRANSFORM:** Frequency domain sampling and the DFT, Properties of the DFT, Linear filtering methods based on the DFT, Efficient computation of the DFT: Decimation-in-time and decimation-in-frequency fast Fourier transform algorithms.

**UNIT 4.Z-TRANSFORM:** Introduction to the  $z$ -transform & the inverse  $z$ -transform, Properties of the  $z$ -transform, Relationship between the Fourier transform and the  $z$ -transform, Rational  $z$ -transforms & the system function, Analysis of linear time-invariant systems in the  $z$ -domain.

**UNIT 5.DIGITAL FILTER STRUCTURES AND DESIGN :** Digital filter categories, Realization structures for FIR & IIR digital filters, Implementation of digital filters. filter design General considerations, Review of analog filter design, Design of IIR digital filters: IIR digital filter design using the impulse invariance method and the bilinear transformation method, Design of linear phase FIR digital filters: FIR digital filter design using the windows method and the frequency-sampling method.

**TEXT BOOKS:**

1. Digital Signal Processing: Principles, Algorithms and Applications by John G. Proakis & Dimitris G. Manolakis; Pearson Education
2. Digital Signal Processing by Sanjit K. Mitra; Tata McGraw Hill Publication

**REFERENCE BOOKS:**

1. Digital Signal Processing by Alan V. Oppenheim & Ronald W. Schaffer; PHI Publication.
2. Theory & Application of Digital Signal Processing by Rabiner & Gold; PHI Publication



### **EC- 703: OPTICAL COMMUNICATION SYSTEM**

**UNIT 1.OVERVIEW:** The Electromagnetic Spectrum, Properties of Light, Dual Nature of Light Concept of a photon, Wave Model, Characteristics of light waves. Concepts of information, general communication systems, evolution of Basic Fiber Optic Communication System, Benefits and disadvantages of Fiber Optics.Transmission Windows. Transmission Through Optical Fiber, The Laws of Reflection and Refraction, Light rays and light waves, Reflection of light from optical surfaces, Refraction of light from optical interfaces, The Numerical Aperture (NA), The Optical Fiber, Types of Fiber.

**UNIT 2. LOSSES IN OPTICAL FIBER:** Attenuation, Material absorption losses, linear and non linear scattering losses, fiber bend loss, dispersion viz. inter modal dispersion and intra modal dispersion, overall fiber dispersion and polarization, Dispersion shifted and dispersion flattened fibers, attenuation and dispersion limits in fibers, Kerr nonlinearity, self phase modulation, combined effect of dispersion and self-phasesmodulation.

**UNIT 3. FIBER MATERIAL, COUPLERS AND CONNECTORS:** Preparation of optical fiber: liquid-phase techniques, vapor phase deposition techniques, Connector Principles, Fiber End Preparation, splices, connectors.

**UNIT 4. OPTICAL SOURCES AND DETECTORS:** Sources: Basic principle of surface emitter LED and edge emitter LED- material used, structure, internal quantum efficiency and characteristics, LASER Diode - material used, structure, internal quantum efficiency and characteristics, working Principle and characteristics of Distributed feedback (DFB) laser. Detectors: PIN photodiode - material used, working principle &characteristics, Avalanche Photodiode: - material used, working principle and characteristics

**UNIT 5. ADVANCED TOPICS:** Optical TDM, SCM, WDM and Hybrid multiplexing methods, Fiber Optic Networks, Trans-ceivers for Fiber-Optic Networks, Semiconductor Optical Amplifiers, Erbium Doped Fiber Amplifiers (EDFAs).

#### **TEXT BOOKS:**

1. Optical Fiber Communication Principles & Practice by John M.Senior, PHI Publication
2. Optical Communication Systems by John Gowar, PHI Publications.

#### **REFERENCE BOOKS:**

1. Optical Fiber Communication by Gerd Keiser, McGraw Hill International Publications.
2. Fundamentals of Fibre Optics in Telecommunication and sensor systmes by BishnuP.Pal.



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**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

**EC-704: MOBILE COMMUNICATION**

**UNIT 1. INTRODUCTION:** Basic cellular systems, Performance criteria, Uniqueness of mobile radio environment, Operation of cellular systems, Concept of frequency reuse channels, Co-channel interference reduction factor, Desired C/I from a normal case in an omnidirectional antenna system, Handoff mechanism, Cell splitting.

**UNIT 2. CELL COVERAGE FOR SIGNAL AND TRAFFIC:** General introduction, Obtaining the mobile point-to-point model, Propagation over water or flat open area, Foliage loss, Propagation in near-in distance, Long-distance propagation, Obtain path loss from a point-to-point prediction model, Cell-site antenna heights and signal coverage cells.

**UNIT 3. COCHANNEL AND ADJACENT-CHANNEL INTERFERENCE:** Cochannel interference, Design of an omnidirectional antenna system in the worst case, Design of a directional antenna system, Lowering the antenna height, Power control, Diversity receiver, Adjacent-channel interference, Near-end – far-end interference, Effect on near-end mobile.

**UNIT 4. FREQUENCY MANAGEMENT, CHANNEL ASSIGNMENT AND HANDOFFS:** Frequency management, Frequency-spectrum utilization, Set-up channels, Definition of channel assignment, Fixed channel assignment schemes, Non-fixed channel assignment schemes, Concept of handoff, Initiation of a hard handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff, Soft handoffs, Cell-site handoff only, Intersystem handoff.

**UNIT 5. DIGITAL CELLULAR SYSTEMS:** Global system for mobile: GSM system architecture, GSM radio subsystem, GSM channel types, Frame structure for GSM, Signal processing in GSM; GPRS; EDGE; CDMA digital cellular standard: Frequency and channel specifications, Forward CDMA channel, Reverse CDMA channel; Overview of 3G network.

**TEXT BOOKS:**

1. Mobile Cellular Telecommunications: Analog and Digital Systems by William C. Y. Lee; Tata McGraw Hill Publication
2. Wireless Communications: Principles and Practice by Theodore S. Rappaport; Pearson.



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**REFERENCE BOOKS:**

1. Wireless Communications and Networks: 3G and Beyond by ItiSahaMisra; Tata McGraw Hill Publication
2. Wireless and Digital Communications by Dr. KamiloFeher; PHI Publication.



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**EC- 705.1: MICRO ELECTRONICS**

**UNIT 1.INTRODUCTION:** Advantages of IC's, General classification of IC's(Linear/Digital IC's ,Monolithic/ Hybrid IC's), Basic IC fabrication steps.

**UNIT 2.CRYSTAL GRTOWTH AND EPITAXY:** Starting material for formation of crystal, Horizontal Bridgeman Method, Czochralski growth, Distribution of dopants, Zone refining, Silicon Float Zone process, Si-Wafer preparation, Epitaxial growth, Techniques used for epitaxial growth(LPE,VPE,MBE)

**UNIT 3.SILICON OXIDATION:** Thermal oxidation process (Kinetics of growth , Thin oxide growth), Effect of impurities on the oxidation rate, Preoxidation Cleaning, Various oxidation techniques, Masking properties of SiO<sub>2</sub> , IV PHOTOLITHOGRAPHY AND ETCHING, Pattern generation/Mask making, Contact and Proximity printing, Photoresistsl, Photolithography Process(Lift off technology , Fine line photolithography), Wet/Dry etching, Reactive Plasma etching techniques and applications

**UNIT 4.DIFFUSION:** Basic diffusion process(Diffusion equation, Diffusion profiles), Extrinsic diffusion, Lateral Diffusion,

**UNIT 5.ION IMPLANTATION:**Process (Ion distribution , Ion Stopping), Implant Damage and Annealing process (Furnace and RTA), VI IC PACKAGING, Isolation Techniques, Testing of the Chip, Wire Bonding techniques, Flip Chip technique, Various Packaging methods and Materials, VII FABRICATION OF MONOLITHIC COMPONENTS, Fabrication of Diodes, Resistors, capacitors and inductors, Fabrication of BJT and FET, Fabrication of MOS Devices , CMOS fabrication techniques(n-well and p-well process sequences), Introduction to MEMS.

**TEXT BOOKS:**

1. Fundamental of Semiconductor Fabrication:GrayS.May and Simon M.Sze
2. VLSI Technology :Sze.

**REFERENCE BOOKS:**

1. Microelectronics: Jacob and Millman



**EC- 705.2 : SATELLITE COMMUNICATION**

**UNIT 1. AN OVERVIEW OF SPACE AND SATELLITE:** Introduction, Basic Definition, Brief History, Satellite in Orbit, Kepler's Law, Orbital Parameters, Orbital Perturbations, Station Keeping, Coverage and Slot Range, Geo Stationary & Non Geo Stationary Orbits, Sun Transit Outrage, Eclipses , Sub Satellite Point. Space Radio Communication, Frequency Selection, Communication Subsystems and Spacecraft, Frequency Plans, Transponder.

**UNIT 2.SATELLITE LINK DESIGN:** Basic Need of Satellite & Ground Station, Basic Transmission Theory, Single Conversion Transponder, Transponder Assignment within the Satellite

**UNIT 3. SYSTEM NOISE TEMPERATURES:** Noise Sources, Effective Noise Temperatures, Noise Figure Of Cascade Network, Noise Due to Lossy Network, System Noise Temperature, Figure Of Merit, (G/T Ratio), Calculations For The Overall Carrier To Noise Ratio (C/N).

**UNIT 4. DESIGN ASPECTS OF SATELLITE RECEIVER:**Low Noise Amplifier, Mixer, L.O., I.F. Amplifier, Demodulator.

**UNIT 5. GPS:** Basic Principles of GPS Operations: Ranging From Space; Satellite, Control and User Segments; GPS Satellite Navigation Message; GPS Time, Fundamental and Derived Frequencies.

**TEXTBOOKS:**

1. D. Roddy, Satellite Communication, McGraw Hill International, 4th Edition, 2006.
2. T. Pratt, and C.W. Boston, Satellite Communication, John Wiley & Sons.
3. W. L. Pritchard, H. G. Snyderhoud, R. A. Nelson, ' Satellite Communication Systems Engineering ', Prentice Hall/Pearson, 2007.

**REFERENCE BOOKS:**

1. N. Agarwal, 'Design of Geosynchronous Space Craft, Prentice Hall, 1986.
2. Bruce R. Elbert, 'The Satellite Communication Application' Hand Book, ArtechHouseBoston London, 1997.



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**EC-705-3: ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**

**UNIT1: Introduction to Artificial Intelligence:** Intelligent Agents, State Space Search, Uninformed Search, Informed Search, TwoPlayers Games, Constraint Satisfaction Problems.

**UNIT2 : Knowledge Representation:** Knowledge Representation And Logic, Interface in Propositional Logic, First OrderLogic, Reasoning Using First Order Logic, Resolution in FOPL.

**UNIT 3 KNOWLEDGE ORGANIZATION:** Rule based System, Semantic Net, Reasoning in Semantic Net Frames, Planning.

**UNIT 4 : KNOWLEDGE SYSTEMS:** Rule Based Expert System, Reasoning with Uncertainty, Fuzzy Reasoning.

**UNIT 5 KNOWLEDGE ACQUISITION:** Introduction to Learning, Rule Induction and Decision Trees, Learning Using neuralNetworks, Probabilistic Learning Natural Language Processing.

**Reference books :**

- 1 James A Anderson, An introduction to Neural Networks. Bradford Books 1995
- 2 Dan. W Patterson, Artificial Intelligence and Expert Systems, PHI 1990
- 3 Kumar Satish, "Neural Networks" Tata McGraw Hill 2004
- 4 S. Rajsekaran& G.A. VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India. 2006
- 6 SimanHaykin, "Neural Netowrks" Prentice Hall of India 1990.

**Text books :**

1. Elaine Rich and Kevin Knight, Artificial Intelligence 3/e, TMH (1991)
2. PADHY: ARTIFICIAL INTELLIGENCE & INTELLIGENT SYSTEMS, Oxford(2005)



**EC-P-706 DIGITAL SIGNAL PROCESSING**

**LIST OF EXPERIMENTS:**

**Perform the following exercises using MATLAB**

1. To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
2. Write a program in MATLAB to generate standard sequences.
3. Write a program in MATLAB to compute power density spectrum of a sequence.
4. To develop program modules based on operation on sequences like signal Shifting, signal folding, signal addition and signal multiplication.
5. Write a program in MATLAB to verify linear convolution.
6. Write a program in MATLAB to verify the circular convolution.
7. To develop program for finding magnitude and phase response of LTI system Described by system function  $H(z)$ .
8. To develop program for finding response of the LTI system described by the difference equation.
9. To develop program for computing inverse Z-transform.
10. To develop program for computing DFT and IDFT.
11. To develop program for conversion of direct form realization to cascade form realization.
12. To develop program for cascade realization of IIR and FIR filters.
13. To develop program for designing FIR and IIR filter.
14. To write a MATLAB program for noise reduction using correlation and autocorrelation methods.
15. To write a MATLAB programs for pole-zero plot, amplitude, phase response and impulse response from the given transfer function of a discrete-time causal system.
16. Write a program in MATLAB to find frequency response of different types of analog filters.
17. Write a program in MATLAB to design FIR filter (LP/HP) through Window technique (a). Using rectangular window (b). Using triangular window



**Raffles University, Neemrana**  
**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

**EC-P-707 OPTICAL COMMUNICATION LAB**

**LIST OF EXPERIMENTS:-**

1. Study and measurement of attenuation and loss in optical fiber.
2. Study and measurement of bending loss in optical fiber.
3. Study and measurement of numerical aperture of optical fiber.
4. Measurement of optical power using optical power meter.
5. To Study the transmission of TDM signal through optical fiber.
6. To determine the bit rate of the optical fiber link.
7. Study of various multiplexing techniques.



## **Semester-VIII**

### **EC- 801 IMAGE PROCESSING**

**UNIT 1. DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS:** Elements of visual perception, Image sampling and quantization, Basic relationship between pixels, Basic geometric transformations, Introduction to Fourier Transform and DFT, Properties of 2-D Fourier Transform , FFT, Separable Image Transforms, Walsh– Hadamard, Discrete Cosine Transform, Haar Transform, Slant – Karhunen – Loevetransforms.

**UNIT 2. IMAGE ENHANCEMENT TECHNIQUES:** Spatial Domain methods: Basic grey level transformation, Histogram equalization, Image subtraction, Image averaging, Spatial filtering: Smoothing, Sharpening filters, Laplacian filters, Frequency domain filters: Smoothing, Sharpening filters, Homomorphic filtering.

**UNIT 3. IMAGE RESTORATION:** Model of Image Degradation/Restoration process, Noise models, Inverse filtering, Least mean square filtering, Constrained least mean square filtering, Blind image restoration, Pseudo inverse, Singular value decomposition.

**UNIT 4. IMAGE COMPRESSION:** Lossless compression: Variable length coding, LZW coding, Bit plane coding, Predictive coding-DPCM, Lossy Compression: Transform coding, Wavelet coding, Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

**UNIT 5. IMAGE SEGMENTATION AND REPRESENTATION:** Edge detection, Thresholding, Region Based segmentation, Boundary representation: Chain codes, Polygonal approximation, Boundary segments, Boundary descriptors: Simple descriptors, Fourier descriptors, Regional descriptors, Simple descriptors, Texture.

#### **TEXTBOOKS:**

1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing – Pearson Education 2003.

#### **REFERENCE BOOKS:**

1. William K Pratt, Digital Image Processing John Willey (2001)  
2. Image Processing Analysis and Machine Vision by MillmanSonka, Vaclav hlavac, Roger Boyle, Broos/colic, Thompson Larniy (1999).



**Raffles University, Neemrana**  
**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

**EC- 802: COMPUTER NETWORKS**

**UNIT 1. INTRODUCTION:** Introduction, Network Topologies, Wired Vs wireless Networks, LAN, MAN, WAN, Internet, Intranet & Extranet, Connection-Oriented and Connectionless Services, Need of Protocols, TCP/IP reference Model, comparison of OSI & TCP/IP. Bridges, Hubs and Switches, Virtual LANs

**UNIT 2. NETWORK PROTOCOLS:** ALOHA, Carrier Sense Multiple Access Protocols, ARP, RARP, Framing, One-Bit Sliding Window Protocol, Protocol Using Go Back N, Protocol Using Selective Repeat, High-Level Data Link Control (HDLC)

**UNIT 3. CONGESTION CONTROL IN DATA NETWORKS:** Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Effects of Congestion, Load Shedding, Jitter Control, Congestion Control in Packet-Switching Networks

**UNIT 4. ROUTING ALGORITHMS:** The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Ad Hoc Networks, Node Lookup in Peer-to-Peer Networks

**UNIT 5. INTERNETWORK PROTOCOLS:** Internet Protocol & IP Addresses, Principles of Internetworking, Internet Protocol Operation, IPv6, Virtual Private Networks and IP Security

**TEXT BOOKS:**

1. Andrew S. Tanenbaum —Computer Networks, PHI

**REFERENCE BOOKS:**

1. William Stallings —Computer Networking with Internet Protocols And Technology, Pearson Education.
2. Keneth C. Mansfield, Jr. James L. Antonakos —An Introduction to Computer
3. Networking, PHI. . Behrouz A. Forouzan —Data Communications and Networking, McGraw Hill



### **EC- 803.1 MEMS & SENSOR DESIGN**

**UNIT 1. INTRODUCTION TO MEMS:** Introduction to MEMS and Microsystems, Materials and Substrates for MEMS, Sensors/Transducers, Sensors characterization and classifications, microactuators, Application of MEMS.

**UNIT 2. MATERIAL PROPERTIES:** MEMS materials, structural and sacrificial materials, properties of silicon, mechanical, electrical and thermal properties of materials, Basic modeling of elements in electrical and mechanical systems.

**UNIT 3. MEMS FABRICATION:** MEMS Fabrication Technologies, single crystal growth, micro-machining, photolithography, microsterolithography, thin film deposition, impurity doping, diffusion, etching, bulk and surface micromachining, etch stop technique and microstructure, LIGA.

**UNIT 4. MECHANICAL SENSORS & ACTUATORS:** Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures, Cantilever, Pressure sensors, Piezoresistance Effect, Piezoelectricity, Piezo-resistive Sensor, capacitive sensors, Inductive sensors, MEMS inertial sensors, micromachined microaccelerometer for MEMS, Parallel-plate Actuator, piezo-actuators.

**UNIT 5. MAGNETIC SENSORS & THERMAL SENSORS:** Magnetic material for MEMS, magnetic sensing and detection, magnetoresistive sensors, hall effect, magneto-diode, magneto-transistors, MEMS magnetic sensors, RF MEMS. Thermal Sensors: Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors, heat pump, micromachined thermocouple probe, thermal flow sensors, shape memory alloy.

#### **TEXT BOOKS:**

1. Analysis and Design Principles of MEMS Devices by Minhang Bao, ELSEVIER.
2. M. J. Usher, "Sensors and Transducers", McMillian Hampshire.
3. N. P. Mahalik, "MEMS" Tata McGraw Hill

#### **REFERENCE BOOKS:**

1. R.S. Muller, Howe, Senturia and Smith, "Microsensors", IEEE Press.
2. S. M. Sze, Semiconductor Sensors, Wiley –Interscience Publications



## **EC- 803.2 WIRELESS SENSOR NETWORKS**

**UNIT 1. INTRODUCTION:** Wireless sensor networks: the vision, Networked wireless sensor devices Applications of wireless sensor networks, Key design challenges

**UNIT 2. NETWORK DEPLOYMENT:** Structured versus randomized deployment, Network topology, Connectivity in geometric random graphs, Connectivity using power control, Coverage metrics, Mobile deployment

**UNIT 3. LOCALIZATION AND TIME SYNCHRONIZATION:** Key issues, Localization approaches, Coarse-grained node localization using minimal information, Fine-grained node localization using detailed information, Network-wide localization, Theoretical analysis of localization techniques, Key issues of time synchronization, Traditional approaches, Fine-grained clock synchronization, Coarsegrained data synchronization

**UNIT 4. WIRELESS CHARACTERISTICS AND MEDIUM-ACCESS:** Wireless link quality, Radio energy considerations, The SINR capture model for interference, Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, Contention-free protocols.

**UNIT 5. SLEEP-BASED TOPOLOGY CONTROL AND ENERGY-EFFICIENT ROUTING:** Constructing topologies for connectivity, Constructing topologies for coverage, Set K-cover algorithms, Cross-layer issues, Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing, Routing to mobile sinks Data-centric networking: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval The database perspective on sensor networks, Transport reliability and congestion control: Basic mechanisms and tunable parameters, Reliability guarantees, Congestion control, Real-time scheduling

### **TEXT BOOK :**

1. BhaskarKrishnamachari : Networking Wireless Sensors- Cambridge University Press

### **REFERENCE BOOK:**

1. KazemSohraby, Daniel Minoli, TaiebZnati : Wireless Sensor Networks: Technology, Protocols, and Applications- John Wiley & Sons



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**EC- 803.3 VLSI TESTING & TESTABILITY**

**UNIT 1.MOTIVATION:** For testing and design for testability, the problems of digital and analog testing, Design for test, Software testing.

**UNIT 2. FAULTS IN DIGITAL CIRCUITS:** General introduction, Controllability and Observability, Fault models- Stuck-at faults, Bridging faults, intermittent faults

**UNIT 3. DIGITAL TEST PATTERN GENERATION:** Test pattern generation for combinational logic circuits, Manual test pattern generation, Automatic test pattern generation - Roth's D-algorithm, Developments following Roth's D-algorithm, Pseudorandom test pattern generation, Test pattern generation for sequential circuits , Exhaustive, non-exhaustive and pseudorandom 70 test pattern Generation, Delay fault testing

**UNIT 4. SIGNATURES AND SELF TEST:** Input compression Output compression Arithmetic, Reed-Muller and spectral coefficients, Arithmetic and Reed-Muller coefficients, Spectral coefficients, Coefficient test signatures, Signature analysis and Online self test, Testability Techniques: Partitioning and ad hoc methods and Scan-path testing , Boundary scan and IEEE standard 1149.1 ,Offline built in Self Test (BIST), Hardware description languages and test.

**UNIT 5.TEST GENERATION ALGORITHMS:** For combinational logic circuits – fault table, Boolean difference, Pathsensitization, D-algorithm, Podem; Fault simulation techniques – serial single fault propagation, Deductive, Parallel and concurrent simulation; test generation for a sequential logic; Design for testability – Adhoc and structured methods, scan design, partial scan, boundary scan, Pseudo-random techniques for test vector generation and response compression, Built –in-Selftest, PLA test and DFT.

**TEXT BOOKS:**

1. Abramovici, M, Breuer, M.A and Friedman, A.D., Digital systems and Testing and Testable Design, Computer Science Press 1990.

**REFERENCE BOOKS:**

1. VLSI Testing: digital and mixed analogue digital techniques Stanley L. Hurst Pub: Inspec / IEE, 1999



**Raffles University, Neemrana**  
**School of Engineering and Technology**

**Department of Electronics and Communication Engineering**

**EC- 804.1 OPTICAL NETWORKS**

**UNIT 1. INTRODUCTION:** Services, Circuit Switching, Packet Switching, Optical Networks, Optical Layer, Transparency and All Optical Networks, Optical Packet Switching, Transmission Basics, Network Evolution.

**UNIT 2. OPTICAL AMPLIFIERS:** Stimulated Emission, Spontaneous Emission, Erbium Doped Fiber amplifiers, Raman amplifiers, Semiconductor Optical Amplifiers, Cross talk in SOAs.

**UNIT 3. MULTIPLEXERS AND FILTERS:** Gratings, Diffraction Pattern, Bragg Gratings, Fiber Gratings, Fabry-Perot filters, Multilayer Dielectric Thin-Film Filters, Mach-Zehnder Interferometers, Arrayed Waveguide Grating, Acousto-Optic Tunable Filter, High channel Count Multiplexer Architectures, Optoelectronics Approach, Optical Gating, Interferometric Techniques, Wave Mixing.

**UNIT 4. TRANSMISSION SYSTEM ENGINEERING:** System Model, Power Penalty, Transmitter, Receiver, Optical Amplifiers, Cross talk, Dispersion, Fiber Nonlinearities, Wavelength Stabilization Design of Soliton Systems, Design of Dispersion –Managed Soliton Systems.

**UNIT 5. CLIENT LAYERS:** SONET/SDH, ATM, IP, Storage Area Networks, Gigabit and 10-Gigabit Ethernet. Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers, Optical Cross connects. Cost Trade-Offs: A Detailed Ring Network Example, LTD and RWA Problems, Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models, Maximum Load Dimensioning Models Access Networks: Network Architecture Overview, Enhanced HFC, fiber to the Curb (FTTC).

**TEXT BOOKS:**

1. Optical Networks: A practical Perspective. Ramaswami & K.N. Sivarajan.
2. Multi-wavelength Optical Networks: A Layered Approach. Thomas E. Stern and Krishna Bala, Addison Wiley.

**References**

1. Introduction to Optical Fiber Communication Systems-William B. Jones HRW.
2. Optical WDM Network Principles and Practice Edited by K.M. Sivalingam & S. Subramanian, Kluwer Academic Publishers.



# Raffles University, Neemrana

## School of Engineering and Technology

Department of Electronics and Communication Engineering

### EC- 804.2 :ROBOTICS

**UNIT 1. INTRODUCTION:** Definition and Need for Robots, Robot Anatomy, Co-ordinate Systems, Work Envelope, types and classification, Specifications, Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load, Robot Parts and Their Functions, Different Applications

**UNIT 2. SENSORS:** Principles and Applications and need of a sensor, Principles, Position of sensors, Piezo-Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors, Range Sensors, Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters, Proximity Sensors, Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors, Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors,

**UNIT 3. DRIVE SYSTEMS & GRIPPERS FOR ROBOT:** Drives systems (Mechanical, Electrical, Pneumatic Drives, Hydraulic), D.C.Servo Motors, Stepper Motor, A.C. Servo Motors, Comparison of all Drives, End Effectors, Grippers (Mechanical, Pneumatic, Hydraulic, Magnetic, Vacuum Grippers), Two Fingereed and Three Fingereed Grippers, Internal Grippers and External Grippers, Selection and Design Considerations

**UNIT 4. MACHINE VISION:** Camera, Frame Grabber, Sensing and Digitizing Image Data, Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis, Data Reduction, Edge detection, Segmentation Feature Extraction, Object Recognition, Other Algorithms, Applications, Inspection, Identification, Visual Serving and Navigation.

**UNIT 5. ROBOT KINEMATICS & PROGRAMMING:** Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional), Deviations and Problems Teach Pendant Programming, Lead through programming, Robot programming Languages, VAL Programming, Motion Commands, Sensor Commands, End effector commands.

#### TEXT BOOKS:

1. M.P.Groover, —Industrial Robotics – Technology, Programming and Applications, McGraw-Hill, 2001.
2. Ghosal, A., Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2<sup>nd</sup> 2008.

#### REFERNCE BOOKS

1. YoramKoren, —Robotics for Engineers, McGraw-Hill Book Co., 1992.
2. Fu, K., Gonzalez, R. and Lee, C.S. G., Robotics: Control, Sensing, Vision and Intelligence, McGraw- Hill, 1987.



### **EC- 804.3 VLSI INTERCONNECTS & PACKAGING**

**UNIT 1. INTERCONNECTS:** Small, Intermediate and long interconnects in VLSI, Interconnect Parasitics: Resistance, Inductance and Capacitance. Interconnect RC Delays: Elmore Delay Calculation. Interconnect Models: Lumped RC Model, Distributed RC Model, Transmission line model. SPICE Wire Models: Distributed RC lines in SPICE, Transmission line models in SPICE.

**UNIT 2. SCALING ISSUES IN VLSI DEVICES AND INTERCONNECTS:** Scaling and its effect on performance parameters.

**UNIT 3. INTERCONNECT DELAY:** Methods for improving interconnect RC delay

**UNIT 4. CMOS REPEATER DRIVEN INTERCONNECTS:** The Static Behavior- Switching Threshold, Noise Margins, The Dynamic Behavior- Computing the capacitances, Propagation Delay: First order Analysis, Propagation Delay from a Design perspective. Power, energy and Energy-Delay- Dynamic Power Consumption, Static Consumption, Transient analysis of repeater loaded interconnects and analysis of Power Consumption using SPICE

**UNIT 5. TRANSMISSION LINE MODEL OF INTERCONNECTS:** Lossy line, Termination Conditions, Crosstalk and Noise in interconnects, Advanced Interconnect Techniques: Reduced-swing Circuits, Current-mode Transmission Techniques, Clocking of high-speed systems, CNT and Optical Interconnects. Packaging Techniques Introduction to packaging, Package design considerations, VLSI Assembly Techniques, Packaging fabrication technology, THM, Surface Mounting.

#### **TEXT BOOKS:**

1. H.K. Bakoglu, "Circuits, Interconnections & Packaging for VLSI", Addison Wesley Publication Company Inc.
2. A.K. Goel, High-Speed VLSI Interconnections, Wiley Interscience, 2nd Edition, 2007.

#### **REFERENCE BOOKS:**

1. M. A. Elgamel, M. A. Bayoumi, Interconnect Noise Optimization in Nanometer Technologies, Springer
2. Jan M. Rabaey, Analysis and Design of Digital Integrated Circuits– A design Perspective, TMH, 2nd Edition 2003.
3. F.Moll, M.Roca, Interconnection Noise in VLSI Circuits, Kluwer Academic Publishers.



**Raffles University, Neemrana**  
**School of Engineering and Technology**  
**Department of Electronics and Communication Engineering**

**EC-P-805 IMAGE PROCESSING LAB**

**Modeling and simulation using MAT LAB**

1. Realising a given block diagram having multiplier, adder/subtractor and system (Discrete/Continuous) with given Impulse response. Calculating output for given input.
2. To simulate the transmitter and receiver for BPSK
3. To design and simulate FIR digital filter (LP/HP).
4. To design and simulate IIR digital filter (LP/HP).

**DSP Lab using TMS320C6XXX DSP Kits**

5. To study the architecture of TMS320C6XXX DSP kits using Bloom with DSP.
6. To generate wave form (SINE, COSINE, SQUARE & TRIANGULAR).
7. Verification of Sampling Theorem.
8. Verification of linear/circular convolution.
9. To design FIR and FIR digital filter ( LP/HP).



**EC-P-806 ADVANCE ELECTRONICS LAB**

**PSPICE EXPERIMENTS**

1. (a) Transient Analysis of BJT inverter using step input.  
(b) DC Analysis (VTC) of BJT inverter with and without parameters.
2. (a) Transient Analysis of NMOS inverter using step input.  
(b) Transient Analysis of NMOS inverter using pulse input.  
(c) DC Analysis (VTC) of NMOS inverter with and without parameters.
3. (a) Analysis of CMOS inverter using step input.  
(b) Transient Analysis of CMOS inverter using step input with parameters.  
(c) Transient Analysis of CMOS inverter using pulse input.  
(d) Transient Analysis of CMOS inverter using pulse input with parameters.  
(e) DC Analysis (VTC) of CMOS inverter with and without parameters.
4. Transient & DC Analysis of NOR Gate inverter.
5. Transient & DC Analysis of NAND Gate.

**VHDL EXPERIMENTS**

1. Synthesis and simulation of Full Adder.
2. Synthesis and Simulation of Full Subtractor.
3. Synthesis and Simulation of 3 X 8 Decoder.
4. Synthesis and Simulation of 8 X 1 Multiplexer.
5. Synthesis and Simulation of 9 bit odd parity generator.
6. Synthesis and Simulation of Flip Flop (D, and T).