# M .TECH INTEGRATED  ECE (VLSI)

### III SEMESTER

| SUBJECT CODE | NAME OF SUBJECT | TEACHING PERIOD | | | Credit |
|---|---|---|---|---|---|
| | | L | T | P | |
| 03IVL101 | Mathematics-III | 3 | 1 | 0 | 4 |
| 03IVL102 | Electronic Devices & Circuits | 3 | 0 | 0 | 3 |
| 03IVL103 | Circuit Analysis & Synthesis | 3 | 1 | 0 | 4 |
| 03IVL104 | Electronic Measurements & Instru. | 3 | 0 | 0 | 3 |
| 03IVL105 | Electronic Materials and processes | 3 | 1 | 0 | 4 |
| 03IVL106 | Data Structures & Algorithms | 3 | 0 | 0 | 3 |
| 03IVL201 | Electronics Workshop Lab | 0 | 0 | 2 | 1 |
| 03IVL202 | Computer Programming Lab-I | 0 | 0 | 3 | 2 |
| 03IVL203 | Electronics Lab-I | 0 | 0 | 3 | 2 |
| 03IVL204 | Electronic Measurement & Instru. Lab | 0 | 0 | 3 | 2 |
| 03IVL301 | Discipline & Co Curricular activities : | 0 | 0 | 4 | 1 |
| TOTAL | | 18 | 3 | 15 | 29 |

## IV SEMESTER

| SUBJECT CODE | NAME OF SUBJECT | TEACHING PERIOD | | | Credits |
|---|---|---|---|---|---|
| | | L | T | P | |
| 04IVL101 | Mathematics-IV | 3 | 1 | 0 | 4 |
| 04IVL102 | Analog Electronics | 3 | 0 | 0 | 3 |
| 04IVL103 | Digital Electronics | 3 | 1 | 0 | 4 |
| 04IVL104 | Electromagnetic Field Theory | 3 | 1 | 0 | 4 |
| 04IVL105 | Random Variables & Stochastic Process | 3 | 1 | 0 | 4 |
| 04IVL106 | Object Oriented Programming | 3 | 0 | 0 | 3 |
| 04IVL201 | Computer Programming Lab-II | 0 | 0 | 3 | 2 |
| 04IVL202 | Electronics Lab-II | 0 | 0 | 3 | 2 |
| 04IVL203 | Digital Electronics Lab | 0 | 0 | 2 | 1 |
| 04IVL204 | Humanities | 0 | 0 | 2 | 1 |
| 04IVL301 | Discipline & Co Curricular activities | 0 | 0 | 4 | 1 |
| | TOTAL | 18 | 4 | 14 | 29 |

## V SEMESTER

| SUBJECT CODE | NAME OF SUBJECT | TEACHING PERIOD | | | CREDITS |
|---|---|---|---|---|---|
| | | L | T | P | |
| 05IVL101 | Signals & Systems | 3 | 1 | 0 | 4 |
| 05IVL102 | Linear Integrated Circuits | 3 | 0 | 0 | 3 |
| 05IVL103 | Telecommunication Engg. | 3 | 1 | 0 | 4 |
| 05IVL104 | Analog Communication | 3 | 0 | 0 | 3 |
| 05IVL105 | Microwave Engg. -I | 3 | 1 | 0 | 4 |
| 05IVL106 | Advanced Data Structures | 3 | 0 | 0 | 3 |
| 05IVL201 | Electronic Engineering Design Lab | 0 | 0 | 2 | 1 |
| 05IVL202 | Microwave Engg. Lab | 0 | 0 | 3 | 2 |
| 05IVL203 | Communication Lab-I | 0 | 0 | 3 | 2 |
| 05IVL204 | Signal Processing Lab-I | 0 | 0 | 3 | 2 |
| 05IVL301 | Discipline & Co Curricular activities | 0 | 0 | 4 | 1 |
| | TOTAL | 18 | 3 | 15 | 29 |

## VI SEMESTER

| SUBJECT CODE | NAME OF SUBJECT | TEACHING PERIOD | | | CREDITS |
|---|---|---|---|---|---|
| | | L | T | P | |
| 06IVL101 | **Microwave Engg.-II** | 3 | 1 | 0 | 4 |
| 06IVL102 | **Microprocessor and Microcontroller** | 3 | 0 | 0 | 3 |
| 06IVL103 | **Industrial Electronics** | 3 | 1 | 0 | 4 |
| 06IVL104 | **Digital Communication** | 3 | 0 | 0 | 3 |
| 06IVL105 | **Control Systems** | 3 | 1 | 0 | 4 |
| 06IVL106 | **Optimization Techniques** | 3 | 0 | 0 | 3 |
| 06IVL201 | **Communication Lab-II** | 0 | 0 | 2 | 1 |
| 06IVL202 | **Microprocessor Lab** | 0 | 0 | 3 | 2 |
| 06IVL203 | **Unix Shell Programming Lab** | 0 | 0 | 3 | 2 |
| 06IVL204 | **Industrial Electronics Lab** | 0 | 0 | 3 | 2 |
| 06IVL301 | **Discipline & Co Curricular activities** | 0 | 0 | 4 | 1 |
| **TOTAL** | | 18 | 3 | 15 | 29 |

## VII SEMESTER

| CODE | SUBJECT | TEACHING PERIOD | | | CREDITS |
|------|---------|:---:|:---:|:---:|:---:|
| | | L | T | P | |
| 07IVL101 | Antenna & Wave Propagation | 3 | 0 | 0 | 3 |
| 07IVL102 | Digital Signal Processing | 3 | 1 | 0 | 4 |
| 07IVL103 | Wireless Communication | 3 | 0 | 0 | 3 |
| 07IVL104 | IC Technology | 3 | 0 | 0 | 3 |
| 07IVL105 | VLSI Design | 3 | 1 | 0 | 4 |
| 07IVL106 | Operating System | 3 | 0 | 0 | 3 |
| 07IVL107 | Embedded System Design | 3 | 0 | 0 | 3 |
| 07IVL201 | Practical training seminar | 3 | 0 | 2 | 1 |
| 07IVL202 | Signal Processing Lab-II | 0 | 0 | 3 | 2 |
| 07IVL203 | Wireless Communication Lab-I | 0 | 0 | 3 | 2 |
| 07IVL301 | Discipline & Co Curricular activities | 0 | 0 | 4 | 1 |
| | TOTAL | 24 | 4 | 12 | 29 |

## VIII SEMESTER

| CODE | SUBJECT | TEACHING PERIOD | | | CREDITS |
|------|---------|:---:|:---:|:---:|:---:|
| | | L | T | P | |
| 08IVL101 | Computer Networks | 3 | 1 | 0 | 4 |
| 08IVL102 | Radar & TV Engineering | 3 | 1 | 0 | 4 |
| 08IVL103 | Optical Communication | 3 | 0 | 0 | 3 |
| 08IVL104 | VLSI Technology | 3 | 0 | 0 | 3 |
| 08IVL105 | MOS Circuit Design | 3 | 0 | 0 | 3 |
| 08IVL106 | VHDL | 3 | 0 | 0 | 3 |
| 08IVL107 | Digital System Design | 3 | 0 | 0 | 3 |
| 08IVL201 | Project-1 | 0 | 0 | 4 | 2 |
| 08IVL202 | Computer Network Programming Lab | 0 | 0 | 2 | 1 |
| 08IVL203 | Industrial Economics & Management | 0 | 0 | 2 | 1 |
| 08IVL204 | VHDL circuit design lab | 0 | 0 | 2 | 1 |
| 08IVL301 | Discipline & Co Curricular activities | 0 | 0 | 4 | 1 |
| TOTAL | | 21 | 2 | 14 | 29 |

## IX SEMESTER

| SUBJECT CODE | NAME OF SUBJECT | TEACHING PERIOD | | | Credits |
|---|---|---|---|---|---|
| | | L | T | P | |
| 09IVL101 | Analog VLSI Design | 3 | 1 | 0 | 4 |
| 09IVL102 | CMOS RF Circuit Design | 3 | 0 | 0 | 3 |
| 09IVL103 | VLSI Test & Testability | 3 | 1 | 0 | 4 |
| 09IVL104 | Algorithms for VLSI Design Automation | 3 | 1 | 0 | 4 |
| 09IVL105 | Advance Digital Signal Processing | 3 | 1 | 0 | 4 |
| 09IVL106 | Process, Devices & Circuit Simulation | 3 | 0 | 0 | 3 |
| 09IVL201 | Wireless communication lab II | 0 | 0 | 2 | 1 |
| 09IVL202 | Modeling & Simulation  Lab | 0 | 0 | 2 | 1 |
| 09IVL203 | Seminar | 3 | 0 | 0 | 3 |
| 09IVL204 | Project -II | 3 | 0 | 0 | 3 |
| 09IVL301 | Discipline  & co curricular activities | 0 | 0 | 4 | 1 |
| | TOTAL | 24 | 4 | 8 | 31 |

# X<sup>TH</sup> SEMESTER

| S.No. | Code No. | Subject Name | HOURS/WEEK | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | Credit |
| 1 | 10IVL201 | **DESSERTATION:** 1) Continuous Evaluation | 5 | 0 | 0 | 5 |
| | | 2) Project Report | 6 | 0 | 0 | 6 |
| | | 3) Viva Voce | 6 | 0 | 0 | 6 |
| 2 | 10IVL301 | Discipline & Co-Curricular activities | 0 | 0 | 4 | 1 |
| | | **TOTAL CREDITS** | 17 | 0 | 4 | 18 |

## MATHEMATICS-III

# Course/Paper: 03IVL-101
# IVL Semester-III

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

**UNIT3 : 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.

#### Recommended books

1. B.S.Grewal- higher engineering mathematics : Khanna Pub.
2. Chandrika Prasad- Mathematics for engineers
3. Johnson- probability and statistics for engineers, pearson education.
4. gaur and Kaul- engineering mathematics, Vol I & II;JPH

# ELECTRONIC DEVICES & CIRCUITS

# Course/Paper: 03IVL-102
# IVL Semester-III

**UNIT 1 : SEMICONDUCTOR PHYSICS :** Mobility and conductivity, charge densities in a semiconductor, Fermi Dirac distribution, carrier concentrations and fermi levels in semiconductor, Generation and recombination of charges, diffusion and continuity equation, Mass action Law, Hall effect.

**UNIT 2 :** Junction diodes, Diode as a ckt. element, load line concept, clipping and clamping circuits, Voltage multipliers. Construction, characteristics and working principles of UJT

**UNIT 3** : Transistor characteristics, Current components, Current gains: alpha and beta. Operating point. Hybrid model, h-parameter equivalent circuits. CE, CB and CC configuration. DC and AC analysis of CE,CC and CB amplifiers. Ebers-Moll model. Biasing & stabilization techniques. Thermal runaway, Thermal stability.

**UNIT 4** : JFET, MOSFET, Equivalent circuits and biasing of JFET's & MOSFET's. Low frequency CS and CD JFET amplifiers. FET as a voltage variable resistor.

**UNIT 5 : SMALL SIGNAL AMPLIFIERS AT LOW FREQUENCY :** Analysis of BJT and FET, DC and RC coupled amplifiers. Frequency response, midband gain, gains at low and high frequency. Analysis of DC and differential amplifiers, Miller's Theorem. Cascading Transistor amplifiers, Darlington pair. Emitter follower, source follower.

**Recommended books**

1. J.Milliman & C.C. Halkias – Integrated Electronics: TMH
2. Robert Boylestand & L.Nashelsky Electronic devices & circui theory
3. Sedra Smith- Microelectronic Circuits, Oxford Press, India.
4. Rajeev tiwari – "electronic devices & circuits", genius publication.
5. H.P.Tiwari "electronic devices & cuircuit", Ashirwad pub.
6. J.B.Gupta "Electronic Devices & Communication", Katson

# CIRCUIT ANALYSIS & SYNTHESIS

## Course/Paper: 03IVL-103
## IVL Semester-III

**UNIT 1 : NETWORK THEOREMS AND ELEMENTS :**Thevenin's, Norton's, Reciprocity, Superposition, Compensation, Miller's, Tellegen's and maximum power transfer theorems. Networks with dependent sources. Inductively coupled circuits – mutual inductance, coefficient of coupling and mutual inductance between portions of same circuits and between parallel branches. Transformer equivalent, inductively and conductively coupled circuits.
**UNIT 2 :TRANSIENTS ANALYSIS :** Impulse, step, ramp and sinusoidal response Analysis of first order and second order circuits. Time domain & transform domain (frequency, Laplace) analysis. Initial and final value theorems. Complex periodic waves and their analysis by Fourier analysis. Different kind of symmetry. Power in a circuit.
**UNIT 3 : NETWORK FUNCTIONS :** Terminals and terminal pairs, driving point impedance transfer functions, poles and zeros. Procedure of finding network functions for general two terminal pair networks. Stability & causality. Hurwitz polynomial, positive real function.
**UNIT 4 : TWO PORT NETWORKS :** Two port parameters and their interrelations – z-parameters, yparameters, h-parameters, ABCD parameters. Equivalence of two ports, transformer equivalent, interconnection of two port networks. Image parameters. Attenuation & phase shift in symmetrical T and ð networks.
**UNIT 5 : NETWORK SYNTHESIS** : RL & RC networks synthesis, Foster First & Second form, Cauer forms.

**Recommended books**

1. Kuo, Franklin F – Network Analysis and synthesis, II Ed, 1999, John Willy & Sons
2. Desoer, C. and Duh, E.S- E.S. Basic Circuit theory, Mc Graw Hill.
3. Schoum's Outline series on circuit analysis.
4. Chakraborti "circuit theory", dhanpat rai pub.
5. K.M. Soni – circuit theory " S.K. Kataria & Sons"

## ELECTRONIC MEASUREMENTS & INSTRUMENTATION

## Course/Paper: 03IVL-104
## IVL Semester-III

**UNIT 1: ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS: -**

Voltage Measurement – Integrating type Voltmeter (Voltage to frequency Converter), Successive Approximation Type Voltmeter, Ramp type Digital Voltmeter, Digital Multimeter, Q Meter , Digital Frequency Meter.

**UNIT 2: OSCILLOSCOPES:-**Multi input Oscilloscopes. Dual Trace Oscilloscopes, Dual Bea Oscilloscopes, Sampling Oscilloscopes. Analog – Storage Oscilloscope. Principle of Secondary emissions. Digital Storage Oscilloscope – Principle of operation. Waveform reconstruction, Comparison between analog & digital storage Oscilloscope.

**UNIT 3: A.C. BRIDGES: -**Generalized treatment of four arm, A.C. Bridges, Sources & Detectors, Measurement of self inductances with the help of Maxwell's Bridges, Hay's Bridge, Anderson's Bridges De-sauty Bridge for Capacitance Measurement, Wein's Bridge for Capacitance and frequency measurement. Measurement of Earth Resistance.

**UNIT 4: SIGNAL GENERATION:-**Signal Analysis **-** Measurement Technique, Wave Analyzers, Frequency - selective wave analyzer, Heterodyne wave analyzer, Harmonic distortion analyzer, Spectrum analyzer.

**UNIT 5: PROCESS CONTROL:** -Diaphragms, Seismic Accelerometers, Ultrasonic Flow meters, Principle of Optical fibers, Acceptance angle & numerical aperture, Photoelectric Tachometer, Variable reluctance tachometer, stroboscope. Introduction to Programmable logic control

**Recommended books**

1. H.S.Kalsi – "Electronic Tns. & Measurement" TMH
2. W.D.Cooper – "Electronic Tns. & Measurement technique", PHI
3. A.K. Sawhney- "Electrical & Electronic Measurement & ins." Dhanpat Ray Pub.
4. J.B.Gupta "electronic measurement & instrumentation", katson pub.

# ELECTRONIC MATERIALS & PROCESSES

## Course/Paper: 03IVL-105
## IVL Semester-III

**UNIT 1 : DIELECTRIC MATERIALS :** Polarisation phenomenon, spontaneous polarisation, dielectric constant and loss, piezo and ferro electricity.

**UNIT 2 : MAGNETIC MATERIALS:** Dia, para, ferro-ferrimagnetism; soft and hard magnetic materials and their applications.

**UNIT 3 : SEMI CONDUCTOR MATERIALS :** Crystal growth, zone refining, Degenerate and nondegenerate semiconductors, Direct and indirect band gap semiconductors. Electronic properties of silicon, Germanium, Compound Semiconductor, Gallium Arsenide, gallium phosphide & Silicon carbide.

**UNIT 4: CONDUCTIVE & SUPERCONDUCTIVE MATERIALS :** Electrical properties of conductive and resistive materials. Important characteristics and electronic applications of specific conductor &

resistance materials. Superconductor phenomenon, Type I and Type II superconductors and their applications.

**UNIT 5: PASSIVE COMPONENETS & PCB FABRICATION:** Brief study of fabrication methods of fixed and variable type of resistors; capacitors, Inductors, solenoid and toroid, air core, iron core and Ferro core conductors. Printed Circuit Boards – Types, Manufacturing of copper clad laminates, PCB Manufacturing process, Manufacturing of single and double sided PCBs. Surface mount devices – advantages & limitations.

**Recommended books**

1. S.O.Kasap – Principal Of electrical engineering material and process, Mc Graw Hill
2. B.D.Indu – Electrical Engineering Materials. Jain Brothers
3. S.P.Seth and P.V.Gupta – Acourse of electrical engineering materials, Dhanpat rai Pub.
4. preeti maheshwari – electronic material & process, New Age Pub.


# DATA STRUCTURES & ALGORITHMS

## Course/Paper: 03IVL-106
## IVL Semester-III

**UNIT 1 : PERFORMANCE MEASUREMENT :** Space complexity and Time complexity, big oh, omega and theta notations and their significance. Linear Lists **-** Array and linked representation, Singly & Doubly linked lists. Concept of circular linked lists.
**UNIT 2 : ARRAY & MATRICES -** Row and Column Major mapping & representation, irregular 2D array, Matrix operations, Special matrices: diagonal, tri-diagonal, triangular, symmetric. Sparse matrices representation and its transpose.
**UNIT 3 : STACKS -** Representation in array & linked lists, basic operation, Applications of stacks in parenthesis matching, towers of Hanoi etc.
Queues **-** Representation in array & linked lists, applications, circular queues.
**UNIT 4 : TREES -** Binary Tree, representation in array & linked lists, basic operation on binary trees, binary tree traversal (preorder, post order, in order).
Search Trees **-** Binary search tree, indexed-binary search tree, basic operation, AVL tree, B-tree.
**UNIT 5 : GRAPHS -** Representation of un weighted graphs, BFS, DFS, Minimum cost spanning trees, Single source shortest path. Sorting **-** Bubble sort, insertion sort, merge sort, selection sort, quick sort, heap sort.
**Recommended books**

1. Harowitz & Sawhni : Data Structure in pascal (BPB Pub.)
2. Langran , Augensteln & Tenenbaum data structure using C & C++, PHI,
3. Kruse, Leung & Tondo : data structure & Program Design in C, Pearson Education.
4. Prkati trivedi "Data Structure Algorithm",

# ELECTRONICS WORKSHOP LAB

## Course/Paper: 03IVL-201
## IVL Semester-III

1. Identification, Study & Testing of various electronic components :
(a) Resistances-Various types, Colour coding (b) Capacitors-Various types, Coding, (c) Inductors
(d) Diodes (e) Transistors (f) SCRs (g) ICs (h) Photo diode (i) Photo transistor (j) LED (k) LDR
(l) Potentiometers
2. Study of symbols for various Electrical & Electronic Components, Devices, Circuit functions etc.
3. To study and perform experiment on CRO demonstration kit.
4. Soldering & desoldering practice.
5. (a) To Design & fabricate a PCB for a Regulated power supply.

(b) Assemble the Regulated power supply using PCB and test it.
6. To study and plot the characteristics of following Opto-Electronic devices –
(a) LED (b) LDR (C) Photovoltatic cell (d) Opto-coupler
(e) Photo diode (f) Photo transistor (g) Solar cell
7. To study the specifications and working of a Transistor radio kit and perform measurements on it.
8. To study the specifications and working of a Tape Recorder kit.
9. To prepare design layout of PCBs using software tools.
10. To fabricate PCB and testing of electronics circuit on PCB.
11. To design and test regulated power supply using ICs
12. To study the specifications and working of a VCD Player.
13. To study the specifications and working of color TV.

# COMPUTER PROGRAMMING LAB-I

## Course/Paper: 03IVL-202
## IVL Semester-III

**Program in C**
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).

# ELECTRONICS LAB I

## Course/Paper: 03IVL-203
## IVL Semester-III

1. Study the following devices:
(a) Analog & digital multimeters
(b) Function/ Signal generators
(c) Regulated d. c. power supplies (constant voltage and constant current operations)
(d) Study of analog CRO, measurement of time period, amplitude, frequency & phase angle
using Lissajous figures.
2 Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, reverse
Saturation current and static & dynamic resistances.
3 Plot V-I characteristic of zener diode and study of zener diode as voltage regulator.
Observe the effect of load changes and determine load limits of the voltage regulator.
4 Plot frequency response curve for single stage amplifier and to determine gain bandwidth
product.
5 Plot drain current - drain voltage and drain current – gate bias characteristics of field
effect transistor and measure of $I_{dss}$ & $V_p$
6 Application of Diode as clipper & clamper
7 Plot gain- frequency characteristic of two stage RC coupled amplifier & calculate its bandwidth
and
compare it with theoretical value.
8 Plot gain- frequency characteristic of emitter follower & find out its input and output resistances.
9 Plot input and output characteristics of BJT in CB, CC and CE configurations. Find their
hparameters.
10 Study half wave rectifier and effect of filters on wave. Also calculate theoretical & practical ripple
factor.
11 Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple

factor.

# ELECTRONIC MEASUREMENT & INSTRUMENTATION LAB

## Course/Paper: 03IVL-204
## IVL Semester-III

1. Measure earth resistance using fall of potential method.
2. Plot V-I characteristics & measure open circuit voltage & short circuit current of a solar panel.
3. Measure unknown inductance capacitance resistance using following bridges
(a) Anderson Bridge (b) Maxwell Bridge
4. To measure unknown frequency & capacitance using Wein's bridge.
5. Measurement of the distance with the help of ultrasonic transmitter & receiver.
6. Measurement of displacement with the help of LVDT.
7. Draw the characteristics of the following temperature transducers:
(a) RTD (Pt-100) (b) Thermistors (c) Thermocouple
8. Draw the characteristics between temperature & voltage of a K type thermocouple.
9. Measure the speed of a Table Fan using stroboscope.
10. Measurement of strain/ force with the help of strain gauge load cell.
11. Study the working of Q-meter and measure Q of coils.
12. To study the working of Spectrum analyzer and determine the bandwidth of different signals.

**SEMESTER IV**

# MATHEMATICS-IV

## Course/Paper: 04IVL-101
## IVL Semester-IV

**UNIT 1 : NUMERICAL ANALYSIS -** Finite differences – Forward, Backward and Central dfferences.Newton's forward and backward differences, interpolation formulae. Stirling's formula, Lagrange's interpolation formula.

**UNIT 2 : NUMERICAL ANALYSIS- Integration**-Trapezoidal rule, Simpson's one third and three-eighth rules. Numerical solution of ordinary differential equations of first order - Picard's mathod, Euler's and modified Euler's methods, Miline's method and Runga-Kutta fourth order method.,Differentiation

**UNIT 3 : SPECIAL FUNCTIONS –** Bessel's functions of first and second kind, simple recurrence relations, orthogonal property of Bessel's , Transformation, Generating functions, Legendre's function of first kind. Simple recurrence relations, Orthogonal property, Generating function.

**UNIT 4 : STATISTICS AND PROBABILITY -** Elementary theory of probability, Baye's theorem with simple applications, Expected value, theoretical probability distributions-Binomial, Poisson and Normal distributions. Lines of regression, co-relation and rank correlation.

**UNIT 5 : CALCULUS OF VARIATIONS -** Functional, strong and weak variations simple variation problems, the Euler's equation.

**Recommended books**

1. B.S.Grewal- higher engineering mathematics : Khanna Pub.
2. Chandrika Prasad- Mathematics for engineers
3. Johnson- probability and statistics for engineers, pearson education.
4. gaur and Kaul- engineering mathematics, Vol I & II;JPH

# ANALOG ELECTRONICS

## Course/Paper: 04IVL-102
## IVL Semester-IV

.**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, conductances 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 complimentary symmetry amplifiers

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### Recommended books

1. J.Milliman & C.C. Halkias – Integrated Electronics: TMH
2. Robert Boylestand & L.Nashelsky Electronic devices & circui theory
3. Sedra Smith- Microelectronic Circuits, Oxford Press, India.
4. Rajeev tiwari "Analog Electroncs", Genius pub.
5. J.B.Gupta "Electronic Devices & circuits" Katson pub.

# DIGITAL ELECTRONICS

## Course/Paper: 04IVL-103
## IVL Semester-IV

**UNIT 1 : NUMBER SYSTEMS, BASIC LOGIC GATES & BOOLEAN ALGEBRA:** Binary Arithmetic & Radix representation of different numbers. Sign & magnitude representation, Fixed point representation, complement notation, various codes & arithmetic in different codes & their inter conversion. Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and vica-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion.

**UNIT 2 : DIGITAL LOGIC GATE CHARACTERISTICS:** TTL logic gate characteristics. Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C-MOS & MOSFET. Interfacing logic families to one another.

**UNIT 3** : **MINIMIZATION TECHNIQUES:** Minterm, Maxterm, Karnaugh Map, K map upto 4 variables. Simplification of logic functions with K-map, conversion of truth tables in POS and SOP form. Incomplete specified functions. Variable mapping. Quinn-Mc Klusky minimization techniques.

**UNIT 4** : **COMBINATIONAL SYSTEMS:** Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders. BCD adder. Binary multiplier. Decoder: Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder. Multiplexer, demultiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode switching matrix. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers.

**UNIT 5** : **SEQUENTIAL SYSTEMS:** Latches, flip-flops, R-S, D, J-K, Master Slave flip flops.

Conversions of flip-flops. Counters : Asynchronous (ripple), synchronous and synchronous decade counter, Modulus counter, skipping state counter, counter design. Ring counter. Counter applications. Registers: buffer register, shift register.

**Recommended books**

1. Morris Mano – Digital Circuits & Logic Design; PHI
2. Gree- Dgital Electronics, pearson education
3. Brtee- digital computer fundamental, TMH
4. Mano – Digital Design, pearson education.
5. shahlivahnan "digital electronics", vikahs pub.

# ELECTROMAGNETIC FIELD THEORY

## Course/Paper: 04IVL-104
## IVL Semester-IV

**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 maping 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. Pointing 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.

**Recommended books**

1. W.H.Hayt Jr. – Engineering electromagnetics, TMH
2. cheng –field and wave electromagnetic, pearson education
3. grifiths – introduction to electromagnetic "2/E PHI" .
4. S.P.Seth "electromagnetic field theory".
5. sadiku "Electromagnetic field theory"
6. sediken ioxted –
7. h.P. tiwari "electromagnetic field theory", Ashrwad pub.

# RANDOM VARIABLES & STOCHASTIC PROCESSES

## Course/Paper: 04IVL-105
## IVL Semester-IV

**UNIT 1** : **PROBABILITY** :Definitions, sample, space & events, joint & conditional probability,dependent events.

**UNIT 2** : **RANDOM VARIABLES :** Introduction, distribution & density functions, discrete & continuous random variables, special distributions : binominal, poisson, uniform, exponential, normal, rayleigh. conditional distribution & density functions.

**UNIT 3 : MULTIPLE RANDOM VARIABLES** :
Vector random variable, joint distribution functions, joint probability density function, conditional distribution & density functions. Statistical independence, distribution & density function of sum of random variable, one function of one random variable ,one function of two random variable, two function of two random variable.

**UNIT 4 : OPERATION ON SINGLE & MULTIPLE RANDOM VARIABLES** :
Mean & variance, moments, chebyshev's inequality, Central limit theorem, characteristic functions & moment generating function, covariance & correlation coefficient of multiple random variable.

**UNIT 5: STOCHASTIC PROCESSES** :
Introduction, random process concept, stationary & independence, ergodicity, correlation, functions Gaussion Random Process, Transmission of Random process through linear systems. Power spectral Density, Cross Spectral density,

**Recommended books**

1. Populis – "random variable & stochastic process" TMH.
2. Schoum's Outline – "RVSP"
3. Schoum's "analog and Digital Communication".
4. "Random Variable & stochastic processes", CBC Pub.

# OBJECT ORIENTED PROGRAMMING

## Course/Paper: 04IVL-106
## IVL Semester-IV

**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.

**Recommended books**

1. folk – file structure: an objecti oriented approach to C++, pearson education
2. balaguruswamY– object oriented programming in C++, TMH
3. Kelley : A book on C, Pearson Education.
4. sunil K Panday "Thinking in C++" Katson Pub.

# COMPUTER PROGRAMMING LAB-II

**Course/Paper: 04IVL-201**
**IVL Semester-IV**

**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.

# ELECTRONICS LAB II

## Course/Paper: 04IVL-202
## IVL Semester-IV

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.

# DIGITAL ELECTORNICS LAB

## Course/Paper: 04IVL-203
## IVL Semester-IV

1. To study and perform the following experiments.
(a) Operation of digital multiplexer and demultiplexer.
(b) Binary to decimal encoder.
(c) Characteristics of CMOS integrated circuits.
2. To study and perform experiment- Compound logic functions and various combinational circuits based on AND/NAND and OR/NOR Logic blocks.
3. To study and perform experiment -Digital to analog and analog to digital converters.
4. To study and perform experiment- Various types of counters and shift registers.
5. To study and perform experiment - Interfacing of CMOS to TTL and TTL to CMOS ICs.
6. To study and perform experiment- BCD to binary conversion on digital IC trainer.
7. To study and perform experiment -
(a) Astable (b) Monostable (c) Bistable Multivibrators and the frequency variation with different parameters, observe voltage waveforms at different points of transistor.
8. To study and perform experiment -Voltage comparator circuit using IC-710.
9. To study and perform experiment- Schmitt transistor binary circuit.
10. Design 2 bit binary up/down binary counter on bread board.

# HUMANITIES

## Course/Paper: 04IVL-204
## IVL Semester-IV

**UNIT 1 : INDIA-** Brief History of Indian Constitution- framing, features, fundamental rights, duties, directive principles of state. History of Indian national movement, Socio economic growth after independence.

**UNIT 2 : SOCIETY –** Social Groups- Concepts and types, socialization- concept and theory, social control; concept, social problem in contemporary India, status and role.

**UNIT 3 : THE FUNDAMENTALS OF ECONOMICS –** Meaning, definition and importance of economics, Logic of choice, Central Economic Problems, Positive and Normative approaches, economic systemssocialism and capitalism.

**UNIT 4 : MICROECONOMICS –**Law of demand and supply, Utility approach, Indifference curves, Elasticity of demand & supply and applications, Consumer surplus, Law of returns to factors and returns to scale.

**UNIT 5: MACRO ECONOMICS –**Concept relating to national product-National income and its measurement, Simple Keynesian theory, Simple multiplier, Money and banking,- Meaning, Concept of international trade, Determination of exchange rate, Balance of payments. Characteris tics of Indian Economy.

## SEMESTER V

# SIGNALS AND SYSTEMS

## Course/Paper: 05IVL-101
## IVL Semester-V

**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. Propertiesof 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 Z-transform. 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 freq. domain. Sampling of discrete time signals.

**Recommended books**

1. A.V.Oppenheim, A.S. Willsky and I.J Young – "signal & system", PHI
2. Taub & Schilling – "Principles of communication system", TMH
3. Prokins & Monalaskys – digital signal processing : Principle Algoriths applications, PHI.
4. sanjay sharma"signal system" Katson pub.
5. fahruk hussain "Signal system"

# LINEAR INTEGRATED CIRCUITS

## Course/Paper: 05IVL-102
## IVL Semester-V

**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,All pass 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.
**Recommended books**

1. R.A.Gayakwad – Op- Amplifier & Linear ICs, PHI
2. Taubay – Oprational Amplifier
3. K.R.Botker – integrated circuits, pearson education.
4. J.B.Gupta "linear integrated circuit" , Katson pub.
5. sanjay sharma "op-Amp & linear integrated circuit" , Katson pub.

# TELECOMMUNICATION ENGINEERING

## Course/Paper: 05IVL-103
## IVL Semester-V

**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, ð-section & T-section attenuators, stub matching,
Transmission equalizers Filters, constant K-section, Ladder type, ð-section, T-section filter, m-derived

filter sections, Lattics 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.

### Recommended books

1. W. Fraser – Telecommunications (BPB Publication)
2. Vishwanathan – Telecommunication switching systems & Netwoks, PHI
3. Cole – Introduction to Telcommunication, Pearson Education.
4. Umesh Sinha "Telecommunication", laxmi pub.

# ANALOG COMMUNICATION

## Course/Paper: 05IVL-104
## IVL Semester-V

**UNIT 1**: **NOISE EFFECTS IN COMMUNICATION SYSTEMS:** Resistor noise, Networks with reactive elements, Noise temperature, Noise bandwidth, effective input noise temperature, Noise figure. Noise figure & equivalent noise temperature in cascaded circuits.

**UNIT 2** : **AMPLITUDE MODULATION** : Frequency translation, Recovery of base band signal, Spectrum
& power relations in AM systems. Methods of generation & demodulation of AM-DSB, AM-DSB/SC and
AM-SSB signals. Modulation & detector circuits for AM systems. AM transmitters & receivers.

**UNIT 3**: **FREQUENCY MODULATION** : Phase & freq. modulation & their relationship, Spectrum & band width of a sinusoidally modulated FM signal, phasor diagram, Narrow band & wide band FM. Generation & demodulation of FM signals. FM transmitters & receivers.. Comparison of AM, FM & PM.
Pre emphasis & deemphasis. Threshold in FM, PLL demodulator.

**UNIT 4: NOISE IN AM AND FM:** Calculation of signal-to-noise ratio in SSB-SC, DSB-SC, DSB with carrier, Noise calculation of square law demodulator & envelope detector. Calculation of S/N ratio in FM demodulators, Super heterodyne receivers.

**UNIT 5**: **PULSE ANALOG MODULATION :** Practical aspects of sampling: Natural and flat top sampling.
PAM, PWM, PPM modulation and demodulation methods, PAM-TDM.

### Recommended books

1. Taub & D.L. Schilling – "principles of communication Systems " TMH.
2. G.Kennedy – "Electronic Communiocation system", TMH.
3. B.P.Lathi – "Communication System", John willy.
4. sanjay sharma "analog communication", katson pub.

# MICROWAVE ENGINEERING-I

## Course/Paper: 05IVL-105
## IVL Semester-V

**UNIT 1 : WAVE GUIDES :**Introduction of Microwaves and their applications. Rectangular Waveguides ,
Solution of Wave equation in TE and TM modes. Power transmission and Power losses. Excitation of modes in Rectangular waveguides, circular waveguides : Basic idea of TE and TM modes, field patterns,
TEM mode of propagation.

**UNIT 2** : **WAVEGUIDE COMPONENTS** : Scattering matrix representation of networks. Rectangular cavity
and circular cavity resonators. Waveguide Tees, Magic Tees. Hybrid rings. Waveguide corners, Bends
and twists. Directional couplers, Circulators and isolators.

**UNIT 3** : **KLYSTRONS :** Limitation of conventional vacuum tubes, Construction and operation of two cavity & multicavity klystrons. Velocity modulation and electron bunching (analytical treatment), Applegate
diagram and applications of two cavity klystrons.Construction, working and operation of Reflex klystron. Applications and practical considerations. Velocitymodulation, power output and frequency characteristics of a Reflex klystron. Electron admittance.

**UNIT 4 : TRAVELLING WAVE TUBES (TWT):** Construction, operation and practical consideration of helix type TWT. Introduction to CW power, pulsed dual mode TWT. Coupled cavity TWT. Applications ofTWT.

**UNIT 5 : MAGNETRON :** Types of Magnetron. Construction, operation, analysis and practical consideration of cavity or travelling wave magnetron. Introduction to coaxial, frequency angle and voltage
tunable magnetrons. Backward cross field oscillator, Forward wave cross field amplifier.

**Recommended books**

1. S.Y.Lio – "Microwave devices & circuits", PHI
2. R.E.Collin – " Founsdation for microwave engineering", Mc Graw Hill
3. Sisodia V.L.Gupta – "Microwave Engineering", New Age.
4. sachin chauhan "microwave- I",Genius pub.
5. Kulkarni "microwave & Radar Engg.", Laxmi pub.

# ADVANCED DATA STRUCTURES

## Course/Paper: 05IVL-106
## IVL Semester-V

**UNIT 1 : ADVANCED TREES -** Definitions and operations on weight balanced trees (Huffman trees), 2-3
trees and Red-Black trees. Augmenting Red-Black trees to dynamic order statistics and interval tree applications. Operations on disjoint sets and its Union-Find problem. Implementing sets, discitionerics, priority queues and concatenable queues using 2-3 trees.

**UNIT 2 : MERGEABLE HEAPS -** Mergeable Heap operations, binomial trees, implementing binomial heaps and its operations. 2-3-4- trees and 2-3-4 heaps. Structure and potential function of Fibonacci heap. Implementing Fibonacci Heap**.**

**UNIT 3 : GRAPH THEORY DEFINITIONS** - Definitions of Isomorphism, Components, Circuits, Fundamental Circuits, Cut-sets, Cut-Vertices, Planer and dual graphs, Spanning trees, Kuratovski's two
graphs.

**UNIT 4 : GRAPH THEORETIC ALGORETHMS** - Algorithms for connectedness, finding all spanning trees
in a weighted graph and planarity testing. Breadth first and depth first search, topological sort, strongly
connected components and, articulation point.

**UNIT 5 : APPLICATION OF GRAPHS**- Single source shortest path and all pair shortest path algorithms.
Min-Cut Max-Flow theorem of network flows, Ford-Fulkerson Max Flow algorithms.

**Recommended books**

1. Narsing Deo – Graph theory with application to engineering and computer Science, PHI.
2. Horwitz and Sawhni – Fundamental Of Data structure, Galgotia book sourse.
3. Coremen – Introduction to Algorithm, PHI.
4. Vineet Khanna ''advance Data Structure'', Genius Pub.

# ELECTRONIC ENGINEERING DESIGN LAB

## Course/Paper: 05IVL-201
## IVL Semester-V

**To design the following circuits, assemble these on bread board and test them.**
**Simulation of these circuits with the help of appropriate software.**
1. Op-Amp characteristics and get data for input bias current, measure the output-offset voltage and reduce it to zero and calculate slew rate.
2. Op-Amp in inverting and non-inverting modes.
3. Op-Amp as scalar, summer and voltage follower.
4. Op-Amp as differentiator and integrator.
5. Design LPF and HPF using Op-Amp 741
6. Design Band Pass and Band reject Active filters using Op-Amp 741.
7. Design Oscillators using Op-Amp (i) RC phase shift (ii) Hartley (iii) Colpitts
8. Design (i) Astable (ii) Monostable multivibrators using IC-555 timer
9. Design Triangular & square wave generator using 555 timer.
10. Design Amplifier (for given gain) using Bipolar Junction Transistor.

# MICROWAVE ENGINEERING LAB

## Course/Paper: 05IVL-202
## IVL Semester-V

1. Study of various microwave components and instruments like frequency meter, attenuator, 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 an 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, 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.

# COMMUNICATION LAB-I

## Course/Paper: 05IVL-203
## IVL Semester-V

1. Harmonic analysis of a square wave of a modulated wave form.
2. Observe the Amplitude modulated wave form & measure modulation index. Demodulation of AM signal.
3. Generation & Demodulation of DSB – SC signal.
4. Modulate a sinusoidal signal with high frequency carrier to obtain FM signal. Demodulation of the FM
signal.
5. To observe the following in a transmission line demonstrator kit :
(a) The propagation of pulse in non reflecting transmission line.
(b) The effect of losses in transmission line.
(c) Transmission with standing waves on a Transmission line.
(d) The resonance characteristics of a half-wave length long X-mission line.
6. (a) To observe the operation of sampling and sample & hold circuits.
(b) To study the effect of sampling time (sampling pulse width).
(c) To study the effects of changing the sampling frequency & observing aliasing phenomena.
7. To study & observe the operation of a super heterodyne receiver.
8. To study & observe the amplitude response of automatic gain controller (AGC ).
9, 10. PAM, PWM & PPM: Modulation and demodulation.

# SIGNAL PROCESSING LAB-I

## Course/Paper: 05IVL-204
## IVL Semester-V

**Simulation in MATLAB Environment:**

1. Generation of continuous and discrete elementary signals (periodic and non-periodic) using mathematical expression.
2. Generation of Continuous and Discrete Unit Step Signal.
3. Generation of Exponential and Ramp signals in Continuous & Discrete domain.
4. Continuous and discrete time Convolution (using basic definition).
5. Adding and subtracting two given signals. (Continuous as well as Discrete signals)
6. To generate uniform random numbers between (0, 1).
7. To generate a random binary wave.
8. To generate random sequences with arbitrary distributions, means and variances for following :
(a) Rayleigh distribution
(b) Normal distributions: N(0,1).
(c) Gaussion distributions: N ($m_x$, $óx_2$)
9. To plot the probability density functions. Find mean and variance for the above distributions

## SEMESTER VI

# MICROWAVE ENGINEERING-II

## Course/Paper: 06IVL-101
## IVL Semester-VI

**UNIT 1 : MICROWAVE MEASUREMENTS :** Detection of microwaves, Microwave power measurement,
Impedance measurement, Measurement of scattering parameters, Frequency measurement, VSWR measurements.

**UNIT 2**: Introduction to microstrip lines, Parallel striplines, Coplanar striplines, Shielded striplines, Slot

lines, Integrated Fin line, Non-radiative guide, Transitions, Bends and Discontinuities.

**UNIT 3 : MICROWAVE NETWORK ANALYSIS:** Impedance and Admittance matrices, Scattering matrix,
Reciprocal networks and Loss less networks parameters, ABCD Matrix, Equivalent circuits for Two port
Network, Conversions between two port network Signal flow graphs, Discontinuities in waveguides and
microstrip.

**UNIT 4 : MICROWAVE SEMICONDUCTOR DEVICES** : Construction, Operation and Practical
applications of PIN diode, varactor and Tunnel diode, Gunn diode, IMPATT, TRAPTT diodes, BJT, JFET,
MESFET, CCD, MASER and LASER.

**UNIT 5 : MONOLITHIC MICOWAVE INTEGRATED CIRCUITS** : Introduction, Materials, MMIC Growth,
MOSFET fabrication, Thin film formation, Hybrid integrated circuit fabrication, Advantages & Difficulties of
MICs.

1.S.Y.Lio – "Microwave devices & circuits", PHI
2.R.E.Collin – " Founsdation for microwave engineering", Mc Graw Hill
3.K.C. Gupta – "Microwaves", New Age.
4.sachin chauhan- "microwave engg-2" genius pub.
5.kulkarni –"microwave engg"- laxmi pub.

# MICROPROCESSOR AND MICROCONTROLLER

## Course/Paper: 06IVL-102
## IVL Semester-VI

**UNIT 1 : INTRODUCTION**: CPU, address bus, data bus and control bus. Input/ Output devices, buffers,
encoders, latches and memories.

**UNIT 2 : 8085 MICROPROCESSOR ARCHITECTURE**: Internal data operations and registers, pins and
signals, peripheral devices and memory organization, interrupts. CISC and RISC architecture overview.

**UNIT 3 : 8085 MICROPROCESSOR INSTRUCTIONS**: Classification, format and timing. Instruction set.
Programming and debugging, 8 bit and 16 bit instructions.

**UNIT 4 : 8085 MICROPROCESSOR INTERFACING**: 8259, 8257, 8255, 8253, 8155 chips and their
applications. A/D conversion, memory, keyboard and display interface (8279).

**UNIT 5: INTRODUCTION TO 8051 MICROCONTROLLER**: General features & architecture of 8051.
Memory, timers and interrupts. Pin details. Interfacing and applications.

1. R .Goankar-microprossesor architecture,, Programing And Application. Wiley Eastern Ltd.
2. INTEL-Microcontroller handbook.
3. Ayle- 8051 Microcontroller,penram press.
4. rahul srivastav – 8085 microprcessor- neelkant pub.
5. B.Ram "microprocessor & Programming"
6. D.S.Sherawt "Microprocessor", katson pub.

# INDUSTRIAL ELECTRONICS

## Course/Paper: 06IVL-103
## IVL Semester-VI

**UNIT 1: SEMICONDUCTOR POWER DEVICES -** Basic characteristics & working of Power Diodes, Diac,
SCR, Triac, Power Transistor, MOSFETs, IGBT, and GTO.

**UNIT 2: RECTIFIERS & INVERTERS -** Working principles of single and three phase bridge rectifiers,
Voltage and current source inverters.

**UNIT 3: POWER SUPPLIES:** Principle of operation of choppers. Step up, Step down and reversible
choppers. High frequency electronic ballast, Switch Mode Power Supply: Fly back converter,
forward/buck converter, Boost converter and buck-boost converter. Uninterruptible Power Supply.

**UNIT 4: MOTOR CONTROL:** Introduction to speed control of DC motors using phase controlled
converters and choppers, Basic idea of speed control of three phase induction motors using voltage and
frequency control methods.

**UNIT 5: STEPPER MOTORS**: Variable reluctance, Permanent magnet and hybrid stepper motors.
Induction and dielectric heating control.

1. Biswanth paul, Industrial Electronics And Control, Prentice Hall Of India.
2. S.N. biswas, Industrial Electronics.Dhanpat Rai& Co.
3. Morris, Industrial Electronics,Tata Mc-Graw Hill.
4.p. s. bhimra – industrial Electronics- laxmi pub.

# DIGITAL COMMUNICATION

## Course/Paper: 06IVL-104
## IVL Semester-VI

**UNIT 1** : **PCM & DELTA MODULATION SYSTEMS** : Uniform and Non-uniform quantization. PCM and
delta modulation, Signal to quantization noise ratio in PCM and delta modulation. DPCM, ADM, T1
Carrier System, Matched filter detection. Error probability in PCM system.

**UNIT 2 : BASE BAND TRANSMISSION:** Line coding(RZ,NRZ): Polar,Bipolar,Manchester,AMI. Inter
symbol interference, Pulse shaping, Nyquist criterion, Raised cosine spectrum.

**UNIT 2 : DIGITAL MODULATION TECHNIQUES** : Geometric interpretation of
signals,Orthogonalization.
ASK, BPSK, BFSK, QPSK, MSK modulation techniques and Coherent detection of these techniques.
Calculation of error probabilities.

**UNIT 4 : INFORMATION THEORY** : Amount of Information, Average Information, Entropy,
Information
rate, Increase in Average information per bit by coding, Shannon's Theorem and Shannon's bound,
Capacity of a Gaussian Channel, BW-S/N trade off,

**UNIT 5: CODING**: Coding and decoding of Information, Hamming code, Single Parity-Bit Code,
Linear
Block code, cyclic code & convolutional code.

1. Taub & D.L. Schilling – "principles of communication Systems " TMH.
2. B.P.Lathi – "Communication System", John willy.
3. Prokasis-"Digital communication" Pearson Education.
4. sanjay sharma-"digital  communication" katson pub.
5. chakrobaty –"digital  communication" laxmi pub.

# CONTROL SYSTEMS

## Course/Paper: 06IVL-105
## IVL Semester-VI

**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. Differential equations. 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.

1. I.J. Nagrath and M gopal: control system Engineering, New Age.
2. M Gopal:. Control system, TMH
3. B.C Kuo: Automatic Control System, PHI.
4. K.M.soni : Automatic Control System, Katson pub.

# OPTIMIZATION TECHNIQUES

## Course/Paper: 06IVL-106
## IVL Semester-VI

**UNIT 1: INTRODUCTION** -Historical development, engineering application of optimization, Formulation of
design problems as a mathematical programming problem, Classification of optimization problems.

**UNIT 2: LINEAR PROGRAMMING** - Simplex methods, Revised simplex method, Duality in linear programming, post optimality analysis.

**UNIT 3:** Applications of Linear programming, Transportation and assignment problems.

**UNIT 4: NON-LINEAR PROGRAMMING** - Unconstrained optimization techniques, Direct search

methods, Descent methods, Constrained optimization, Direct and Indirect methods.

**UNIT 5: Dynamic Programming**: Introduction, multi-decision processes, computational procedure

1. S . S. Rao: optimization _ Theory & application . Wiley Eastern .
2. H.A. Taha: Operation  Reserch And Introduction. Mc millan Co.
3.  A.O.Converse: Optimization , Halt Pinchort Inc..
4.  jain & rawat " Optimization technigue"  CBC

# COMMUNICATION LAB-II

## Course/Paper: 06IVL-201
## IVL Semester-VI

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, Bi-polar, 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.

# MICROPROCESOR LAB

## Course/Paper: 06IVL-202
## IVL Semester-VI

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.

# UNIX SHELL PROGRAMMING LAB

## Course/Paper: 06IVL-203
## IVL Semester-VI

1. Use of Basic Unix Shell Commands: ls,mkdir,rmdir,cd,cat,banner,touch,file,wc,sort,cut,grep, dd,dfspace,du,ulimit.
2. Commands related to Inode,I/O redirection and piping, process control commands, mails.
3. Shell Programming: Shell script exercises based on following
(i) Interactive shell scripts
(ii) Positional parameters
(iii) Arithmetic
(iv) if-then-fi, if-then-else-fi, nested if-else
(v) Logical operators
(vi) else + if equals elif, case structure
(vii) while, until, for loops, use of break
(viii) Metacharacters
(ix) System administration: disk management and daily administration
4. Write a shell script to create a file in $USER /class/batch directory. Follow the instructions
(i) Input a page profile to yourself, copy it into other existing file;
(ii) Start printing file at certain line
(iii) Print all the difference between two file, copy the two files at $USER/CSC/2007 directory.
(iv) Print lines matching certain word pattern.


5. Write shell script for-
(i) Showing the count of users logged in,
(ii) Printing Column list of files in your home directory
(iii) Listing your job with below normal priority
(iv) Continue running your job after logging out.
6. Write a shell script to change data format .Show the time taken in execution of this script.
7. Write a shell script to print files names in a directory showing date of creation & serial number of the
file.
8. Write a shell script to count lines, words and characters in its input(do not use wc).
9. Write a shell script to print end of a Glossary file in reverse order using Array. (Use awk tail)
10. Write a shell script to check whether Ram logged in, Continue checking further after every 30 seconds
till success.

# INDUSTRIAL ELECTRONICS LAB

## Course/Paper: 06IVL-204
## IVL Semester-VI

1. Study the characteristics of SCR.
1.1 Observe the terminal configuration.
1.2 Measure the breakdown voltage.
1.3 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.

# ANTENNA & WAVE PROPAGATION

## Course/Paper: 07IVL-101
## IVL Semester-VII

**UNIT 1 : ANTENNA FUNDAMENTALS** - Antenna parameters, Radiation from a current element in free space. Quarter & half wave antenna. Reciprocity theorem. Resonant and non-resonant antenna. Effective length and aperature, gain, beamwidth, directivity, radiation resistance, efficiency, polarization, impedance and directional characteristics of antenna, antenna temperature.

.**UNIT 3 : ANTENNAS -** V and Rhombic antennas, Folded dipole, Yagi-Uda antenna, Frequency independent antennas, Log-periodic antennas,UHF and Microwave antennas- Antenna with parabolic reflectors, Horn and Lens antennas, Helical antennas, Square and Circular loop antennas, Fundamentals of Slot and Microstrip antennas.

**UNIT 2 : ANTENNA ARRAYS -** Two element array, N-element linear arrays, Broadside, End fire, collinear and combination arrays, Multiplication of patterns, Binomial arrays. Effect of ground on antennas, Antenna loading.
**Antenna Measurements** - Antenna impedance, radiation pattern, gain, directivity, polarization and phasemeasurements

**UNIT 4 : RADIO WAVE PROPAGATION** - Mechanism of radio wave propagation, Reflection, Refraction interference and diffraction of radio waves. Theory of ground wave, space wave and sky wave propagation. Plane earth reflection, Reflection factors for horizontal and vertical polarizations. Duct propagation and tropospheric scattering.

**UNIT 5 :** Various Ionospheric layers. Characteristics of ionosphere and its effects on wave propagation. Critical frequency, Virtual height, skipzone & maximum usable frequency. Multiple hop transmission.Oblique & vertical incidence transmission. Effect of earth's magnetic field, solar activity and meteorological conditions on wave propagation.

1. J.D.Kraus, ' Anteenas', Mc –graw Hill.
2. C.A.Balanis,' Antenna Theory'  Harper& row.
3. K.D. Prasad,'Anteena and Wave propagation', SATYA Prakashan, New delhi.
4. A.K.Gautam "Antenna & Wave propagation", Katson Pub.

# DIGITAL SIGNAL PROCESSING

## Course/Paper: 07IVL-102
## IVL Semester-VII

**UNIT 1 : SAMPLING -** Discrete time processing of Continuous-time signals, continuous-time processing of discrete-time signals, changing the sampling rate using discrete-time processing.

**UNIT 2 : TRANSFORM ANALYSIS OF LTI SYSTEMS -** Introduction, The frequency response of LTI systems, System functions for systems characterized by LCCD (Linear Constant Coefficient Difference) equations, All-pass system, Minimum-Phase systems, Linear systems with linear phase.

**UNIT 3 : STRUCTURES FOR DISCRETE-TIME SYSTEMS-** Block diagram and signal flow graph representation of LCCD (LCCD – Linear Constant Coefficient Difference) equations, Basic structures for IIR and FIR systems, Transposed forms.

**UNIT 4 : FILTER DESIGN TECHNIQUES -** Introduction, Analog filter Design: Butterworth & Chebyshev.IIR filter design by impulse invariance & Bilinear transformation. Design of FIR filters by Windowing: Rectangular, Hanning, Hamming & Kaiser.

**UNIT 5 :** The Discrete Fourier transform (DFT), Properties of the DFT, Linear Convolution using DFT.Efficient computation of the DFT: Decimation–in-Time and Decimation-in frequency FFT Algorithms.Processing of speech signals: Vocoders, linear predictive coders.

1. Scahafer Buck-Discreate Time Signal Prossecing , Person Education Asia.
2. Prokis & Manolaski- Digital Signal Processing, PHI.
3. S.K.Mitra- Digital Signal Processing,TMH.
4. Faruq Hussain –" Digital Signal Processing"
5. sanjay sharma – ''digital signal processing'' Katson Pub.

# WIRELESS COMMUNICATION

## Course/Paper: 07IVL-103
## IVL Semester-VII

**UNIT 1 : PROPAGATION PHENOMENA -** Fundamentals of fading, Multipath channels, Spread Spectrum signals: Direct-sequence spread spectrum signals, p-n sequences, Frequency-hopped spread spectrum signals, Code-division multiplexing.

**UNIT 2 : LINE OF SIGHT MICOWAVE COMMUNICATION**- Link Engineering, Frequency planning, Free space loss, Fresnel zone clearance bending of radio beam, Effective earth radius, Building blocks of Transmitter & Receiver.

**UNIT 3 : MULTIPLE ACCESS TECHNIQUES -** FDMA, TDMA and CDMA with reference to mobile radio and satellite systems. TDMA based networks. CDMA based networks,

**UNIT 4 : CELLULAR WIRELESS NETWORKS-**, GSM: Introduction, overview of the GSM systems, GSM codec, channel coding and interleaving, radio like control. Cordless systems and WLL, Mobile IP, Wireless access protocol. Wireless LAN's: Technology, IEEE 802.11 standards and Blue tooth. Broadband Wireless 802.16

**UNIT 5 : SATELLITE COMMUNICATION -** Elements of satellite communication: Frequency bands, Transmission and multiplexing. Modulation, Multiple access. Satellite orbit and description- orbital period and velocity, effects of orbital inclination, Azimuth and elevation, Coverage angle and slant range, Geostationary orbit, Satellite description. Earth Station antenna, high-power amplifier, low-noise amplifier, up converter, down converter, monitoring and control, reliability. Satellite Link: basic link analysis,

1. Reappaport- Wireless Communication, Pearson Education .
2. William Stallings- Wireless Communication& Network,Pearson education, Asia  .
3. Richharia M- Sattelite communication, mac Millan.
4. R.P.Yadav –"wirless Communication "
5. modani – "wirless Communication" Genius pub.

# IC TECHNOLOGY

## Course/Paper: 07IVL-104
## IVL Semester-VII

**UNIT 1 : INTRODUCTION TO TECHNOLOGIES-** Semiconductor Substrate-Crystal defects, Electronic Grade Silicon, Czochralski Growth, Float Zone Growth, Characterization & evaluation of Crystals; Wafer Preparation- Silicon Shaping, Etching and Polishing, Chemical cleaning.

**UNIT 2 : DIFFUSION & ION IMPLANTATION-** Ficks diffusion Equation in One Dimension, Atomic model, Analytic Solution of Ficks Law, correction to simple theory , Diffusion in $SiO_2$. Ion Implantation and Ion Implantation Systems Oxidation. Growth mechanism and Deal-Grove Model of oxidation, Linear and Parabolic Rate co-efficient, Structure of $SiO_2$, Oxidation techniques and system, Oxide properties.

**UNIT 3 : CHEMICAL VAPOUR DEPOSITION AND LAYER GROWTH-** CVD for deposition of dielectric and polysilicon – a simple CVD system, Chemical equilibrium and the law of mass action, Introduction to atmospheric CVD of dielectric, low pressure CVD of dielectric and semiconductor. Epitaxy-Vapour Phase Expitaxy, Defects in Epitaxial growth, Metal Organic Chemical Vapor Deposition, Molecular beam epitaxy.

**UNIT 4 : PATTERN TRANSFER-** Introduction to photo/optical lithography, Contact/ proximity printers, Projection printers, Mask generation, photoresists. Wet etching, Plasma etching, Reaction ion etching.

**UNIT 5 : VLSI PROCESS INTEGRATION-** Junction and Oxide Isolation, LOCOS methods, Trench Isolation, SOI; Metallization, Planarization. Fundamental consideration for IC Processing, NMOS IC Technology, CMOS IC Technology, Bipolar IC Technology.

1. S.M.Sze- VLSI Technology, TMH.
2. kang- CMOS circuit design,TMH .
3. D.Nagchoudhary-principles of microelectronic Technology,Wheeler Publishing.
4. P.k. malhotra – "I C Technology" CBC
5. Arti sharma – "IC Technology"- Genius Pub.

# VLSI DESIGN

## Course/Paper: 07IVL-105
## IVL Semester-VII

**UNIT 1 : INTRODUCTION TO MOS TECHNOLOGY-** Basic MOS transistors, Enhancement Modetransistor action, Depletion Mode transistor action, NMOS and CMOS fabrication.

**UNIT 2 : BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS-** $I_{ds}$ versus $V_{ds}$ relationship, Aspects of threshold voltage, Transistor Transconductance $g_m$. The nMOS inverter, Pull up to Pull-down ratio for a NMOS Inverter and CMOS Inverter $(B_n/B_p)$, MOS transistor circuit Model, Noise Margin.

**UNIT 3 : CMOS LOGIC CIRCUITS-** The inverter, Combinational Logic, NAND Gate NOR gate, Compound Gates, 2 input CMOS Multiplexer, Memory latches and registers, Transmission Gate, Gate delays, CMOS-Gate Transistor sizing, Power dissipation.

**UNIT 4 :** Basic physical design of simple Gates and Layout issues. Layout issues for inverter, Layout for NAND and NOR Gates, Complex Logic gates Layout, Layout optimization for performance.

**UNIT 5 :** Introduction to VHDL, Prolog & other design tools. VHDL Code for simple Logic gates, flip-flops,shift registers.

.
1. Pucknell, Kamaran Esragian- Basic VLSI Design.
2. kang- CMOS circuit design,TMH .
3. Stephen Brown  -Fundamental of design logic with VHDL , TMH.
4. P.k.malhotra-"VLSI Desgin " CBS

# OPERATING SYSTEMS

## Course/Paper: 07IVL-106
## IVL Semester-VII

**UNIT 1 : INTRODUCTION –** History, Operating system services, types, responsibilities, generations,LINUX, WINDOWS.

**UNIT 2 : PROCESS MANAGEMENT**- Operations on process, Process state, Scheduling, Criteria,scheduling algorithms, Evaluation, Synchronization, Semaphores, Monitors.

**UNIT 3 : MEMORY MANAGEMENT-** Swapping, Continuous memory allocation, Paging, Pure paging,Demand paging, Page-replacement algorithms, thrashing, Example-Pentium, Disk Scheduling.

**UNIT 4 : INFORMATION MANAGEMENT-** File and directory concept, Access methods, Protection, Free space management, Efficiency and performance, Access matrix, Capability-based systems, Programthreats, User authentication, Firewall.

**UNIT 5 : DEAD LOCKS-** System model, Dead lock characterization, Deadlock prevention, Avoidance, Detection, Recovery, Classic problems of synchronization.

1. Andrew S.Tanenbaum- modern Operating System , PHI
2. JPeterson , a. Silberschatz – operating System Concepts .
3. H.M.Deitl- An introduction to Operating sytem , Addision wesely.
4. Rajeev Chaupra "Operating System" S.Chand.

## EMBEDDED SYSTEM DESIGN

## Course/Paper: 07IVL-107
## IVL Semester-VII

**Introduction to an embedded systems design:**
Introduction to Embedded system, Embedded System Project Management, ESD and Co-design issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development ofan ES.

**RTOS&itsoverview:**
Real Time Operating System: Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS.

**Microcontroller:**
Role of processor selection in Embedded System (Microprocessor V/s Micro-controller), 8051 Microcontroller: Architecture, basic assembly language programming concepts, Instruction set, Addressing Modes, Logical Operation, Arithmetic Operations, Subroutine, Interrupt handling, Timing subroutines, Serial data transmission, Serial data communication

**Embedded system development**
Embedded system evolution trends. Round - Robin, robin with Interrupts, function-One-Scheduling Architecture, Algorithms. Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

**Networks for Embedded Systems**
The I2C Bus, The CAN bus, SHARC link Ports, Ethernet, Myrinet, Internet, Introduction to Bluetooth: Specification, Core Protocol, Cable replacement protocol. IEEE 1149.1 (JTAG) Testability: Boundary ScanArchitecture.

**References:**
1. Embedded Systems by Raj Kamal, TMH
2. The8051 Microcontroller by K.J.Ayala, Penram International
3. J B Peatman, Design with PIC Microcontrollers, Prentice Hall
4. An Embedded Software Primer by David E. Simon, Pearson Education
5. Designing Embedded Hardware by John Catsoulis, O'reilly

6. Embedded System Design by FrankVahid, Tony Givargis,", John Wiley & Sons, Inc
7. Building Embedded Linux Systems by Karim Yaghmour, O'reilly
8. Programming Embedded Systems by Michael Barr, O'reilly

## PRACTICAL TRAING & SEMINAR

## Course/Paper: 07IVL-201
## IVL Semester-VII

Industrial visit (20 marks) is for the duration of 10 days at the end of V semester and Practical Training (80 marks) is for the duration of 30 days at the end of VI semester. Both will be evaluated during the VII semester and graded accordingly

## SIGNAL PROCESSING LAB-II

## Course/Paper: 07IVL-202
## IVL Semester-VII

**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).

## WIRELESS COMMUNICATION LAB-I

## Course/Paper: 07IVL-203
## IVL Semester-VII

Measurement of antenna characteristics :
Radiation Pattern on polar plots, Beam width and Gain of main lobe for the following types of antennas.
(1) Half wave and quarter wave dipole
(2) Folded dipole
(3) Yagi UDA multiple element folded dipole
(4) Hertz Antenna
(5) End fire array and broad side array
(6) Helix antenna
(7) Paraboloid reflector antenna
(8) Loop antenna
(9) Ground plane antenna
(10) Log periodic antenna
(11) Rhombus antenna
(12) Slot antenna

# COMPUTER NETWORKS

## Course/Paper: 08IVL-101
## IVL Semester-VIII

**UNIT 1: QUEUING THEORY-** Pure birth, Pure death & Birth-death processes, Mathematical models for M/M/1, M/M/∞, M/M/m, M/M/1/K and M/M/m/m queues. Little's formula. M/G/1 Queuing model basics.

**UNIT 2: DATA LINK LAYER -** Packet & Circuit switching, OSI & TCP/IP Reference Models, Framing,Simplex protocol, Simplex stop & wait protocol, Sliding window protocol, Go back N protocol, selective repeat, HDLC, Data link layer in internet.

**UNIT 3: MEDIUM LAYER-** Static & dynamic channel allocation, Multiple Access Protocols: ALOHA, slotted ALOHA, CSMA, Token Bus, Token Ring, FDDI, IEEE standards 802.2, 802.3 Hubs, Bridges, Routers & Gateways.

**UNIT 4: NETWORK LAYER-** Network layer Design issues.Adaptive & Non-adaptive routing algorithms, Congestion control algorithms for TCP/IP networks,Internetworking, Network layer in the Internet: IPv4 & IPv6 Protocols, OSPF and BGP.TCP Protocol architecture.

**UNIT 5: ATM NETWORKS-** Connection Oriented Networks: X.25, Frame Relay & ATM. ISDN systemarchitecture. Broadband ISDN. ATM Protocol architecture, Recognition Algorithm in ATM Networks,Congestion control Algorithms.

1. Tanenbaum- Computer Network , Pearson Education of Asia .
2. Frouzan – Data communication and Networking , TMH .
3. Stallings- Data& Commuter communication,  persons Educationn Asia .

# RADAR & TV ENGINEERING

## Course/Paper: 08IVL-102
## IVL Semester-VIII

**UNIT 1: RADAR -** Radar Block diagram, frequencies and applications. Radar range equation.
Continuous wave (CW) & FM radar; Moving target indicator (MTI) : Delay line cancellers, blind velocity Pulse Doppler Radar. Tracking radar sequential lobbing, Conical scan and monopulse radar, Types of display, Radar receivers, Noise figure.

**UNIT 2: NAVIGATIONAL AIDS** - Principle of operation of Radar direction finder & range system.
LORAN system, DME, TACAN, Aircraft landing systems.

**UNIT 3: TV ENGINEERING-** Theory of scanning standards, Principles of Monochrome and colour T.V. system (PAL, SECAM, NTSC). Composite video signal analysis.T.V Cameras : Image orthicon, plumbicon, vidicon. CCD camera tubes.Types of Monochrome and colour picture tubes, set-up adjustments. LCD and Plasma displays

**UNIT 4:** Picture, colour and sound carriers. Vestigial side band transmission. Encoding picture information. Chrominance modulation. Compatibility of colour and monochrome T.V. systems. Block diagram of T.V. transmitters. TV transmission & reception antennas.

**UNIT 5: TV RECEIVER:** Functional block diagram of T.V. receiver, R.F. Tuner, I.F. amplifier, Video detector, video amplifier, AGC, Synch. Separation, Sync. Processing and AFC. Deflection oscillators,

vertical & horizontal deflection and sound system circuits. EHT generation. Common faults and their diagnosis. Basic idea of HDTV, DBS-TV and 3D-TV.

1.  M.I.Skonik –'introduction to radar system'  mc –graw Hill.
2.  N.S.Nagaraja, "Elements of Electronic Navigation" , TMH .
3.  R.R.Gulati-Monochromaic & colour television, Wiley Eastern.
4.  Kulkarni "microwave & radar engg." Laxmi pub.

# OPTICAL COMMUNICATION

## Course/Paper: 08IVL-103
## IVL Semester-VIII

**UNIT 1 : OPTICAL FIBERS** - Basic optical laws and definitions, Principles of light propagation in fibers,Ray theory, Optical fiber modes and configurations, Step index and graded index fibers, Monomode and multimode fibers, Fiber materials, fiber fabrication, Fiber optic cables. Attenuation, signal distortion in optical fibers, Dispersion-intra modal & inter modal, Dispersion shifted and flattened fiber.

**UNIT 2: OPTICAL SOURCES** - LED's- Structure, Materials, Characteristics, Modulation, Power & efficiency, Laser Diodes - Basic concept, Hetro Structure, properties and modulation.

**UNIT 3: OPTICAL DETECTORS** - PIN and Avalanche photo diodes, photo detector noise, detector response time, Avalanche multiplication noise. Photo diode materials. Fundamental of Optical Receiver Operation.

**UNIT 4: OPTICAL FIBER COMMUNICATION SYSTEMS**- Source to fiber coupling, fiber to fiber joints, fiber splicing, fiber connectors. Principal components. Link design calculation, Applications, Wavelength division multiplexing.

**UNIT 5: OPTICAL FIBER MEASUREMENTS**: Measurements of Fiber attenuation, Dispersion, refractive index profile, Numerical aperture & diameter.

1.  Gerd Keiser- Optical Fiber Communication,TMH .
2.  J.N.Senior   - Optical Fiber Communication,PHI
3.  J.gowar- . - Optical Communication system ,PHI.
4.  preeti maswari-"Optical communicatio" Genius Pub.

# VLSI TECHNOLOGY

**Course/Paper: 08IVL-104**
**IVL Semester-VIII**

.UNIT 1  **Epitaxy**

Crystal growth & wafer preparation. Processing considerations: Chemical

cleaning, getting the thermal Stress factors etc
Vapors phase Epitaxy Basic Transport processes & reaction kinetics, doping & auto doping, equipments, & safety considerations, buried layers, epitaxial defects, molecular beam epitaxy, equipment used, film characteristics, SOI structure.

UNIT 2**Oxidation**
Growth mechanism & kinetics, Silicon oxidation model, interface considerations, orientation dependence of oxidation rates thin oxides. Oxides. Oxidation technique & systems dry & wet oxidation. Masking properties of $SiO_2$

UNIT 3**Diffusion**

Diffusion from a chemical source in vapor form at high temperature, diffusion from doped oxide source, diffusion from an ion implanted layer.

## UNIT 4 **Lithography**

Optical Lithography: optical resists, contact & proximity printing, projection printing, electron lithography: resists, mask generation. Electron optics: roster scans & vector scans, variable beam shape. X-ray lithography: resists & printing, X ray sources & masks. Ion lithography.

## UNIT 5 **Etching**

Reactive plasma etching, AC & DC plasma excitation, plasma properties, chemistry & surface interactions, feature size control & apostrophic etching, ion enhanced & induced etching, properties of etch processing. Reactive Ion Beam etching, Specific etches processes: poly/polycide. Trench etching,

**References:**
1. Sze," Modern Semiconductor Device Physics", John Wiley & Sons, 2000. B.G. Streetman,
2. "Solid State Electronics Devices", Prentice Hall, 2002Chen, "VLSI Technology" Wiley, March2003.


# MOS CIRCUIT DESIGN

# Course/Paper: 08BVL105
# IVL Semester-VIII

**Introduction:**
BasicprincipleofMOS transistor, IntroductiontolargesignalMOSmodels(longchannel)fordigitaldesign.

**TheMOSInverter:**
Inverter principle, Depletion and enhancement load inverters, the basic CMOS inverter, transfer characteristics, logic threshold, Noise margins, and Dynamic behavior, Propagation Delay, PowerConsumption.

**MOS Circuit Layout & Simulation:**
MOS SPICE model, device characterization, Circuit characterization, interconnects simulation. MOS device layout: Transistor layout, Inverter layout, CMOS digitalcircuits layout&simulation

**Combinational MOS Logic Design**

StaticMOSdesign:

ComplementaryMOS,Ratioedlogic,PassTransistorlogic,complexlogiccircuits. **Dynamic**

**MOS design:** Dynamic logic families andperformances. **Sequential MOS Logic Design**

Static latches, Flip flops & Registers, Dynamic Latches & Registers, CMOS Schmitt trigger, Monostable sequential Circuits, Astable Circuits. Memory Design: ROM & RAM cells design.

**Interconnect & Clock Distribution**

Interconnect delays, Cross Talks, Clock Distribution. Introduction to low power design, Input and Output Interface

circuits. **BiCMOS Logic Circuits**
Introduction, BJT Structure & operation, Basic BiCMOS Circuit behavior, Switching Delay in BiCMOS Logic circuits, BiCMOS Applications.

**References:**
1. Kang & Leblebigi "CMOS Digital IC CircuitAnalysis & Design"- McGraw Hill, 2003
2. Rabey, "Digital Integrated Circuits Design", Pearson Education, Second Edition, 2003
3. Weste and Eshraghian, "Principles of CMOS VLSI design" Addison-Wesley, 2002


# VHDL
# Course/Paper: 08BVL106
# IVL Semester-VIII

**UNIT 1: INTRODUCTION –** Fundamental & history of various hardware description language, Design flow of ASICs and and standard logic circuits using software.

**UNIT 2 : COMBINATIONAL CIRCUIT BUILDING BLOCKS-** Multiplexer, Decoders, encoders, Code Converters, VHDL Code for Combinational Circuits.

**UNIT 3 : SEQUENCIAL CIRCUITS:** VHDL code for Flip-Flops, shift registers, Counters.

**UNIT 4 : SYNCHRONOUS/ ASYNCHRONOUS SEQUENTIAL CIRCUITS:** Mealy & Moore type FSMs, VHDL Code for Mealy & Moore Machines, VHDL Codes for Serial Adder, Vending Machine.

**UNIT 5 : DIGITAL SYSTEM DESIGN-** Building Block circuits, Memory organization, SRAM, Design examples of divider, Multiplier, Shifting & Sorting Operations, Clock Synchronization, CPU organization and design concepts.

1. Stephen brown and Zvokunki Vransic- Fundamental of digital logic circuit, TMH .
2. D.L.PERRY – vhdl3 ED, TMH.
3. Morris Mano- Digital Logic & Computer Design , PHI .
4. J.Bhaskar- Vhdl premier- prentice hall.

pins, Port, External memory, Counters and Timers, Serial data. Interrupts.

**UNIT 2 : 8051 ASSEMBLY LANGUAGE PROGRAMMING:** Addressing modes, External data moves, push and pop opcodes, Logical operations, Byte level and bit level logical operations. Arithmetic operations, Jump and call instructions, Interrupts & returns.

**UNIT 3: REAL TIME CONTROL:** Interrupts, Multiple sources of interrupts, Non maskable sources of interrup

# DIGITAL SYSTEM DESIGN

## Course/Paper: 08BVL107
## IVL Semester-VIII

Specification of combinational systems using VHDL, Introduction to VHDL, Basic language element of VHDL, Behavioral Modeling, Data flow modeling,Structuralmodeling,Subprogramsandoverloading,VHDLdescriptionofgates.

DescriptionanddesignofsequentialcircuitsusingVHDL,Standardcombinationalmodules,DesignofaSerialAdderwithAccumulator,StateGraph forControlNetwork,designofaBinaryMultiplier,MultiplicationofaSignedBinaryNumber,DesignofaBinaryDivider.

Register- transferlevelsystems, ExecutionGraph, OrganizationofSystem, ImplementationofRTLSystems,Analysis ofRTLSystems, Designof RTL Systems.

Data Subsystems, Storage Modules, Functional Modules, Data paths, Control Subsystems, Micro programmed Controller, Structure of a micro programmed controller, Micro instruction Format, Micro instruction sequencing, Micro instruction Timing, Basic component of a micro system, memory subsystem.

I/Osubsystem, Processors, Operationofthecomputerandcycletime. BinaryDecoder, BinaryEncoder, Multiplexers andDemultiplexers, Floating PointArithmetic-RepresentationofFloatingPointNumber,FloatingPointMultiplication.

**References:**
1. J. Bhaskar,"AVHDLPrimer",AddisonWesley,1999.
2. M. Ercegovac,T. LangandL.J. Moreno, "IntroductiontoDigitalSystems",Wiley,2000
3. C. H. Roth,"DigitalSystemDesignusingVHDL",PWSPublishing
4. J.F.Wakerly,"DigitalDesign-PrinciplesandPractices",PHL
5. Douglas Perry, "VHDL", MGH
6. MichaeJohnSebastianSmith,"Application-SpecificIntegratedCircuits",Addison-Wesley.
7. Z. Navabi,"VHDL-AnalysisandModelingofDigitalSystems",MGH

# PROJECT I

## Course/Paper: 08IVL-201
## IVL Semester-VIII

# COMPUTER NETWORK PROGRAMMING LAB

## Course/Paper: 08IVL-202
## IVL Semester-VIII

1. **PRELIMINARIES:** Study and use of common TCP/IP protocols and term viz. telnet rlogin ftp, ping,finger, Socket, Port etc.
2. **DATA STRUCTURES USED IN NETWORK PROGRAMMING:** Representation of unidirectional, Directional weighted and unweighted graphs.
3. **ALGORITHMS IN NETWORKS:** computation of shortest path for one source-one destination and one source –all destination.
**4. SIMULATION OF NETWORK PROTOCOLS:**
(i) Simulation of M/M/1 and M/M/1/N queues.
(ii) Simulation of pure and slotted ALOHA.
(iii) Simulation of link state routing algorithm.
**5. Case study : on LAN Training kit**
(i) Observe the behavior & measure the throughput of reliable data transfer protocols under
various Bit error rates for following DLL layer protocolsa.
Stop & Wait
b. Sliding Window : Go-Back-N and Selective Repeat
(ii) Observe the behavior & measure the throughput under various network load conditions for
following MAC layer Protocols
a. Aloha
b. CSMA, CSMA/CD & CSMA/CA
c. Token Bus & Token Ring
**6. DEVELOPMENT OF CLIENT SERVER APPLICATION:**
(i) Develop 'telnet' client and server which uses port other than 23.
(ii) Write a finger application which prints all available information for five users currently logged on and are using the network for longest duration. Print the information in ascending order of time.

# INDUSTRIAL ECONOMICS & MANAGEMENT

## Course/Paper: 08IVL-203
## IVL Semester-VIII

**UNIT 1 :** Organizational forms, Profit maximization and other objectives of industrial firms, Theory of profitability, Economies of scale. Financing of Industries- Need and sources of finance, Role of special financial institutions, Investment criteria-NPV, IRR.

**UNIT 2 :** Approaches to industrial location analysis, Productivity analysis, Input-Output analysis, Concentration of economic power.New Industrial Policy – Critical analysis, Role of technology and entrepreneurship in industrial development.

**UNIT 3:** Management – Principles of management, functions-planning, Organization staffing, Directing,Controlling, Coordination, Decision making.

**UNIT 4 :** Production Management – Total quality management, JIT, Quality circle, Quality-ISO9000,ISO14000, KANBAN, Bench marking, Effective communication.

**UNIT 5:** Labour Legislations.

# VHDL CIRCUIT DESIGN LAB

## Course/Paper: 08IVL-204
## IVL Semester-VIII

Design of following ckt using appropriate software like VHDL/ FPGA.

1  3 input NAND gate.
2. Half adder.
3. D-Latch.
4. Serial in-serial out shift register.
5. half subtractor
6. multiplexer.
7. Digital clock.
8. ALU

## SEMESTER IX

# ANALOG VLSI DESIGN

# Course/Paper: 09IVL-101
# IVL Semester-IX

SmallSignal&largesignalModelsofMOS&BJTtransistor.AnalogMOSProcess(DoublePolyProcess

**) MOS & BJTTransistorAmplifiers:**

Single transistor Amplifiers stages: Common Emitter, Common base, Common Collector, Common Drain, Common Gate & Common Source Amplifiers

Multiple Transistor Amplifier stages: CC-CE, CC-CC, & Darlington configuration, Cascode configuration, Active Cascode. Differential Amplifiers: Differential pair & DC transfer characteristics.

**Current Mirrors,Active Loads & References**

Current Mirrors: Simple current mirror, Cascode current mirrors Widlar current mirror, Wilson Current mirror, etc. Active loads, Voltage & current references. Analysis of DifferentialAmplifier with active load, supply and temperature independent biasing techniques, Frequency Response,

**OperationalAmplifier:**

Applications of operational Amplifier, theory and Design; Definition of Performance Characteristics; Design of two stage MOS Operational Amplifier, two stage MOS operational Amplifier with cascodes, MOS telescopic-cascode operational amplifiers, MOS Folded-cascode operational amplifiers, Bipolar operational amplifiers. Frequency response & compensation.

**NonlinearAnalog Circuits:**

Analysis of four quadrant and variable Tran conductance multiplier, Voltage controlled oscillator, Comparators,Analog Buffers, Source Follower and Other Structures. Phase Locked Techniques; Phase Locked Loops (PLL), closed loop analysis of PLL. Digital-to-Analog (D/A) andAnalog-to-Digital

(A/D)Converters

**OTA & Switched Capacitor filters**

OTAAmplifiers. Switched Capacitor Circuits and Switched Capacitor Filters.

**References:**
1. Paul B Gray and Robert G Meyer, "Analysis and Design ofAnalog Integrated Circuits".
2. BehzadRazavi, "Principles of data conversion system design", S.Chand and company Ltd, 2000. John Wiley
3. D.A. Johns and Martin,Analog Integrated Circuit Design, John Wiley, 1997.
4. R Gregorian and GCTemes,Analog MOS Integrated Circuits for Signal Processing, John Wiley, 1986.
5. RL Geiger, P E Allen andNR Strader, VLSI DesignTechniques forAnalog & Digital Circuits, McGraw Hill, 1990.
6. Gray and Meyer," Analysis and Design ofAnalog IC ", Wiley international,1996.
7. Gray, Wooley, Brodersen, "Analog MOS Integrated circuits", IEEE press, 1989.
8. Kenneth R. Laker, Willy M.C. Sensen," Design ofAnalog Integrated circuits and systems", McGraw Hill, 1994.

# CMOS RF CIRCUIT DESIGN

# Course/Paper: 09IVL-102
# IVL Semester-IX

Optical fibers: review of fundamentals, Signal distortion and attenuation, Intermodal and intramodal dispersion, dispersion flattened and dispersion compensated fibers, Profile dispersion, study of PMD.

Laser diode and photodiode, Photo detector noise analysis, Analog and Digital communication link design. WDM, DWDM, optical couplers, Mach-Zehnder interferometer multiplexer, optical add/drop

multiplexers, isolators, circulators, optical filters, tunable sources and tunable filters, arrayed waveguide grating, diffraction grating, optical amplifiers, optical integrated circuits .Characterization of optical fibers, OTDR

SONET: frame format, overhead channels, payload pointer, Virtual tributaries, multiplexing hierarchy.

SDH: Standards, frame structure and features.
Optical switching, WDM networks,
Classification of optical sensors. Intensity modulated, phase modulated and spectrally modulated sensors.

1. **Shinner "Optical Fiber Communication", Pearson.**
2. **Gerd Keiser – "Optical Fiber Communication", TMH.**
3. J.N.Senior  - "Optical fiber communication", PHI

# VLSI TEST & TESTABILITY

# Course/Paper: 09IVL-103
# IVL Semester-IX

The need for testing, the problems of digital and analog testing, Design for test, Software testing Faults in Digital circuits:General introduction, Controllability and Observability.. Faultmodels - Stuck-at faults, Bridging faults, intermittent faults

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

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 Testing of Analog and Digital circuits : Testing techniques for Filters, A/D Converters, RAM, Programmable logic devices and DSP

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

# ALGORITHMS FOR VLSI DESIGN AUTOMATION

# Course/Paper: 09IVL-104
# IVL Semester-IX

**Logic synthesis & verification**
Introductiontocombinationallogicsynthesis,BinaryDecisionDiagram,Hardwaremodelsfor High-levelsynthesis.

**VLSIautomationAlgorithms:**
Partitioning: problem formulation, classification of partitioning algorithms, Group migration algorithms, simulated annealing & evolution, other partitioning algorithms.

Placement, floor planning & pin assignment: problem formulation, simulation base placement algorithms, other placement algorithms, constraint basedfloorplannning,floorplanningalgorithmsformixedblock&celldesign.General&channelpinassignment.

GlobalRouting: Problemformulation, classificationofglobalroutingalgorithms, Mazeroutingalgorithm, lineprobealgorithm, SteinerTreebased algorithms, ILPbasedapproaches.

Detailed routing: problem formulation, classification of routing algorithms, single layer routing algorithms, two layer channel routing algorithms, three layer channel routing algorithms, and switchbox routing algorithms.

Over the cell routing & via minimization: two layers over the cell routers, constrained & unconstrained via

minimization Compaction: problem formulation, one-dimensional compaction, two dimension based compaction,

hierarchical compaction

**References:**
1.   Naveed Shervani, "Algorithms for VLSI physical designAutomation", KluwerAcademic Publisher, Second edition.
2.   Christophn Meinel & Thorsten Theobold, "Algorithm and Data Structures for VLSI Design", KAP, 2002.
3.   Rolf Drechsheler: "EvolutionaryAlgorithm for VLSI", Second edition

4.   Trimburger," Introduction to CAD for VLSI", KluwerAcademic publisher, 2002

# ADVANCE DIGITAL SIGNAL PROCESSING

## Course/Paper: 09IVL-105
## IVL Semester-IX

DFT & its properties. Decimation in time and decimation in frequency FFT algorithms, discrete cosine transform. IIR Filter design: Butterworth design, bilinear transformation. Low Pass, High Pass, Band Pass and Band Stop digital filters. Spectral transformation of IIR filters.

FIR filter design: Symmetric and antisymmetric linear phase. FIR filter by rectangular, triangular and Blackman window functions.

Finite word length effects in FIR and IIR digital filters: Quantization, round off errors and overflow errors.

Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators. Polyphase decompositions.

1. **S .K. Mitra – "Digital Signal Processing", TMH.**
2. **Prokis & Monalskis – "Digital signal processing", PHI.**
3. **Shahliwahnan – "digital signal processing ", Eastern economy edition.**
4. **Schafer & Buck – "discrete time sinal processing", Pearson.**

# PROCESS, DEVICES & CIRCUIT SIMULATION

## Course/Paper: 09IVL-106
## IVL Semester-IX

Introduction, Main data structure & program organization, Geometrical manipulations, Ion implantation, A novel measurement technique for 2D implanted ion distributions, Introduction to partial differential equation solver, the merged multi grid method, Isothermal device modeling & simulation, Non Isothermal device modeling & simulation, hydrodynamic device modeling & simulation.

**References:**
1) Circuit, Device and Process Simulation: Mathematical and Numerical Aspects by Graham F. Carey (Editor), W. B. Richardson, C. S. Reed, B. Mulvaney, John Wiley & Sons; 1 edition.
2) Process and Device Simulation for MOS-VLSI Circuits, edited by P. Antognetti, D.A. Antoniadis , Robert W. Dutton, W.G. Oldham, kluwer Academic Publisher, 2000.

# WIRELESSS COMMUNICATION LAB-II

## Course/Paper: 09IVL-201
## IVL  Semester-IX

1. Demonstration of modeling of wire antenna using appropriate design software.
2. Simulation of antenna arrays using appropriate software.
3. Design and testing of micro strip rectangular patch antenna using appropriate software.
4. Investigate the transmission characteristics of the link and measure the gain of the microstrip patch antennas. Draw the antenna radiation diagram.
5. Radar Trainer: Working of Doppler radar, velocity of moving object, time and frequency measurement and other applications.
6. To perform Modulation, Demodulation and BER measurement using CDMA – DSSS Trainer
7. To establish analog/digital communication link and transmit & receive three signals (audio, video, tone) simultaneously using Satellite Communication Trainer.
8.To study GPS Receiver, establishing link between GPS satellite & GPS trainer and measure of latitude & longitude
.

# MODELING & SIMULATION LAB

**Course/Paper: 09IVL-202**
**IVL Semester-IX**

**EXPERIMENTS USING TMS320C6XXX DSP KITS**
1. FIR Digital Filter Design
2. IIR Digital Filter Design
3. FFT of a given signal
4. Plot PSD/Power Spectrum of a signal
5. Discrete Cosine Transform
6. Adaptive Filter Design using Standard LMS Algorithm
7. Speech analysis using L.P.C.

# SEMINAR

**Course/Paper: 09IVL-203**
**IVL Semester-IX**

**OBJECTIVE**
The students are to select one technical topic related its branch for Seminar. The student is to submit the synopsis for assessment and approval. Progress for preparation of the seminar topic would be continuously assessed from time to time. Two periods per week are to be allotted and students are expected to present the seminar Progress. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain the attendance.
 Students have to give a final presentation for 15 minutes on his topic.  Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews

# PROJECT-II

**Course/Paper: 09IVL-204**
**IVL Semester-IX**

## OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 3 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution.
The student should select any one of the topics offered from the department or select one on his own duly approved from the department. Candidate is required to submit the detailed synopsis of the work that he would complete in the part-II
Each student shall finally produce a comprehensive report covering back ground information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

# Semester X

# DISSERTATION

**Course/Paper: 10IVL 201**
**IVL Semester-IX**

The student will submit a synopsis at the beginning of the semester for the approval from the University project committee in a specified format. Synopsis must be submitted within a two weeks. The first defense, for the dissertation work, should be held with in a one month. Dissertation Report must be submitted in a specified format to the University  for evaluation purpose.