REVISED SCHEME & SYLLABUS

of

B.TECH.

ELECTRONICS & COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.
NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR-177 005 (HP)

DEC, 2007
# REVISED SCHEME
## B.TECH
### ELECTRONICS & COMMUNICATION ENGINEERING

**1st Semester (Group-A)**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Course no.</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Hours</th>
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<td>BS-111</td>
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### PRACTICALS

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</table>
1. **SEMICONDUCTORS, DIODES AND DIODE CIRCUITS:**
Insulators, semiconductors and metals, Mobility and conductivity, Intrinsic and extrinsic semiconductors and charge densities in semiconductors, current components in semiconductors, continuity equation. PN Junction diode – characteristic and analysis, Types of diodes – Zener diodes, Photodiodes, Light emitting diodes (LED’s), Varactor diodes and tunnel diodes. Rectifiers and filter circuit: Half wave, full wave and Bridge rectifier circuits and their analysis, L, C and Pi filters, Basic regulator supply using zener diode. Working of Switched Mode Power Supply


3. **FIELD EFFECT TRANSISTOR:** construction and characteristics of JFET. JFET biasing circuit JFET amplifier MOSFET construction and characteristics.

4. **AMPLIFIERS AND OSCILLATORS:** Classification of amplifiers, concept of feed back, general characteristics of feed back amplifiers, Single stage RC coupled amplifier. Oscillators – Criterion for Oscillation, type of oscillators: Hartley oscillator, Colpitt Oscillator & RC Phase shift oscillator.

5. **OPERATIONAL AMPLIFIERS:** Introduction to Op-amp, Inverting and non-inverting configuration, Applications – adder, subtractor, integrator, differentiator and comparator, practical op-amps.

6. **ELECTRONIC INSTRUMENTS:** Role and importance of general purpose test instruments, Electronic Millimeter, Cathode Ray Oscilloscope, Measurement of amplitude, frequency and phase using CRO

**TEXT BOOKS**
1. Electronics Devices and circuits by Millman & Halkias.
2. Electronics devices and circuit theory by Robert Boylestad

**REFERENCE BOOKS**
1. Electronics Devices and circuits by P.John Paul
2. Electronics Devices and circuits by Y.N.Bapat.
3. Electronics devices and circuit by G.K. Mittal
1. Familiarization of electronics component and equipments like C.R.O,
   Function generator and power supplies etc.
2. To study the V-I characteristics of pn junction diode and determine
   static resistance and dynamic resistance.
3. To study the characteristics of zener diode and hence determine the dynamic
   resistance from the characteristics.
4. Determine the voltage regulation of zener diode stabilizer.
5. To study and plot the wave form of half wave and full wave rectifier with and
   without capacitor filter.
6. To study and plot the input and output characteristics of common emitter transistor
   and calculate its input and output resistance.
7. To study and plot the input and output characteristics of common base transistor
   and calculate its input and output resistance.
8. To study the characteristics of FET(Field effect transistor) and hence calculate
   dynamic ($r_d$), mutual conductance ($g_m$) and amplification factor($\mu$).
9. To study the frequency response of single stage CE amplifier and hence calculate
   the band width ($3\text{dbBW}$).
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<tr>
<th>Sr. No.</th>
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1. NUMBER SYSTEM & CODES:
Binary, Octal, Hexadecimal number systems and their inter-conversion, Binary Arithmetic (Addition, Subtraction, Multiplication and Division), Diminished radix and radix compliments, BCD codes, 8421 code, Excess-3 code, Gray code, error detection and correction, Hamming code.

2. LOGIC GATES, BOOLEAN ALGEBRA & LOGIC FAMILIES:
Axiomatic definition of Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Canonical and Standard forms, Digital Logic Gates. Various Logic Families like TTL and ECL etc., working and their characteristics, MOS and CMOS devices.

3. COMBINATIONAL LOGIC DESIGN:

4. MSI AND PLD COMPONENTS:
Binary adder and subtractor, Multiplexers, Decoders / Demultiplexers, Read Only Memory, Programmable Logic Arrays, Programmable Array Logic. Implementation of Combinatorial Logic using these devices.

5. INTRODUCTION TO SEQUENTIAL LOGIC:
Introduction, S-R Flip-flops, JK flip-flop, D flip-flop, T flip-flop, master slave flip-flop. Flip-flop excitation table, Classification of sequential circuits, Registers and A to D and D to A converter circuits, design & analysis of synchronous and asynchronous sequential circuits: Counters, Sequence Detector and Sequence Generator.

6. SEMICONDUCTOR MEMORIES: Introduction, Memory organisation, Classification and characteristics of memories, Sequential memories, ROMs, R/W memories. Content addressable memories, Programmable logic arrays, Charged-Coupled device memory.

Books Suggested:

2. Thomas Downs and Mark F Schulz, Logic Design with Pascal, Van Nostrand Reinhold.
3. Digital principle and applications Malvino and Leach- (TMH)
4. Modern digital systems design Cheung (WPC)
1. To verify the truth table of logic gates realize AND, OR, NOT gates
2. To realize AND, OR gates using diodes and resistors
3. To verify the Boolean algebra function using digital IC gates (consensus theorem) only
4. To realize the function \( F(A, B, C, D) = (C+D)(A+B)(B+D) \) using NOR gates only
5. Design a half/full adder circuit using FF for 2 bits
6. Design a half/full subtractor circuit using FF for 2 bits
7. Use Quine Mclusky method for designing \( F(A,B,C,D) = \Sigma m(1,3,5,7,9,15)+d(4,6,12,13) \) realize it NOR-OR implementation.
8. Design a binary to gray code converter.
9. Design a function using K-map and verify its performance using SOP and POS form
10. Design BCD to seven-segment display using 7447 IC
11. Implement \( F(A, B, C) = E(1, 3, 4, 5, 6) \) with a multiplexer.
12. Design a modulus N counter and a ring counter.
13. Design a shift register using flip-flops
1. **LOW FREQUENCY TRANSISTOR AMPLIFIER**: Equivalent circuit of BJT using h-parameter for CB, CE and CC configuration, calculation of transistor parameter for CB, CE & CC using h-parameters, comparison of transistor amplifier configuration.

2. **MULTISTAGE AMPLIFIER**: General cascaded system, RC coupled amplifier and its frequency response, merits and demerits, cascode amplifier, Darlington compound configuration, multistage frequency effect.

3. **HIGH FREQUENCY RESPONSE OF TRANSISTOR AMPLIFIER**: High frequency model for CE configuration, approximate CE high frequency model with resistive load, CE short circuit current gain, HF current gain with resistive load.

4. **LARGE SIGNAL AMPLIFIER**: Analysis and design of class A,B, AB,C amplifiers, push pull amplifiers, transformer less output stages, distortion calculations.


6. **FEEDBACK AMPLIFIER**: Feedback concept, characteristics of negative and positive feedback. Effect of negative and positive feedback on input impedance, output impedance, gain, and noise and frequency response.

7. **OSCILLATORS** Classification of Oscillators, frequency and frequency stability of oscillatory circuits, Tuned based Oscillators, Hartley Oscillator, Colpitts Oscillators Clapp Oscillator, Crystal Oscillator, Phase Shift Oscillator, Wein Bridge Oscillator

8. **MULTIVIBRATORS** Monostable multi-vibrator, astable multi-vibrator and bistable multivibrator and timer applications. Introduction and block diagram of 555 timer and UJT.

**TEXT BOOKS**

1. Integrated devices & circuits by Millman & Halkias.
2. Electronic Devices & circuit theory by R. Boylestad.

**REFERENCE BOOKS**

2. Electronic Devices & Circuit by G.K.Mithal
ECE-232 (P)  ANALOG ELECTRONIC CIRCUITS LAB

1. To study the phase shift oscillator and find its frequency.
2. To study the frequency of a given crystal oscillator and measure the output.
3. To study the two stage RC coupled transistor amplifier.
4. To study voltage gain and frequency response of FET audio power amplifier.
5. To study WEIN-BRIDGE oscillator and determine its frequency.
6. To study power gain and frequency response of a transistor audio amplifier.
7. To study CLASS-B push pull amplifier at audio frequency.
8. To study series and parallel resonance.
9. To study the HARTLEY and COLPITS oscillator.
1. INTRODUCTION: Review of vector analysis, Scalar & vector products, gradient, divergent and curl of a vector and their physical explanation-Transformation amongst rectangular, cylindrical and spherical co-ordinate system.

2. ELECTROSTATICS: Coulomb's law, electric field intensity from point charges, field due to continuous distribution of charges, gauss’s law, Electric displacement and displacement density potential function, potential field of a point charge, laplace’s and poisson’s equations.

3. MAGNETOSTATICS: Magnetic field intensity and magneto motive force, Ampere’s Circuital law, Energy stored, Biot-savart law, vector potential, magnetic dipole.

4. TIME DEPENDENT FIELDS: Ampere's work law in differential vector form, continuity of currents, conduction and displacement current. Maxwell's equations and their interpretations, boundary conditions. Wave equations, sinusoidal time varying fields, uniform plane wave in dielectric and conductor media, skin effect and depth of penetration, reflection and refraction of plane waves at boundaries for normal and oblique incidence surface impedance.


6. TRANSMISSION LINES: Transmission line theory from the circuit concept, properties; constants; transmission line equations; infinite line; reflections in transmission lines; voltage, current and impedance relations-open and short circuit lines; Experimental determination of line constants. Standing wave ratio; impedance matching, quarter and half wave lines single stub and double stub matching; circle diagram - Smith chart.

7. INTRODUCTION TO WAVE GUIDES Waves between parallel plane; Transverse Electric wave, Transverse magnetic waves; characteristics of TE & TM waves; Transverse Electromagnetic waves; velocity of propagation; Attenuation in parallel plane guides; wave impedance.

BOOKS RECOMMENDED:

1. Electromagnetic waves & radio system by Jorden R.F.
2. Principle and applications of Electromagnetic fields by Ptonsey R and Collin R.P
3. Applied Electromagnetic by Planus M.A.
### IV Semester

<table>
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<th>Course no.</th>
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**Total**

|          |               |                                | 26 | 23 |     |       |         |

* After class work (Any three of the following). per hours per week (Yoga, NCC, NSS, Sports, Cultural)
1. **INSTRUMENTATION SCHEME & CHARACTERISTICS**: Definition, Application and types of measurements, instrument classification, Functional elements of an instrument, input output configuration of measuring instruments, Methods of correction for interfering and modifying inputs, standards, calibration, introduction to static characteristics and dynamics characteristics, selection of instruments, loading effects. Dynamic characteristics of measurement systems, Zero order, first order and second order systems & their response.

2. **Error analysis**: Types of errors, Methods of error analysis, uncertainty analysis, statistical analysis, Gaussian error distribution, chi-square test, correlation coefficient, students T – test, method of least square, curve fitting, graphical analysis, general consideration in data analysis, design of experiment planning.


4. **TRANSDUCERS**: Principles and classification of transducers, guidelines for selection and application of transducers, basic requirements of transducers. Different types of transducers, displacement, strain gauge, LVDT, potentiometer, capacitive & inductive, Piezoelectric, temperature, optical, Hall effect transducers. Measurement of parameter: Measurement of length, angle, area, temperature, pressure flow, speed force, torque, vibration, level, concentration (conductivity and pH) measurement.

5. **Display Devices and Recorders**: Telemetry & Remote sensing, GIS (Geographical information System), various display devices & Recorder, CRO (basic block diagram, deflection sensitivity, application: voltage, current, frequency and phase angle measurement).


7. **SIGNAL GENERATORS & ANALYZERS**: Sweep frequency generator, frequency synthesized signal generator & function generator, Wave analyzer, Spectrum analyzer.

**Text Books:**
2. Instrumentation, Measurement & Analysis by K K Chaudhury & R C Nakra, TMH
3. Instrumentation, Measurement & Feedback by Barry Jones, PHI

**Reference Books:**
1. Instruments & Measurement for Electronic by Clyde N. Herrick
1. To measure frequency and phase of a signal from a Lissajous Pattern using CRO.
2. To study the characteristics of LDR, Photo-diode and Phototransistors.
3. To measure a Water Level using Water Level Sensors.
4. To measure a strain using a strain cantilever.
5. To measure a displacement using LVDT Linear variable Differential Transformer Transducer.
6. To study & determine the characteristics of VDR.
7. To measure a load using Load Cell Transducer.
8. To measure a Temperature using Thermocouple & Thermistor Transducer.
9. To measure a Displacement through Inductive Linear transducer.
1. REPRESENTATION IN FREQUENCY AND TIME DOMAIN

Introduction to information, messages & signals classification of signals. The discrete and continuous spectrum, power spectrum energy density spectrum, Dirac delta functions, sampling theory and approximations.

2. RANDOM SIGNAL THEORY

Discrete probability theory, continuous random variables, statistically independent random variables, probability density functions of sums, transformation density functions with discrete components ergodic process, correlation functions, spectral density and white noise.

3. NOISE

Atmospheric, thermal, shot and partition noise, noise figure and experimental determination of noise figure, shot noise in temperature limited diode and space charge limited diodes, Pulse response and digital noise.

4. TRANSMISSION THROUGH NETWORKS

Networks with random input, auto-correlations, spectral density and probability density input-output relationships, envelope of sine waves plus Gaussian noise, optimum system and non-Linear systems, maximum criterion, equivalent noise bandwidth.

5. BASIC INFORMATION THEORY

Definition of information, units of information, entropy, uncertainty and information rate of communication, redundancy, relation between system capacity and information content of messages, discrete system, discrete noisy channel, continuous systems, comparison of existing system.

TEXT BOOKS

1. Hancock J.C."Elements of Communication Theory"
2. Sharma Sanjay “Signals And Systems”

REFERENCE BOOKS

3. Swartz, "Information & Transmission"
5. Simon Hay Kin “Communication Systems”


4. **Monolithic Components**: Diodes and Transistors, JFETs, MOSFETs, Resistors, Capacitors, MESFETs, Basics of VLSI CMOS technology, Reliability issues in CMOS VLSI, Latching, Electromigration.

5. **Assembly Techniques & Packaging of VLSI Devices**: Introduction to packaging, Package design considerations, VLSI Assembly techniques, Packaging fabrication technology.

6. **Surface Mount Technology (SMT)**: Through hole technology, Surface Mount Technology, applications & SM Components.

7. **Special Techniques for Modern Processes**: Self aligned silicides, hallow junction formation, nitride oxides etc. process flows for CMOS and bipolar IC processes.

**Text Books**

1. S.M. Sze, “VLSI Technology”, TMH
2. Eshraghian & Pucknell, “Introduction to VLSI”, PHI
5. D.Nagchoudhuri “Principles of Microelectronics Technology” PHI

**Reference Books**

### V Semester

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Course no.</th>
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</table>
Introduction To Microprocessor
History and Evolution, types of microprocessors, 8085 Microprocessor, Architecture, Bus Organization, Registers, ALU, Control section, Instruction set of 8085, Instruction format, Addressing modes, Types of Instructions.

Assembly Language Programming and Timing Diagram
Assembly language programming in 8085, Macros, Labels and Directives, Microprocessor timings, Micro instructions, Instruction cycle, Machine cycles, T states, State transition diagrams, Timing diagram for different machine cycles.

Serial I/O, Interrupts and Comparison of Contemporary Microprocessors
Serial I/O using SID, SOD. Interrupts in 8085, RST instructions, Issues in implementing interrupts, Multiple interrupts and priorities, Daisy chaining, Interrupt handling in 8085, Enabling, disabling and masking of interrupts. Brief comparison of contemporary 8-bit microprocessors like Z-80, M68000 with 8085.

Data Transfer techniques
Data transfer techniques, Programmed data transfer, Parallel data transfer using 8155. Programmable parallel ports and handshake input/output, Asynchronous and Synchronous data transfer using 8251A. Programmable interrupt controller 8259A. DMA transfer, cycle stealing and burst mode of DMA, 8255, 8257 DMA controller.

Microprocessor Interfacing Techniques
Interfacing memory and I/O devices, Addressing memory, interfacing static RAMs, Interfacing and refreshing dynamic RAMs, Interfacing a keyboard, Interfacing LED and seven segment displays, Interfacing a printer, Interfacing A/D converters, D/A converters.

Architecture of typical 16 bit microprocessors (Intel 8086)
Memory address space and data organization - Segment registers and memory segmentation - Generating a memory address - I/O address space - Addressing modes - Comparison of 8086 and 8088 - Basic 8086/8088 configuration - Minimum mode - Maximum mode - System timing.

Introduction to 80186/188, 286, 386 & 486 with Block diagram, features & application.

Books Recommended:
1. R.S. GAONKAR, Microprocessor Architecture, Programming and applications with the 8085/8080A, Wiley Eastern Ltd.

REFERENCE BOOKS
1. Simple programs for sorting a list of numbers in ascending and descending order.

2. Sorting a list without destroying the original list.

3. Code conversion - Binary to Gray/Gray to Binary.

4. Program for addition of BCD numbers.

5. Program for multiplication of 8-bit numbers.

6. Interface an LED array and 7-segment display through 8255 and display a specified bit pattern/character sequence at an interval of 2 seconds.

7. Interface the given microprocessor kit to a personal computer through R.S-232C. The band rate is specified. Verify data transfer in both directions (P - PC and PC - P).

8. Assembly language programming of 8086.
1. MODULATION TECHNIQUES: Various frequency bands used for communication, types of communication and need of modulation. Introduction to AM, FM, PM, Frequency spectrum of AM Waves, Representations of AM, Power relation in AM waves, Need and description of SSB, suppression of carrier, suppression of unwanted side bands, Independent side band system, vestigial side band system, Mathematical representation of FM, frequency spectrum of the FM waves, Phase modulation, comparison between analog and digital modulation, Wide band and narrow band FM, Sampling theorem, frequency division multiplexing and time division multiplexing.

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

FM RECEIVERS: Limiters, single and double tuned demodulator, balanced slope detector, foster seeley or phase discriminator, de-emphasis, ratio detector, block diagram of FM receiver, RF amplifiers, FM receiver characteristics.


5. BASIC CONCEPTS OF DIGITAL MODULATION TECHNIQUES:
Binary phase shift keying, differential phase shift keying, differential encoded PSK, quadrature PSK, Quadrature Amplitude shift keying (QASK), Binary frequency shift keying.

6. RADIO WAVE PROPAGATION- Basic ideas of ground wave, propagation, reflection at the surface of a finitely conducting plane, earth (on ground), space and surface waves, tilt of the surface wave, troposphere waves-reflection, refraction, duct propagation. The ionosphere, formation of the various layers, their effective characteristics, reflection and refraction of waves by ionosphere, virtual height, maximum frequency, skip distance, regular and irregular variation of ionosphere, ordinary and extraordinary waves.

TEXT BOOKS
1. Electronic communication Systems by George Kennedy.
4. Electronic communication Systems by Dennis Roddy and John Coolen
1. To study Amplitude modulation using a transistor and determine depth of modulation.
2. To study Amplitude demodulation.
3. To study Frequency modulation using voltage controlled oscillator,
4. Generation of DSB-SC signal using balanced modulator, single side band signal,
5. Study of phase lock loop and detection of FM Signal using PLL,
6. Measurement of noise figure using a noise generator,
7. Study of super heterodyne AM receiver and measurement of sensitivity, selectivity & fidelity.
9. Study of PCM and analysis of sampling theorem.

2. INTRODUCTION TO OPERATIONAL AMPLIFIERS: The basic operational amplifier & its schematic symbol, Block diagram representation of OP-AMP, Power supply requirements of an OP-AMP, Evolution of OP-AMP., Specification of a typical OP-AMP (741).


5. OPERATIONAL AMPLIFIER CONFIGURATIONS & LINEAR APPLICATION:
Open loop OP-AMP configurations- The differential amplifier, inverting amplifier, non-inverting amplifier, negative feed back configurations - inverting and non inverting amplifiers, voltage followers & high input impedance configuration, differential amplifiers, closed loop frequency response & circuit stability, single supply operation of OP-AMP, summing, scaling and averaging amplifier, voltage to current & current to voltage converters, integrators & differentiators, logarithmic & anti logarithmic amplifiers


7. COMPARATORS & CONVERTERS: Basic comparator & its characteristics, zero crossing detector, voltage limiters, clippers & clampers, small signal half wave & full wave rectifiers, absolute value detectors, sample and hold circuit.

TEXT BOOKS
2. Design with operation amplifiers and Analog Integrated circuits by Sergei Franco.
3. Integrated Electronics: Analog and Digital circuits & system by Millman & Halkias.
4. Linear Integrated Circuits by D.R.Chaudhary (WEL)
1. To demonstrate the relationship between input and output for the inverting and non-inverting configuration of the Op-Amp 741.
2. To verify the function of op-amp as a summer and as a difference amplifier.
3. To perform the mathematical operation of integration using basic and practical circuits of op-amp’s.
4. To perform the mathematical operation of differentiation using basic and practical circuits of op-amp’s.
5. To study half wave and full wave rectifier circuits using op-amp’s.
6. To design a second order butter worth low pass filter for cut of frequency of 2 KHz and determining its frequency response.
7. To study the frequency response of a high pass filter(second order).
8. To study fourth order low pass filter and high pass filter.
9. To plot the frequency response of the band pass filter for a specified frequency range.
10. To design a square wave and triangular wave generator using Op-amp’s.
11. To design Wein bridge oscillator using Op-Amp for oscillating frequency 1 KHz.
## VI Semester

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**Total** 22 19
1. **RADIATION:** Retarded potentials, radiation from an oscillation dipole in free space, induction and radiation fields. Radiated power from a current element, radiation resistance, short antennas, radiation from a quarter wave monopole and half wave dipole.

2. **ANTENNA PARAMETERS** - Basic ideas of reciprocity properties of antennas, Radiation patterns, directional properties of dipole antennas. Antenna gain, Antenna aperture and its relation to gain, antenna terminal impedance, self and mutual impedance. Elementary ideas about self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, Antenna temperature and signal to noise ratio.

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

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

5. **RADAR:** Radar Block diagram and operation, radar frequencies, application of radar.
   **RADAR EQUATION:** Prediction of range, minimum detectable signal, receiver noise, transmitter power, pulse repetition frequency and range ambiguity, antenna parameters, system losses and propagation effects.

6. **RADAR SYSTEM:** Doppler effect and its application to CW radar, FM CW Radar altimeters, MTI and pulse doper radar, tracking radar.

7. **RECEIVERS:** Noise figure, radar mixers, Duplexers, A scope and PPI display, Matched Filters, Modulators and Pulse Forming Networks.

**BOOKS RECOMMENDED:**

**Text Book**


**Reference Book**


2. **Phase Controlled Converters:** Principle of Phase Control - Single-Phase Half wave circuit with different types of loads, Single-Phase & Three-Phase Semi-Converter Semi-Converter & Full-Converter. Bridge Circuit with line commutation - Continuous & discontinuous conduction. Single-Phase & Three-Phase Full Converters, Single-Phase & Three-Phase Dual Converters.


**Text Books:**
1. Power Electronics by M H Rashid, PHI (1996)

**Reference Books:**
1. Power Electronics by P C Sen, TMH Edn.
1. To study the characteristics and application of various power devices.

2. To verify the V-I characteristics of SRC and also determine the latching, holding current.

3. To verify the V-I characteristics of UJT also calculate peak voltage ($V_p$), peak current ($I_p$), valley point current ($I_v$).

4. To study and design IC-723 based voltage regulator.

5. To observe the wave form of single phase controlled half wave and full wave rectifier

6. AC phase controlled using triac.

7. To compare the performance of Morgan chopper and jones chopper.

8. To control the speed of D motor using open loop control concept.

9. To control the speed of DC motor using close loop control concept.

10. To control the speed of DC motor using TRAIC.

11. To observe the waveform that IC-555 acted as monostable multivibrator.

To observe the waveform that IC-555 acted as astable multivibrator
### VII Semester

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| Total |            |                                  |   |   |   |       | 29     | 24     |

2. MOSFET fundamentals, Enhancement Mode MOSFETs, Depletion Mode MOSFETs, Weak & strong Inversion Conditions, Threshold Voltage Concept in MOSFETs, IV Characteristics of a MOSFET, Limitations in IV Model and MOSFET Parasitics.

3. Basic VLSI Design Styles-NMOS, CMOS Process flow ; Noise Margin; Inverter Threshold Voltage; NMOS Inverter design and characteristics; CMOS Inverter Design and Properties; Inverter as an Amplifier and Differential Amplifier, Delay, Power Dissipation and scaling in CMOS circuits.

4. Parallel & Series Equivalent circuits; Static CMOS Circuit Design: case study; VLSI Interconnects.

5. Stick Diagrams; Physical Design Rules; Layout Designing; Euler’s Rule for VLSI Physical Design.

6. High Speed Dynamic CMOS logic families; Precharge-Evaluate logic; Dynamic CMOS logic circuits, cascading, charge redistribution and clocking strategies.

7. Memory / Regular Structure Design; ROM Design, SRAM Design

8. SPICE models.

Text Books
3. K. Eshraghian & Pucknell, “Introduction to VLSI”, PHI.

Reference Books
Experiment of the lab will be based on:

Circuit Design using SPICE, VHDL/Verilog, Design using FPGA
I. Introduction to Digital Signal Processing:

II The Z-Transform:

III Frequency Analysis of Signals &Systems:

IV The Discrete-Time Fourier Transform:
Frequency Domain Sampling and DFT. Properties of DFT. Linear convolution using DFT. Efficient computation of the DFT- Fast Fourier Transform Algorithms.-Efficient computation of DFT of two real Sequences. Efficient computation of the DFT of a 2-N point Real Sequences

V Digital Filter Design Techniques:

VI. Realization & Implementation of Discrete-Time Systems-

Text Books
2. Digital Signal Processing by Sanjit K Mitra

Reference Books
1. Digital Signal Processing by Alan V. Oppenheim & Ronald W. Schafer
2. Theory & Application of Digital Signal Processing by Rabiner & Gold
• Study of Floating Point Digital Signal Processor & Fixed Point Digital Signal Processor
• Realisation of Circular & Linear Convolution and Correlation of two sequences.
• Computation of DFT&IDFT of a given Sequence using DSP Processors
• Radix-2 & Radix-4 algorithm FFT Calculation using DSP Processors
• FIR & IIR Filter Implementation using the DSP Processors.

• Basics of MATLAB-Realisation of Unit Impulse, Unit Step & Unit Ramp signals
• Linear & Circular Convolution of two Sequences, Correlation of two sequences
• DFT&IDFT Computation
• Radix-2&Radix-4 algorithm FFT Calculation
• Generation of Gaussian Distributed Numbers
1. ELEMENTS OF DIGITAL COMMUNICATION:

Model of digital communication systems, Noisy communications channels, channel capacity of a discrete memory less channel, Hartley Shanon Law, Bandwidth –S/N tradeoff, pulse Amplitude modulation, pulse code modulation (PCM), Delta Modulation, adaptive delta modulation

2. SAMPLING THEORY:

Sampling Theorem Natural sampling, Flat top sampling, signal recovery & holding, Quantization of signal, Quantization error

3. DIGITAL CARRIER MODULATION TRANSMISSION AND RECEPTION

Introduction, Amplitude Shift Keying (ASK), ASK Spectrum, ASK Modulator, Coherent ASK Detector, Non-coherent ASK Detector, Frequency Shift Keying (FSK), Bandwidth and Frequency Spectrum of FSK, Non-coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, Binary Phase Shift Keying, Binary PSK Spectrum, Coherent PSK Detection, Quadrature Phase Shift Keying (QPSK), QPSK Demodulator, Differential PSK.

4. DATA TRANSMISSION:

A base band signal receiver, probability of error, the optimum filter, white noise-the matched filter, probability of error of the matched filter, coherent reception: correlation, application of coherent reception in PSK and FSK. Correlation receiver for QPSK.

5. NOISE IN PULSE CODE & DELTA MODULATION SYSTEMS:

PCM transmission, calculation of quantization noise, the O/P signal power, the effect of thermal noise, O/P signal to noise ratio in PCM, Delta Modulation, Quantization noise in delta modulation, the O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation.

6. INFORMATION CODING AND DECODING:

Coding for error detection and correction, Block coding – coding, anticoding, Hadamard code, Hamming code, Cyclic Codes, Convolution coding and decoding, Viterbi algorithm, Shannon Fano and Hoffman Codes.

BOOKS RECOMMENDED:

1. Principles of communication systems by Taub & Schilling
1. To study and observe waveform of FSK Modulation and demodulation.

2. To study the characteristics of second order Band pass filter

3. To study sampling and time division Multiplexing and demultiplexing.

4. To study the characteristics of gaussian noise and to measure its spectrum height in

5. the frequency band over which its spectral density is flat.

6. To study delta modulation and demodulation.

7. To observe the time domain and spectral Characteristics of the waveform of

   BPSK, QPSK and offset-QPSK, to build modulators for them and measure their BER

   Performance with ideal receivers.

8. To implement the optimal receiver for 4- PAM and 16 QAM modulated signals, study

   the spectral characteristics of PAM, QAM and measure their BER performance.
## VIII Semester

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Total: 26 hours, 20 credits
1. Introduction to microwave and applications: - Limitations of the conventional tubes, frequency allocations and frequency plans, letter designation for microwave bands.

2. Microwave generators and amplifiers: - Klystrons, Two and multi cavity klystron, reflex klystron amplifiers and oscillators, backward wave oscillators, Magnetrons, the MASER (Microwave Amplification By Stimulated Emission of Radiations).


4. Microwave passive devices and other component: - Rectangular wave guide of its mathematical analysis, circular wave guide, modes of propagation, dominant modes, cut off wave length scattering matrix of microwave junction, properties of scattering matrix of loss-less junction, cavity resonators, E-plane tee, H-plane tee, magic tee, phase shifters, attenuators, directional couplers, ferrite devices, Faraday rotation, gyrator, isolator, circulators, detector.

5. Block diagram of microwave transmitter and receiver, multiplexing equipment, microwave link


7. Strip Line: -Introduction, Micro strip lines, parallel strip lines, coplanar strip lines, shielded strip lines, characteristic impedance of micro strip lines, losses in micro strip lines, quality factor of micro strip lines.

BOOKS RECOMMENDED:

Text Books

1. Foundations for microwave engineering, international student edition, R E.Collins
3. Microwave Engineering by A Dass and S K Dass
4. Microwave by K.C.Gupta
5. Microwave engineering Rajeswari Chatterjee
1. To study the microwave components, sources and different types of loads.
2. To study the characteristics of reflex klystron and determine it’s electronic and mechanical tuning range.
3. To study the characteristics of Gunn diode.
4. To measure the coupling and directivity of a directional coupler.
5. To study various tees i.e.: - E-plane, H-plane and magic tees.
6. To measure VSWR of an unknown load and determine its impedance.
7. To measure large standing wave ratio.
8. To determine the gain of a pyramidal horn and plot its beam pattern and find its lobe width.
9. To match the impedance of maximum power transfer using a slide screw tuner.
10. To measure VSWR, insertion loss and attenuation of fixed and variable attenuator.
11. To measure the frequency of microwave source and demonstrate the relationship among the frequency, free space wavelength and guide wavelength.
12. To determine the insertion loss, isolation of a three port circulator.
1. OVERVIEW:

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

3. FIBRE MATERIAL, COUPLERS AND CONNECTORS

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

5. OPTICAL FIBER SENSORS:
Intensity modulated sensor - general features, intensity modulation through light interruption, shutter multimode fiber sensors and reflective fiber optic sensors.

6. ADVANCED TOPICS:

Text Books
1. Optical Fiber Communication Principles & Practice by John M.Senior, PHI Publication

Reference Books
ECE-482 (P)   OPTICAL FIBER COMMUNICATION LAB

1. To setting up fiber optic analog link.
2. Study of losses in optical fiber.
3. Study of numerical aperture of optical fiber.
4. Study of time division multiplexing (digital).
5. Study of framing in time division multiplexing.
7. Study of voice coding and codec chip.
8. Study of characteristics of fiber optic LED’s and photo detector.
Introduction to an embedded systems design
Introduction to Embedded system, Role of processor selection in Embedded System (Microprocessor V/s Micro-controller), Embedded System Project Management, 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 of an ES.

RTOS & its overview
Real Time Operating System: Task and Task States, tasks and data, Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic designs Using RTOS.

Microcontroller

Embedded system development
Interfacing of external Memory. Interfacing Analog and digital blocks, interfacing of Different peripheral devices such as LED, LCD, Graphical LCD, Switches, Relay, stepper motors, ADC, DAC and various sensors. Introduction to-assembler, compiler, cross compilers and Integrated Development Environment (IDE).

Networks for Embedded Systems

TEXT BOOKS

References
2. The 8051 Microcontroller by K.J. Ayala, Penram International
4. Programming and Customizing the AVR Microcontroller by Dhananjay Gadre, MGH
5. J B Peatman, Design with PIC Microcontrollers, Prentice Hall
1. Study A/D Converter and Analysis of External input using A/D converter and Display the result on LCD.

2. Study D/A Converter, Waveform generation i.e. ramp wave, step wave, square wave, triangular wave.

3. Display the status of 4-bit Keyboard switches on LCD and interface the LCD with micro-controller to display data or character string.

4. Study the 7-segments Display, Digital clock, counter (0-9) and (0-99).

5. Study the L.E.Ds, check the status of any ports, add two numbers and display the result on L.E.Ds, multiply the two numbers and display the result on L.E.Ds.

6. Study the Relay Switch and perform switching of relays to turn ON/OFF.

7. Study the Buzzer operation by using the micro-controller.

8. Study the stepper motor and interfacing stepper Motor to the Micro-controller.
Departmental Electives- I, II

1. Satellite & TV Engg
2. Data Communication & Network
3. Mobile Communication
4. Nano Technology
5. Advance Microprocessor Architecture
6. Photonic switching and Network
7. Digital System Design
8. Device modeling for circuit simulation
9. HDL and FPGAs
10. Electronic Switching Circuits

Open Elective

1. CE-1 Environmental Science and Engg.
2. CE-2 Transportation system planning
3. CE-3 Earthquake Engg
4. CSE-1 Image Processing
5. CSE-2 UNIX Environment Programming
6. CSE-3 Information Security System
7. CSE-4 Computer graphics
8. ME-1 Energy Conservation and Management
9. ME-2 Alternate Sources of Energy
10. ME-3 Computer Graphics and rapid prototyping
11. ME-4 Noise Control
12. ME-5 Elements of Mechanical Engineering
13. ME-6 Product Design and Value Engineering
14. ME-7 Value Engineering
15. ME-8 Science and Technology
16. EE-1 Neural network and fuzzy logic
17. EE-2 Switched Mode power supplies
18. EE-3 Fundamental of Electrical machines
19. EE-4 Image Processing
20. BS-1 Physics of Semiconductor Devices
21. BS-2 Material Characterization
22. BS-3 Bio Polymer
23. BS-4 Aspects of Nano Technology
24. BS-5 Polymer Technology
25. BS-6 Operation Research
26. HU-1 Managing Interpersonal and group processes
27. HU-2 Human resource Management
28. HU-3 Financial Management
29. HU-4 Marketing Management
30. HU-5 Managerial Communication
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**TOTAL CREDITS**  189
1. **INTRODUCTION TO SATELLITES:**

2. **SATELLITE TRANSPONDER AND LINK:**
Transponder Model, Satellite signal Processing, RF-RF Translation, IF Demodulation, Interference Analysis, Rain Induced Attenuation, Rain Induced Cross-Polarization Interference, System Availability, Satellite Link Design.

3. **CARRIER RECOVERY:**
Carrier Recovery for MPSK, PLL, Carrier Recovery with narrowband band pass filter and AFC loop, symbol Timing Recovery Circuit.

4. **Principles of TV:** Theory of Scanning, blanking synchronization, nature of picture signals line and field frequency, interlacing, resolution, block diagram of transmitter and receiver.

5. **Television Cameras and Picture Tube:** Image orthicon, vidicon, plumbicon (Principle of operation, construction and working), TV picture tubes.

6. **Transmitter:** Modulation system used to sound and various transmitter vestigial side bands. TV transmitter and receiver response characteristics.

7. **Colour T.V. and Applications:** Operation of colour T.V: Hue, saturation and luminance, Colour signal generation colour picture tubes (Basic principle) colour television systems, N.T.S.C., PAL and SECAM: Colour TV Receiver, Video tape recording, VCR, Merits of Digital Processing, Block Diagram of Digital T.V. receiver, HDTV, Concept of Plasma Screen

**BOOKS RECOMMENDED**

4. Basic Television by G.M.Grobe.
1. Introduction to data communication

2. Physical Layer
Maximum data rate of a channel, Transmission media, Wireless transmission, Circuit switching, Packet switching, network topology.

3. Data Link Layer
Data link layer design issues, services provided to network layers, Framing, Error control, Flow control, Error detection and correction, Elementary data link protocols, An unrestricted Simplex protocol, A Simplex Stop-and-Wait protocol, Simplex Protocol for a noisy channel, Sliding Window protocols, A protocol using go-back-N, A protocol using selective repeat, Example data link protocol-HDLC, PPP and SLIP.

4. Medium Access Sublayer
Channel Allocations, Static and dynamic allocation in LAN, Multiple Access protocols, ALOHA, Carrier Sense multiple access protocols, Wireless protocols, Collision free protocols, Limited contention protocols, IEEE standard 802.3 and Ethernet, IEEE standard 802.4, Token bus IEEE standard 802.5, Token Ring, Distributed Queue Dual bus, Logical link control, bridges, High speed LAN.

5. Network Layer

6. Transport Layer
Transport services, Design issues, elements of transport protocols, simple transport protocols, Connection management, TCP, UDP.

7. Session, Presentation and Application Layer
Session Layer - Design issues, remote procedure call.
Presentation Layer - Design issues, Data compression techniques, cryptography.
Application Layer - File Transfer, Access and Management, Electronic mail, Virtual Terminals.

8. ISDN
Narrowband ISDN, Broadband ISDN and ATM, Virtual circuits

TEXT BOOKS
1. Introduction to Cellular Mobile Systems:
A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, analog & digital cellular systems.

2. Elements of Cellular Radio Systems Design:
General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems.

3. Interference:
Introduction to co-channel interference, real time co-channel interference co-channel measurement design of antenna system, antenna parameter and their effects, diversity receiver in co-channel interference – different types.

4. Cell Coverage for Signal & Traffic:
General introduction, obtaining the mobile point to point mode, Radio propagation characteristics: models for path loss, shadowing and multipath fading, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model-characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation.

5. Cell Site Antennas and Mobile Antennas:
Characteristics of antennas, antenna at cell site, mobile antennas

6. Frequency Management, Channel Assignment and hand off:
Frequency management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment, Why hand off, types of handoff and their characteristics, handoff analysis, dropped call rates & their evaluation.

7. Multiple access techniques used in mobile wireless communications:
FDMA/TDMA, CDMA. FDM/TDM Cellular systems, Cellular CDMA, soft capacity, Earlang capacity comparison of FDM/TDM systems and Cellular CDMA.

8. Global System for Mobile Communication (GSM) system overview:
GSM Architecture, Mobility management, Network signaling, Frequency allocation and control, Base System and Master System, GSM, DCS 1800, Various value added services.

Text Books:
1. Wireless Communication; Principles and Practice; T.S.Rappaport
2. Mobile Communication

Reference Book
1. Wireless and Digital Communications; Dr. Kamilo Feher (PHI)
3. Mobile Communication Engineering – Theory & Applications; TMH
1. Introduction

Introduction to nanoscale science and technology, why nanoscience and nanotechnology? Length energy and time scales, nanostructure types and properties, electronic and optical properties of materials, top down approach to nanolithography. Spatial resolution of optical, deep ultraviolet, X-ray, electron beam and ion beam lithography.

2. Quantum Mechanics

Band gap engineering, Quantum confinement of electrons in semiconductor nano structures, One dimensional confinement (Quantum wires), Two dimensional confinement (Quantum wells), three dimensional confinement (Quantum dots) and Bottom up approach, Single electron transistors, coulomb blockade effects in ultra small metallic tunnel junctions.

3. Molecular Techniques

Molecular Electronics, Chemical self-assembly, carbon fullerenes and nano tubes, Self assembled mono layers, Applications in biological and chemical detection.

4. Surface analytical instrumentation techniques for nanotechnology

Atomic scale characterization techniques, scanning probe microscopy, scanning tunneling microscopy and atomic force microscopy.

BOOKS:

Text

References
2. Y. Imry “ Introduction to Mesoscopic Physics, Oxford University press 1997
1. FUNDAMENTALS OF COMPUTER DESIGN:

2. INSTRUCTION SET PRINCIPLES AND EXAMPLES:
Introduction, Classifying Instruction Set Architectures, Register Transfer and Micro operation: Register transfer, Register transfer language, Bus and Memory transfers. Memory Addressing, Operations in the Instruction Set, Type and Size of Operands, Encoding an Instruction Set, The Role of Compilers.

3. PIPELINING:
Introduction, The Basic Pipeline, Pipeline Hazards, Data Hazards, Control Hazards, Difficulties in Implementing Pipelines, Extending the Pipeline to Handle Multicycle Operations, Instruction Set Design and Pipelining.

4. PARALLEL COMPUTER MODELS AND INSTRUCTION LEVEL PARALLELISM:
The state of computing, Classification of parallel computers, Multiprocessors and multicomputers, Multivector and SIMD computers, Instruction Level Parallelism, Overcoming Data Hazards with Dynamic Scheduling, Reducing Branch Penalties with Dynamic, Hardware Support for Extracting More Parallelism.

5. MEMORY HIERARCHY DESIGN:

6. MULTIPROCESSORS:
Introduction, Characteristics of Application Domains, Centralized Shared Memory Architectures, Distributed Shared Memory Architectures, Synchronization, Models of Memory Consistency, Crosscutting Issues.

7. ADVANCED PROCESSORS:
Advanced processor technology, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

BOOKS:
1. Kai Hwang, “Advanced computer architecture”, TMH.
3. J.P.Hayes, “computer Architecture and organization”, MGH.
6. PHOTONIC SWITCHING AND NETWORK

**Introduction:** Overview of the architectures and principles of optical systems and networks; Access networks; LANS, WANS & MANS; SONET, SDH and ATM.

**Components for Optical Networks:** Fused fibre devices such as couplers, WDMs and WFCs; filters and WDMs such as interference filters, Fabry Perot etalons and Bragg gratings; optical isolators; integrated optic modulators and switches; wavelength converters, Dispersion Compensating techniques.

**Optical Amplifiers (EDFAs and SOAs):** Principles of operation; gain characteristics; wavelength characteristics, cross talk and wavelength conversion; noise characteristics and noise figure; characteristics of amplifiers cascades.

**Design and Analysis of Optically Amplified links:** systems performance analysis and power budget analysis for BERs of $10^{-9}$ for optically Amplified links.

**Design and Analysis of Common Optical Systems and Networks:** Power budgets, issues of component specification and tolerances; PONs, BPONs, WDM systems, wavelength routing networks and all optically switched systems. Optical Fiber impairment issues like: higher order dispersion, fiber nonlinearities in optical systems and Networks, optical solitons.

**Note:** Design and analysis is to be learned practically using simulation tool OptSim or OptiSystem and Artifex.

**Books Recommended:**

2. OptSim/OptiSystem Manuuals.
3. Abdellatif Marrakchi, “Photonic Switching and Interconnects,” Marcel Dekker, November 1993
1. Introduction to Digital Design Concepts Review of digital design fundamentals, minimization and design of combinational circuits, sequential machine fundamentals.

2. Traditional Approaches to Sequential Analysis and Design State diagram, analysis of synchronous circuits, design of synchronous sequential state machine, design and applications of counters and shift registers.

3. Multipin Put System Controller Design System controller, controller design principles, timing and frequency considerations, DFD development, controller architecture design, asynchronous input handling, state assignment concepts, date / flip / flop level implementation using VEM's


5. Programmable System Controller Concepts and basic features of programmable system controller microinstructions, programmable controller with fixed instructions set with subroutine capability, application of 8 x 02, 74S 422 and MC2900 in system control design.

6. Asynchronous Finite State Machines Asynchronous analysis, design of asynchronous machine, cycles and races, hazards excitation map MEV method.

7. VHDL Basic Language elements : data objects, classes and data types, operators, overloading, logical operators, VHDL representation of Digital design entity, entity and architectural declarations, introduction to behavioral, dataflow and structural models.

BOOKS:

1. An Engg. approach to Digital Design By W. I. Fletcher, PHI

2. VHDL-analysis and modeling of digital systems - Navabi Z. (McGraw Hill)

3. VHDL Primer, by Bhaskar (Prentice Hall)
8. DEVICE MODELLING FOR CIRCUIT SIMULATION

Basics Semiconductor Physics.

Principle of circuit simulation and its objectives.

Introduction to SPICE: AC, DC, Transient, noise, temperature extra analysis.

Junction Diodes: DC, small signal, large signal, high frequency and noise models of diodes. Measurement of diode model-parameters.

BJT: DC, small signal, high frequency and noise models of bipolar junction transistors. Extraction of BJT model parameters.

MOSFETs: DC, small signal, high frequency and noise models of MOSFETs. MOS Capacitors.

Device SCALING: short and narrow channel MOSFETs. MOSFET channel mobility model, DIBL, charge sharing and other non-linear effects.


JFET & MESFETs: modeling of JFET & MESFET and extraction of parameters.

HBTs: Principles of hetrojunction devices, HBTs, HEMT

BOOKS

Text

References
1. Rashid, “SPICE”.
2. Sedra, Smith, “SPICE”.
4. BG Streetman, “Solid state Electronic Devices”, PHI.
5. Raghuram, Electronic Circuits.
VHDL Language, Design methodology based on VHDL, Elements of VHDL, Top down design, verification.

Basic concept in VHDL: Characterizing Hardware Language, Timing, Concurrency, modelling Hardware, Objects & Classes, Signal assignment, Inertial delay mechanism, Transport delay mechanism, Comparing Inertial and Transport.

Concurrent and Sequential Assignment: concurrent assignment, Event and Transaction, Delta delay, Sequential placement of transaction.


Data flow Description in VHDL: Multiplexing and data selection, General Multiplexing, Guarded signal assignments, Block Declaration Parameters, Resolving between several driving values, General data flow circuits.

FPGA Architecture: Programming technologies like SRAM, Antifuse EPROM and EEPROM. Mux based Design. LUTs. Xilinx LCA. CLBs, Logic realization. Channel and I/Os. Timing and Power dissipation. CPLD architecture. Altera Max Logic Block.

Text Book:

VHDL primer by J. Bhasker; Addison Wesley Longman Pub.

1. **INTRODUCTION TO SEQUENTIAL CIRCUITS** - Flip-Flops, flip-flop conversions, flip-flop excitation table. Classification of sequential circuits. Registers and A to D and D to A converter circuits.

2. **DESIGN & ANALYSIS OF SYNCHRONOUS SEQUENTIAL CIRCUITS**: - Sequential circuits introductory examples, Counters, Sequence Detector and Sequence Generator circuits. Definite state model. Basic definition, capabilities & Limitation of finite state machines, state equivalence & machine minimization, simplification of incompletely specified machines, Extraction of maximum compatibles, synthesis & analysis of synchronous sequential circuits.

3. **DESIGN OF ASYNCHRONOUS SEQUENTIAL CIRCUITS**: - Introduction to asynchronous circuits, timing diagram, state diagram & flow tables, fundamental mode circuits, synthesis, state assignment in asynchronous sequential circuits, pulse mode circuits.

4. **DESIGN OF ASYNCHRONOUS SEQUENTIAL CIRCUITS**: - Introduction to asynchronous circuits, timing diagram, state diagram & flow tables, fundamental mode circuits, synthesis, state assignment in asynchronous sequential circuits, pulse mode circuits.

5. **HAZARDS**: - Introduction, gate delays, generation of spikes, production of static hazards in combinational networks, elimination of static hazards, design of hazard free combinational networks, hazard free asynchronous circuit design, dynamic hazards, essential


**BOOKS RECOMMENDED:**

**Text Books**

1. Switching and finite automata theory by ZVI Kohavi
2. Logical design of switching circuits by Douglas Lewin.
3. Logic Design by N.N Biswas
ECE- 484  1. ADVANCED TELECOMMUNICATIONS

Evolution of Tele-Communication : Basic Switching System, Simple Telephone Communication, Telephone Transmitter, Telephone receiver, Telephone’s bell & dialer pulsing mechanism, subscribers telephone sets, Dialing types, signaling tones., Brief Introduction to Electromagnetic Exchanges.

Electronic Switching – Space Division Switching Stored Programme Control – Centralized SPC, Distributed SPC, Software Architecture, Application Software – Enhanced Services, Multi Stage Switching Networks.

Time Division Switching - Time Division space switching, Time Division Time Switching, Time multiplexed space switching, Time multiplexed Time Switching, Combination Switching

Traffic Engineering, Grade of Service and Blocking Probability - Telephone Networks, Subscriber Loops, Switching Hierarchy and Routing, Signaling Techniques, In Channel, Common Channel. Transmission media.

Fax system: Basic facsimile system, facsimile applications working of FAX machines, recording media, FAX reproduction technique.


BOOKS
1. Digital Telemetry by John C Bellamy.
2. Telecommunication Switching System and Network by Tyagraj\an
3. Telecommunication system Engg. by Roger L.Freeman.
4. Wireless Mobile Communication by Rappaport


3. **AUDIO METERS**: Mechanism of harvesting, measurement of sound, basic audiometer, pure tone audiometer, sped audiometer.

4. **IMAGE SYSTEMS**: Introduction, Basic principle and block diagram of x-ray machine, x-ray computed tomography (C.T. Scanner) and Nuclear Magnetic resonance (NMR) Topography, Ultrasonic Imaging System: Introduction, medical ultrasound, block diagram of pulse echo-system, A-Scan, M-mode, B-scanner and real time ultrasound imaging systems.

5. **THERAPEUTIC EQUIPMENTS**: Type of cardiac Pacemakers. Cardiac Defibrillator. Kidney Machine.

6. **PHYSIOTHERAPY EQUIPMENTS**: Short-wave Diathermy, Microwave Diathermy, Ultrasound Therapy unit.

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

**BOOKS RECOMMENDED:**

2. Biomedical Instruments: Theory and Design by Walter Welko- Witz and Sid Deutsch
3. INTRODUCTION TO VLSI AND HDL


2. **MOSFET fundamentals**, Enhancement Mode MOSFETs, Depletion Mode MOSFETs, Weak & strong Inversion Conditions, Threshold Voltage Concept in MOSFETs, IV Characteristics of a MOSFET, Limitations in IV Model and MOSFET Parasitic.

3. **Basic VLSI Design Styles**-NMOS, CMOS Process flow ; Noise Margin; Inverter Threshold Voltage; NMOS Inverter design and characteristics; CMOS Inverter Design and Properties; Delay, Power Dissipation and scaling in CMOS circuits. Introduction to SPICE

4. **Introduction to HDL**: Design Flow, Design Methodologies, HDL History, Capabilities, Hardware Abstraction, Basic Terminology, Model Analysis, Comparison between VHDL and Verilog.

5. **Basic VHDL Elements**: Identifiers, Data Objects, Data Types, Operators.


7. **Dataflow Modeling**: Concurrent Signal Assignment Statements, delta delay model, multiple drivers, block statement, concurrent assertion statement.

8. **Structural Modeling**: Component Declaration, component Instantiation, resolving signal values.


**Text Books**

3. K. Eshraghian & Pucknell, “Introduction to VLSI”, PHI.
4. VHDL primer by J. Bhasker; Addison Wesley Longman Pub.
1. **INTRODUCTION TO SEQUENTIAL CIRCUITS** - Flip-flops, flip-flop conversions, flip-flop excitation table. Classification of sequential circuits. Registers and A to D and D to A converter circuits.

2. **DESIGN & ANALYSIS OF SYNCHRONOUS SEQUENTIAL CIRCUITS**: - Sequential circuits introductory examples, Counters, Sequence Detector and Sequence Generator circuits. Definite state model. Basic definition, capabilities & Limitation of finite state machines, state equivalence & machine minimization, simplification of incompletely specified machines, Extraction of maximum compatibles, synthesis & analysis of synchronous sequential circuits.

3. **DESIGN OF ASYNCHRONOUS SEQUENTIAL CIRCUITS**: - Introduction to asynchronous circuits, timing diagram, state diagram & flow tables, fundamental mode circuits, synthesis, state assignment in asynchronous sequential circuits, pulse mode circuits.

4. **HAZARDS**: - Introduction, gate delays, generation of spikes, production of static hazards in combinational networks, elimination of static hazards, design of hazard free combinational networks, hazard free asynchronous circuit design, dynamic hazards, essential

5. **CONTACT NETWORKS & SYMMETRIC NETWORKS**: - Relay contents, analysis & Synthesis of contact Networks, Properties of symmetric functions, Synthesis & identification of symmetric functions

**BOOKS RECOMMENDED:**

**Text Books**

1. Switching and finite automata theory by ZVI Kohavi
2. Logical design of switching circuits by Douglas Lewin.
3. Logic Design by N.N Biswas
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**TOTAL CREDITS**  189