

UNIVERSITY OF PUNE
S.E (E&TC)'2003 Course [Common with S.E (Electronics)]
Sem I

Sub. No.	Subjects	Teaching Scheme			Examination Scheme					
		Lecture	Tu/Practi.	Total	Paper	Practi.	Oral	T/W	Total	
Semester I										
204181	Signal and Systems *	4	1	5	100	-	50	-	150	
204182	Semiconductor Devices and Circuits	4	2	6	100	50	-	-	150	
204183	Network Theory	4	2	6	100			25	125	
204184	Control Systems	4	2	6	100			25	125	
204185	Digital Systems	4	2	6	100	50	-	-	150	
204186	Electronics Hardware workshop	-	2	2				50	50	
Total		20	1	10	31	500	100	50	100	750

Sem II

Sub. No.	Subjects	Teaching Scheme			Examination Scheme					
		Lecture	Tutori.	Practi . Total	Paper	Practi.	Oral	T/W	Total	
Semester-II										
204187	Electronic Circuits and Applications	4	2	6	100	50	-	25	175	
207003	Engineering Maths III	4	-	4	100	-			100	
203189	Electrical Circuits and Machines	4	2	6	100			25	125	

210256 Data Structure and Files	4	2	6	100	50	-	-	150	
204191 Analog Communication	4	2	6	100	-	50	-	150	
204192 Electronics Software Workshop		1	2	2			50	50	
Total	20	1	10	31	500	100	50	100	750

Note - * indicates oral based on tutorials of theory subject

204181: SIGNALS AND SYSTEMS

Teaching scheme:

Lectures: 4 hrs/week

Tutorial: 1 hr/week

Examination Scheme:

Paper: 100 Marks

Oral: 50 Marks

Unit 1: Introduction to signals and systems

Definition of signal, Classification of signals, Continuous and Discrete time, Analog & Digital, Periodic & Non-periodic, Deterministic and non-deterministic, Energy & Power. Basic Signals & Operations on signals, Sine, Cosine, Exponential, Unit step, Unit Impulse. Sum, Product, difference, even, odd. Time shifting, time scaling, Differentiation and integration.

Systems:: Definition, Classification, Linear & Nonlinear, Time variant and time invariant, Causal & Non-Causal, Static & dynamic, Stability.

Unit 2 System Analysis

Introduction to LTI systems. Block Diagram & System Terminology. Convolution Integral. Impulse response. Convolution & Methods of Convolution. Properties of convolution, System interconnections, stability & impulse response of systems to standard signals.

Unit3

Continuous Time System & Discrete Time System Analysis

Response of LTI systems to exponential signals, periodic signals. Fourier series, fourier transforms, properties, application of fourier series & fourier transforms to the system analysis.

Analysis of DTS (Discrete Time Systems)

Response of LTI systems to exponential discrete signals, Discrete time Fourier series, Discrete fourier transforms and its properties.

Unit 4

Laplace Transforms

Definition and its properties, methods of inversion, application to LTI system analysis.

Z-Transforms

Definition and properties, significance of ROC, inversion of Z-transforms, applications to LTI system analysis.

Unit 5

Correlation, Energy spectral density and Power Spectral Density

Introduction, Correlation & Correlogram, **The correlation function**: Conceptual basis, Energy signals, power signals, **Auto-correlation**: Relation to signal energy and signal power, Properties of auto-correlation, **Cross-correlation**: Properties of cross-correlation, Correlation of Fourier Series, **Energy Spectral density**: Definition & Derivation of ESD, Effects of system on ESD, The ESD concept, Relation of ESD to auto-correlation, **Power Spectral density**: Definition and derivation of PSD, Effects of system on PSD, The PSD concept, Relation of PSD to autocorrelation, Sampling Theorem and its proof, effects of under sampling, sampling of band pass signals.

Unit 6

Probability, Random Variables and Random Processes •

Sample space, Event, Probability, Conditional Probability and statistical independence. Random Variables, Discrete Random Variable, Cumulative Distributive Function, Continuous Random Variable, Probability Density Function, Properties of CDF and PDF. Transformation of random variables, Statistical averages, Mean, Moments and expectations, Standard Deviation and Variance, Chebyshev inequality, Multivariate expectations. Probability models, Binomial, Poissons. Gaussian, Rayleigh. Random Process, Ensemble averages and correlation functions, Ergodic and stationary process. Gaussian process. Random signals, power spectral density, auto-correlation, Superposition and Modulation, Filtered Random signals.

Text Books

1. Simon Haykin - Signals & Systems - PHI
2. I.J Nagrath - Signals & Systems –TMH

Reference Books

1. Roberts MJ. - Signals & Systems -TMH
2. Linder - Signals & Systems
3. B.P Lathi - Linear Systems & Signals
4. B.P Lathi - Signals & Systems

List of assignments (Any seven):

- 1) Study characteristics & features of following signals in continuous time (CT) & discrete time (DT) domain signals: impulse, step, ramp, sine, cosine, exponential characteristics & features: periodic / non periodic, even / odd symmetric, random /deterministic energy / power real, complex etc.
- 2) Simple signal processing operations: sum, product, difference, scaling, even / odd, time shifting & time scaling, differentiation & integration
- 3) Study various types of systems in CT / DT domains on the basis of linearity / non linearity, time in variance, memory less, stability, causality etc.
- 4) Study of characteristics of systems in terms of input -output relationship, convolution integral/sum, differential / difference equation.
- 5) Fourier transform evaluation for following signals: i) Gate function (rectangular pulse) ii) Gaussian function
Both amplitude & phase spectra
- 6) To verify properties of Fourier transform such as: i) Scaling ii) Symmetry iii) Modulation iv) Time shifting

- 7) a) Analysis of typical signals using Laplace transform
- b) Solution of typical differential equations using Laplace transform (with initial conditions)
- 8) Evaluation of Z transform for causal / Non - causal and Infinite/finite duration Discrete Time signals.
- 9) Evaluation of Inverse Z transform using different methods.
- 10) Advanced signal processing operations: i.) Auto-correlation and cross correlation
ii.) Covariance iii.) Energy and Power spectral density

204182: SEMICONDUCTOR DEVICES AND CIRCUITS

Teaching scheme:	Examination scheme:
Lectures: 4 hrs /week	Paper: 100 marks
Practicals: 2hrs/week	Practical: 50 marks

UNIT 1

Objective-To study how properties of intrinsic semiconductor can be modified by doping so that an array of useful semiconductors can be fabricated.

SEMICONDUCTOR PHYSICS AND MATERIALS

Intrinsic and extrinsic semiconductors, Conduction mechanism in extrinsic semiconductors, Carrier concentrations, Drift and diffusion mechanisms, Drift and diffusion current densities, Excess carriers, Recombination process, Mean carrier lifetime, Conductivity, Mobility, Mass action law, Einstein relationship.

Semiconductor materials used in Optoelectronic devices and Modern semiconductor devices and Integrated circuits- GaAs, SiGe, GaAsP

UNIT 2

Objective-To study semiconductor diode characteristics and other types of diodes in brief.

SEMICONDUCTOR DIODES

A brief overview of following types of diodes, their peculiarities and applications -Rectifier, Signal, Switching, Power, Tunnel, Shockley, Gunn, PIN.

Semiconductor P-N junction diode -Open circuited step graded junction, Metallurgical junctions and Ohmic contacts, Depletion region, Barrier potential, Forward and reverse biased diode operation.

V-I characteristic equation of diode (no derivation). Volt equivalent of temperature, Temperature dependence of V-I characteristics, DC load line. Forward and reverse dynamic resistance, Small signal and large signal diode models. Diode data sheet specifications - PIV, $I_{FMSURGE}$, I_{AV} .

Switching diodes - Diode switching times, junction capacitances. (No derivations)

UNIT 3

Objective-To study FET characteristics and other types of FETs in brief.

FIELD EFFECT TRANSISTORS

An overview of different types of FETs viz. JFET, MOSFET. Peculiarities of these types and their application areas.

JFET : JFET construction, Symbol, Basic operation, V-I Characteristics, Transfer Characteristics (Shockley's Equation), Cut-off & Pinch-off voltages, Transconductance, Input resistance & Capacitance. Drain to Source resistance. Universal JFET bias curve. Biasing

arrangements for JFET - Biasing against device variation, biasing for zero current drift. JFET as voltage controlled current source. JFET data sheet specifications - I_{DSS} , V_p , g_m , R_{DS} or $R_{D(On)}$

JFET Amplifiers: CS, CD, CG amplifiers. Their-analysis using small signal JFET model.

UNIT 4

Objective-To study MOSFET characteristics and other types of MOSFETs in brief.

MOSFETs: An overview of following MOSFET types -D-MOSFET, E-MOSFET, Power MOSFET. n-MOS, p-MOS and CMOS devices. Handling precautions for CMOS devices. D and E-MOSFET characteristics & parameters, non ideal voltage current characteristics viz. Finite output resistance, body effect, sub threshold conduction, breakdown effects and temperature effects. MOSFET Biasing, Introduction to MOSFET as VLSI device.

UNIT 5

Objective-To study BIT characteristics and other types of BJTs in brief.

BIPOLAR JUNCTION TRANSISTOR

An overview of different types of BJTs - Small signal and large signal low frequency types, Switching/RF, Heterojunction types. Peculiarities of these types and their application areas.

BJT Biasing and basic amplifier configurations:

Need for biasing BJT, DC analysis of BJT circuits, Typical junction voltages for cutoff, active and saturation regions, Voltage divider bias and its analysis for stability factors, Small signal- low frequency h-parameter model, Variation of h-parameters with operating point, Other small signal models, Derivations for CE configuration for A_v , R_o , A_{vs} , A_{IS} in terms of h-parameters, Comparison of performance parameters with CB and CC configurations in tabular form. Need for multistage amplifiers and suitability of CE, CC and CB configurations in multistage amplifiers. Small signal and DC data sheet specifications for BJT.

UNIT 6

Objective-To study frequency response of FET and BJT amplifiers.

Concept of frequency response, Human ear response to audio frequencies, significance of Octaves and Decades. The decibel unit. Square wave testing of amplifiers. Miller's theorem. Effect of coupling, bypass, junction and stray capacitances on frequency response for BJT and FET amplifiers. Concept of dominant pole. N stage cascade amplifier, band pass of cascaded stages (effect on frequency response). Concept of GBW. (No derivations)

Text Books

- 1) Thomas L. Floyd - Electronic Devices - Pearson Education (Sixth edition).
- 2) Donald A. Neamen - Electronic circuit analysis & Design - Tata McGraw Hill (Second Edition)

Reference Books

- 1) Boylestead Nashelsky - Electronic devices and circuits theory - PHI
- 2) Millman Halkies - Electronic Device & Circuits - Tata McGraw Hill
- 3) Millman Halkies - Integrated Electronics - Tata McGraw Hill
- 4) Millman Grabel - Microelectronics - Tata McGraw Hill (Second edition).
- 5) S.Poornachandra Rao, B.Shashikala - Handbook of Experiments in Electronics & communication engineering - Vikas Publishing House.

List of Practicals

1. Drain Characteristics of JFET, Transfer Characteristics of JFET. Study of V_p , g_m , $V_{GS(off)}$, g_{mo} from characteristics.
2. JFET biasing arrangement Graphical method.
3. Build and Test JFET CS amplifier. Find performance parameters for JFET amplifier- A_v , R_i , R_o .
4. Simulation of JFET CS amplifier using proteus/ multisim/pspice
Find performance parameters for JFET amplifier- A_v , R_i , R_o . Comparison with theoretical results and practical results.
5. Input and Output Characteristics of BJT CE amplifier. Find h parameters from characteristics.
6. Build and Test BJT in CE configuration.
Find performance parameters for BJT CE amplifier- A_v , A_{vs} , A_i , R_i , R_o .
7. Simulation of BJT CE amplifier using proteus/ multisim/pspice
Find performance parameters for BJT amplifier- A_v , A_{vs} , A_i , R_i , R_o . Comparison with theoretical results and practical results.
8. Comparison of CE, CC, CB configurations for $-A_v$, R_i , R_o .
9. Frequency response - For BJT and FET single stage amplifiers - Effect of unbypassed R_E and R_s . Effect of coupling and bypass capacitors on low frequency cut-off.

204183: NETWORK THEORY

Teaching scheme:

Examination scheme:

Lectures: 4 hrs /week

Practicals: 2hrs/week

Paper: 100 marks

Term Work: 25 marks

Unit 1:-

Simplification & Analysis Techniques (AC & DC circuits)

Sinusoidal steady state. Phasors & phasor diagramme. Energy Sources. Mesh and nodal analysis. Source transformation. Network theorems.

- 1) Superposition theorem.
- 2) Thevinins theorem.
- 3) Nortan's theorem.
- 4) Maximum power transfer theorem.

Unit 2:- Resonance & applications.

Definition of figure of merit, Q. Series resonance: Current Bandwidth, Impedance, & selectivity in series resonance. Parallel (anti) resonance: Application of resonance ckts including impedance transformation.

Unit 3:- Transient Response.

Initial Conditions in elements. A procedure for evaluating initial conditions. Solution of RC, RL, RLC step response using classical method. Solution of RC, RL, RLC step response using Laplace transform.

Unit 4:-Four terminal Networks

Classification of four terminal networks (Symmetrical, Asymmetrical, Balanced & Unbalanced) Characteristic Impedance & propagation constant for symmetrical Networks.

Image & Iterative impedance for symmetrical networks. Filter fundamentals: Constant K type Low pass filter. Constant K type high pass filter.

Constant K type band pass filter. Constant K type band stop filter. M-derived T and Π sections of low pass filter. Composite Low pass filter.

Attenuators: Introduction. Nepers & decibels. Symmetrical T & Π type attenuators.

Unit 5:-Network Functions

Terminal pairs and ports. Network functions for one and two port networks.

Poles & zeros of network function. Time domain behavior from pole zero plot.

Unit 6:-Two port network parameters.

Introduction. Open ckt. Impedance parameters. Short ckt. Admittance parameters.

Hybrid parameters. Transmission parameters. Interrelation between Different parameters.

Inter connection of two port networks.

Text Books

D. Roy Choudhary - Network & System - Wiley Eastern (2nd Edition).

John D. Ryder - Network lines & Fields by - PHI.

M.E. Van Valkenburg - Network Analysis - PHI (3rd Edition).

Reference Books

F.F. Kuo - Network Analysis & Synthesis- John Wiley & Sons (2nd Edition).

Hayt & Kimmerly - Engineering Circuit Analysis-Mcgraw-Hill International.

List of practicals

1. To Verify Thevenin's Theorem.
2. To verify Maximum power transfer Theorem (ac and dc).
3. To plot frequency response of frequency selective network (Twin T or Wein bridge).
4. To build & test series and parallel Resonance circuits (fr, BW, Q calculations).
5. To design constant k LPF and HPF circuits, to plot frequency response & to find cut off frequency.
6. To design constant k BPF and BSF circuits, to plot frequency response & to find cut off frequencies.
7. Select any two port network & find Z-Y parameters.
8. To plot Poles & zeroes for one port driving point function.
9. Measurement of Z_o and γ for T and pi network.
10. Design, build & test symmetrical T and pi attenuators (plot of attenuation versus load resistance).

204184: CONTROL SYSTEMS

Teaching Scheme:

Examination Scheme:

Lectures: 4 Hrs/Week

Practical: 2 Hrs/Week

Paper: 100 Marks

Term Work: 25 Marks

Unit 1

1) Introduction to linear & nonlinear control system, Elements of control systems, Open loop & closed loop, feedback & feed forward control systems. (Each control systems will be highlighted with real time applications).

2) Transfer function using block diagram reduction techniques & signal flow graph using Mason's gain formula.

Unit 2

3) Time domain Analysis of linear control systems. First order & second order system. Error constant, steady state error, transient response specifications.

4) Stability of control system, Routh-Hurwitz criterion and Root locus technique.

Unit3

5) Frequency domain analysis, frequency domain specification, Bode plot-Gain margin and phase margin, Mapping theorem and Nyquist Plot.

6) Design of basic lead, lag compensators using Root Locus & Bode Plots.

Unit 4

7) State Variable Representation of control system (SISO, MIMO), conversion of state variable into transfer function and vice versa, solution of state equation, state transition matrix.

Unit 5

8) Capacitance type level, Electromagnetic type flow meter, piezoelectric type pressure transducer, thermistor, strain gauge, piezoelectric type accelerometer, photo electric tachometer (pick up). Signal Conditioning circuits for all above transducers. Study of Synchros.

Unit 6

9) a) Control actions: On/Off , P, PI, PD, PID . b) PLC: Architecture, comparison with relay logic. Ladder Diagrams for

- 1) Bottle filling plant
- 2) Elevator control
- 3) Washing Machine

Text Books

- 1) Nagrath and Gopal-Control Systems.
- 2) K. Ogata-Modern Control Engg.

Reference Books „

- 1) Naubart-Mechanical Transducers.
- 2) C.D. Johnson-Process Control Instrumentation Technology.

List of Practicals

- 1) Phasor plot of synchro system (Transmitter -Receiver)
- 2) Magnitude and phasor plot of lead network.
- 3) Magnitude and phasor plot of lag network.
- 4) Transient response of second order system.
- 5) Verification of ladder diagram using PLC
- 6) Flow control using PID action.
- 7) Study of LVDT for displacement measurement.
- 8) Study of pressure transducer.
- 9) Unit step and ramp response of the transfer function system using MATLAB.
- 10) To draw Root locus and Bode plot using MATLAB.

204185: DIGITAL SYSTEMS

Teaching Scheme: **Examination Scheme:**
Lectures: 4 Hours/week **Paper: 100 Marks**
Practical: 2 Hours/week **Practical: 50 Marks**

UNIT - 1

LOGIC FAMILIES:

Parameter definitions -noise margin, power dissipation, voltage and current parameters, propagation delay. Typical values for TTL, CMOS&ECL. Input/output profile for TTL & CMOS. TTL logic families-standard TTL, Totem-pole, open collector, tri-state (concept & application). Significance of TTL sub families (L, H, LS, S) & MOS family-importance of (C, HC), PMOS, NMOS (inverter only), CMOS (inverter, AND & NOR). TTL-CMOS/CMOS-TTL interfacing, comparison of TTL & CMOS. TTL compatible high speed CMOS series.

UNIT - 2

(A) Combinational logic circuits:

Binary number system - Signed number representation (1's, 2's complement & sign magnitude representation). Codes- BCD, GRAY, Seven Segment.
Principles of combinational logic: Canonicals forms don't care conditions, minimization techniques (K-maps upto 4 variables only). Quine-Mc Cluskey method (4 variables).
Design examples- code converters (binary to gray and gray to binary, BCD to 7 segment, 1C 7447, 7448)

UNIT - 3

(B) Combinational logic circuits:

Digital comparators (2 - bit, 4- bit using 1C 7485), parity generation and checking (1C 741'80).
Design methodology using MSI Ic's. Multiplexer, Demultiplexer (Trees), multivariable function implementation using MUX & decoder. Parallel adder (1C 7483). Look ahead carry generator, arithmetic logic unit (1C 74181).
Programmable Logic Devices: Detail architecture, study of PROM, PAL, PLA, designing combinational circuits using PLDs. (Code conversion)

UNIT-4

Sequential logic circuit:

Study of flip-flop, 1 bit latch, clocked S-R, J-K, M/S J-K, T and D F/F, race around condition, flip-flop truth table, excitation table, flip-flop conversion, flip-flop characteristics. Design of ripple counter using flip-flop (1C 7490, 93) 4 bit up/down (positive / negative edge triggered).
Shift register (modes of operation), 4 bit bi-directional using D/ J-K universal shift registers, application of shift registers (Ring counter, Sequence generator, Johnson's counter) 1C 7495/74195.

UNIT - 5

Synchronous sequential m/c's:

Design of Synchronous counter using 1C 74191, 4 bit up/down mod-n counters.

Moore/Mealy M/c's, representation techniques, state diagrams, state tables, state reduction, state assignment, implementation using flip-flops. Applications like sequence generator and detection.

UNIT - 6

(A) A/D and D/A converters :

Digital to Analog converters, example of D/A converter 1C, Analog to Digital converters, example of A/D converter,

(B) Semiconductor Memories:

Memory organization and operation, expanding memory size, classification and characteristics of memory, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM.

Text Books :

1. M. Morris Mano - Digital Design - PHI (3rd Edition)
2. R.P. Jain - Modern Digital Electronics - TMH.
3. Shaw - Logic Circuit Design

Reference Books :

1. Tocci - Digital Systems - (PHI)
2. Gothman - Digital Electronics - (PHI)
3. Morris Mano - Digital logic and computer design - (PHI)
4. Texas Instruments incorporated designing with TTL IC's - International Students edition
5. Alan Clements (Low Price 2000) The Principles of Computer hardware (Third Edition), Oxford Press.

List of Practicals

1. Verification of parameters & transfer characteristics of 74LS and 74HC family.
2. Verification of TTL - CMOS/CMOS-TTL interfacing.
3. Code conversion using logic gates: BCD to Binary BCD to Gray Gray to BCD
4. Design and implementation of 2 bit digital comparator using logic gates and functional verification of 4 bit digital comparator 1C 7485.
5. Design & implementation of 1 digit BCD adder using 1C 7483.
6. A) Verification of functionality of multiplexer and demultiplexer 1cs
B) Design and implement combinational function using multiplexer and demultiplexer.
7. A) Design & implementation of 3 bit bi directional shift register using D flip flop.
B) Design and implementation of Johnson counter using above shift register
8. A) Functional A verification of universal shift registers 1C 7495/194.
B) Design and implementation of pulse train generator using above 1C
9. Design and implementation of 3 bit up down ripple counter using flip-flop
10. Functional verification of ripple counter 1C 7490 & synchronous counter 1C 74191(mod n operation)
11. Design of synchronous sequence generator using MS JK flip-flop
(Minimum 2 expts must be conducted by using 74HCT/ HC, 40Xxseries of ICs)
12. Verification of DAC using R/2R method.

204186: ELECTRONICS HARDWARE WORKSHOP

Teaching scheme: Practice: 2 hrs/week

Examination scheme: Term Work: 50 Marks

Objective:

The objective of this workshop is to make the students aware of testing of electronic components & devices, handling equipments & circuit fabrication techniques.

1. Study of passive components: - Specifications, application and simple testing procedure and study of IEEE symbols for components/devices.
2. Study of active components like Diodes, Transistors, SCR etc study using data sheets and simple testing procedures. Use of analog multimeter & DMM.
3. Explain and demonstrate various types of PCB materials and all types of PCBs like single sided, double sided, multilayer & flexible etc.
 - (a) Overview of PCB design & fabrication.
 - (b) Make a single sided PCB for a simple circuit such as two stage transistor amplifier/discrete voltage regulator.

Do not use computer for artwork, manual layout is expected.

4. Soldering practice should be carried out for the above circuit diagram on general purpose PCB and fabricated PCB and test the same.
5. To learn specifications & front panel controls of Dual trace oscilloscope for measurement of waveform parameters.
6. To learn & use signal generator, power supply and Digital multimeter. To understand specifications, precautions, and limitations for measurement.
7. Build & test a digital circuit on general purpose PCB using digital IC's and verify logic levels.

NOTE:

Tool kit should consist of following items,

- 1) Soldering gun /station
- 2) Multimeter
- 3) Cutter
- 4) Noseplier
- 5) Desoldering strip/gun

Journal should contain collection of specifications, datasheets and photographs.

Reference Books

- 1) J. A. Sam Wilson, Joseph A. Risse - Electronic Troubleshooting and Servicing Techniques - Thomson Learning.
- 2) W.Bosshart - PCB Design and fabrication - PHI.

204187: ELECTRONIC CIRCUITS AND APPLICATIONS

Teaching scheme:

Lectures: 4 hrs /week

Practicals: 2hrs/week

Examination scheme:

Paper: 100 marks

Practical: 50 marks

Term Work: 25 marks

UNIT 1

Objective: To study diode and MOSFET applications

DIODE APPLICATIONS -

Voltage multiplier circuits: Working and comparison of voltage doubler, tripler and voltage quadruple configurations. Limitations of voltage multiplier circuits. Effect of frequency on load regulation.

Clipping and clamping circuits: Series and parallel forms of clipping circuits, Biased clipper, their operation and transfer characteristics. Clamping circuits.

MOSFET APPLICATIONS:

MOSFET in VLSI: V-I characteristic equation in terms of W/L ratio, MOSFET scaling and small geometry effects, MOSFET capacitances. Modeling MOS transistors using SPICE. CMOS inverter, Static characteristics - Noise margin, threshold voltage, Layout and latch-up prevention, Other logic gates- NAND and NOR gates. [8L]

UNIT 2

Objective: To study POWER MOSFET and POWER BJT devices and their data sheet specifications.

POWER MOSFET: Construction- Lateral double diffused MOSFET, VMOSFET. Drive requirements, Comparison with power BJT. One example of drive circuit for POWER MOSFET.

POWER BJT: Power BJT construction, Data sheet specifications, Thermal resistance, Second breakdown, Safe operating area (SOA), Thermal runaway, BJT as a switch in display and relay drive applications, Drive considerations, Anti saturation circuits, Comparison with POWER MOSFET

UNIT 3

Objective: To study BJT power amplifiers.

Large signal AF BJT amplifiers: Block schematic of AF amplifier.

Classes of power amplifiers - Class A, Class B, Class AB. An overview and applications of Class C and Class D amplifiers. Class A with resistive load, Transformer coupled class A amplifier, Class B Push-pull, Class AB, Complementary symmetry and Quasi-complementary configurations. Efficiency analysis for Class A transformer coupled amplifier, Class B push-Pull amplifiers. Comparison of efficiencies of other configurations. Distortions in amplifiers, concept of Total Harmonic Distortion (THD).

UNIT 4

Objective: To study BJT high frequency applications.

High frequency, small signal BJT amplifiers:

Behavior of transistor at high frequencies. Modified T equivalent circuit. High frequency hybrid n CE amplifier model. CE short circuit current gains for T and hybrid n models. Definitions and derivations for f_a , f and f_r

Amplifier bandwidth taking into account source and load resistances. Techniques to improve bandwidth. Single tuned, double tuned and stagger tuned amplifiers. Unloaded and loaded Q. Effect of staggering on bandwidth (no derivations).

UNIT 5

Objective: To study concepts of negative and positive feedback and oscillator circuits.

FEEDBACK AMPLIFIERS AND OSCILLATORS

: Concept of feedback. Negative and positive feedback. Classification of amplifiers based on feedback topology. (Voltage, Current, Transconductance and Transresistance amplifiers). Transfer gain with feedback. Advantages and disadvantages of negative feedback. Effect of feedback on input and output impedances and bandwidth of an amplifier. Analysis of one circuit for each feedback topology.

OSCILLATORS: Oscillator startup mechanism, need for amplitude limiting. Study of following oscillator circuits (using FET) - (Derivations not expected)

LC oscillators - General form of LC oscillator. Hartley oscillator, Colpitts oscillator, Clapp oscillator.

Crystal oscillator, Crystal clock

UNIT 6

Objective: To study different types of linear voltage regulators and their data sheet specifications.

LINEAR VOLTAGE REGULATORS AND VOLTAGE REFERENCES: Block schematic of linear regulators. Emitter follower regulator, Transistor series regulator and its analysis for performance parameters. 3 terminal floating, dual and adjustable regulators. Method of boosting output current using external series pass transistor. Performance parameters - Load and Line regulation, Ripple rejection, Output resistance and efficiency. Protection circuits - Reverse polarity protection, over current, fold back current limiting, over voltage protections. Important data sheet specifications of linear regulators. Voltage references, their peculiarities and applications.

Text Books

- 1) Thomas L. Floyd - Electronic Devices - Pearson Education (Sixth edition).
- 2) Donald A. Neamen - Electronic circuit analysis & Design - Tata McGraw Hill (Second Edition)

Reference Books

- 1) Mark N. Horenstein - Microelectronic Circuits & Devices - Prentice Hall (Second Edition).
- 2) Millman Halkies - Electronic Devices & Circuits -Tata McGraw Hill
- 3) Millman Halkies - Integrated Electronics - Tata McGraw Hill
- 4) Chryssis - Switched mode power supplies
- 5) Pucknell - Basic VLSI design - PHI
- 6) Reinhold Ludwig and Pavel Bretchko,- RF circuit design - Theory and applications - Pearson education.

LIST OF PRACTICALS

1. Center tapped bridge rectifiers, Dual Power supply
2. Clipping and clamping circuits
3. Voltage multiplier circuits - Regulation characteristics and effect of frequency

4. Class A transformer coupled, Class B push-pull amplifier - Efficiency calculations
5. Transistor inverter in relay and LED driving application
6. Tuned amplifiers - Single and double tuned amplifiers
7. Voltage series, current series feedback amplifier
8. Voltage shunt and current shunt feedback amplifiers.
9. Simulation of LC oscillator
10. Linear Voltage regulators - Floating, Adjustable three terminal regulators, current boosting, CV and CC modes of operation.

207003: ENGINEERING MATHEMATICS - III

Teaching Scheme: Examination Scheme:

Lectures: 4 hrs/week Paper: 100 marks

Duration: 3 hrs.

Section I

Unit I: Linear Differential Equations (**LDE**) (08 Hours) General n order LDE. Solution of n' order LDE with constant coefficients. PI by variation of parameters. Cauchy's & Legendre's DE. Solution of Simultaneous & Symmetric Simultaneous DE. Applications to Electrical circuits.

Unit II: Complex Variables (08 Hours)

Functions of complex variables, Analytic functions, C-R equations, Conformal mapping, Bilinear transformation, Residue theorem, Cauchy's Integral theorem & Cauchy's Integral formula (without proofs).

Unit III: Transforms (10 Hours) Fourier Transform (FT): Fourier Integral theorem. Sine & Cosine Integrals. Fourier Transform, Fourier Cosine Transform, Fourier Sine Transforms and their inverses. Problems on Wave equation.

Introductory Z Transform (ZT): Definition, Std. Properties (without proof), ZT of std. Sequences & Inverse. Solution of simple difference equations.

Section II

Unit IV: Laplace Transform (LT) (10 Hours)

Definition of LT, Inverse LT. Properties & theorems. LT of standard functions. LT of some special functions viz. error, 1st order Bessel's, Periodic, Unit Step, Unit Impulse and ramp. Problems on finding LT & inverse LT. Applications of LT for solving ordinary differential equations.

Unit V : Vector Calculus (08 Hours)

Vector Differentiation & its physical interpretation. Vector differential operator. Gradient, Divergence & Curl. Directional derivative. Vector identities.

Unit VI : Vector Analysis (08 Hours)

Line, Surface & Volume integrals. Conservative, Irrotational & Solenoidal fields. Scalar potential. Gauss's, Stoke's & Green's theorems (without proofs). Applications to problems in Electromagnetic Fields.

Text Books

1. Advanced Engineering Mathematics, 5e, by Peter V. O'Neil (Thomson Learning).
2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.).

Reference Books

3. Advanced Engineering Mathematics by Wylie C.R. & Barrett L.C. (McGraw-Hill, Inc.)
4. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
5. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
6. Engineering Mathematics by B.V. Raman (Tata McGraw-Hill).
7. Applied Mathematics (Volumes I and II) by P. N Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).
8. Advanced Engineering Mathematics with MATLAB 2e, by Thomas L. Harman, James Dabney and Norman' Richert (Brooks/Cole, Thomson Learning).

203189 : ELECTRICAL CIRCUITS & MACHINES

Teaching Scheme:

Examination Scheme:

Lectures: 04

Paper: 100 Marks

Practical: 02

Term Work: 25 Marks

Course objectives:

1. To make the students familiar to various types of Electrical machines available, their important features and applications.
2. To make the students aware of energy and power concept.

Unit I : Transformers

Single-phase transformers: Ideal & Practical Transformers, Equivalent circuit, Determination of transformer parameters (O.C. and S.C. tests), Efficiency and regulation of transformer.

Design of Single phase transformer for instrument power supply. Coupled circuit.

Special transformer : (Theoretical treatment only) Auto transformer, current transformer, induction heating transformers, ferrite core transformer, Welding transformer, Phase shift transformer, Three phase transformer, Star/Delta, Delta/Star, Application of each Type.

Unit 2: DC Machines

DC Generator: Construction, Types, role of commutator, induced emf equation, characteristics and applications.

DC Motors : Operation, types, losses, basic equations of DC Motors, Torque speed characteristics, Speed control methods, speed regulation, starters (manual, electronic), braking and applications.

Unit 3: Active, Reactive and Apparent Power

Instantaneous power, active power, reactive power, Power factor, distinction between active and reactive power, combined active and reactive loads (apparent power). Measurement and Calculation of active, reactive power factor in 3 ϕ balanced circuit using Two Wattmeter and One Wattmeter.

Measurement of 1 ϕ and 3 ϕ power using CT and PT.

Electronic meters for energy measurement. Introduction to energy audit.

Unit 4: Three phase Induction Motors

Construction, operation, types, equivalent circuit, torque-slip characteristics, slip and torque equations, max torque, starting torque, full load torque, condition for max torque, power flow diagram, starters for IM (manual and soft starters). Introduction to speed control, braking, protection circuits (e.g. single phase preventer, ELCB, MCB) and application.

Unit 5: Synchronous machines

Synchronous Generators: Construction, types (rotating field & rotating armature), Synchronous speed and emf equation. Coil span factor and distribution factor (derivation not expected). Alternator on no load and on load. Armature reaction in 3-phase alternators, Regulation of alternator by Synchronous impedance method.

Synchronous motors: Construction, operation, effect of variation of load, Hunting, V curves, Starting methods, Synchronous Condenser, applications.

Unit 6 : Special purpose machines

Principle of operation, working, types and applications of single phase IM, universal motors, reluctance motor, stepper motors, AC & DC servo motors.

Text Books

1. Guru, Hiziroglu - Electric Machinery & Transformers, Oxford University Press.
2. H. Cotton - Electrical Technology. *Reference Books*
1. Fitzgerald - Electric Machinery, TMH (Sixth Edition).
2. Theodore Wildi - Electrical Machines, Drives & Power systems, Pearson Education.
3. Nagrath Kothari - Electric Machines, TMH.
4. Irving Kosow - Electrical Machines and transformers.

List of Experiments (Any Eight)

1. Speed control of DC Shunt motor.
2. Load test on DC Shunt motor.
3. Load test on DC Series motor.
4. Power measurement in 3-phase circuit by two-wattmeter method.
5. Reactive power measurement in 3-phase circuit by one-wattmeter method.
6. O.C. & S.C. test on single-phase transformer.
7. Load test on 3-phase Induction motor.
8. Study of IM starters.
9. Direct loading on alternator.
10. O.C. & S.C. test on Alternators.
11. V curves of synchronous motor.
12. Study of stepper motor.

210256: DATA STRUCTURES AND FILES

Teaching Scheme: Examination Scheme:

Lectures: 4 Hrs / Week Theory: 100 Marks

Practical: 2 Hrs / Week Practical: 50 Marks

Learning Objectives:

1. Study the representation and use of primitive data types, built in data structures.
2. Study how the data structures in the topic list are allocated and used in memory and study common applications of each .
3. Implement the user defined data structures in a high level language.

4. Compare alternative implementations of data structures with respect to performance.
5. Compare and contrast the cost and benefits of dynamic and static data structures implementations.
6. Choose the appropriate data structures for modeling given problems.

Unit - I . Review of 'C' :

Arrays, Pointers: arrays and pointers

Functions: Parameter passing call by value and call by reference, scope rules, concept of recursion and recursive functions, functions and pointers.

Structure and Union: Passing and returning structure and union as parameter for function structure / union and pointer.

Input / Output Files: Concept, file operations, types: sequential & random access files.

Unit - II Introduction to data structures:

Overview - algorithm, data structure, how to create a program, how to analyze the program.

Abstract Data Types. Concept of sequential organization, concept of linear and non linear data structure, arrays as ADT, storage representations (row major and column major).

Concept of ordered list & polynomial representation using arrays. Searching and sorting techniques: Searching: Basic search techniques, sequential searching, binary search, indexed sequential search. Analysis of these algorithms.

Sorting: General background, bubble sort, quick sort, selection sort, insertion sort & merge sort. Analysis of these algorithms.

Hash Tables: Introduction, hashing functions, Overflow/collision Handling.

Unit - III

Linear Data structure using linked organization: Concept of link organization. Singly linked list, doubly linked list, Circular linked list. Insertion, deletion & traversal on above data structures. Representation & manipulation of polynomials using linked list.

Generalized lists: Representation of polynomial using generalized list.

Unit - IV

Stack: Definition & examples, representing stack in C, implementing stack using linked list.

Example: infix, post fix and prefix (basic definition and examples, evaluating postfix expressions, program to evaluate postfix expression, converting infix to postfix expression, program to convert infix to postfix).

Queues: The queue and its sequential representation, linked implementation of queues, circular queue, concept of priority queue.

Unit-V

Trees : Basic terminology, binary trees, binary tree representation ,binary tree traversal, primitive operations on binary trees, Binary search trees-primitive operations on binary search trees, Threaded binary trees, traversal of threaded binary tree.

Unit -VI

Graphs: Concepts and terminology, Representation of graphs using adjacency matrix, adjacency list.

Traversal: Depth first search Breath First Search. Algorithms for minimal spanning tree and shortest path.

Text Books

1. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum - Data structures using C and C++ - PHI Publications (2nd Edition).
2. Ellis Horowitz, Sataraj Sahni- Fundamentals of Data Structures - Galotia Books source.

Reference books: I Brain W Kernighan and Denis s M Ritchie- The programming Language - PHI publications.

2. Robert L Kruse - Data structures & program design -PHI publications (3rd Edition).

List of Practicals (Any Eight)

- 1) a) Program to create & manipulate database using structure.
b) Program to add two polynomials using array of structure.
- 2) Program to implement primitive operations on Sequential file.
- 3) a) Program to search for a record from a given list of records stored in an array using, i) Linear Search ii) Binary Search.
b) Program to create Hash table & handle collision using linear probing without replacement.
- 4) Program to sort an array of names using
i) Bubble Sort ii) Insertion Sort iii) Quick Sort.
- 5) a) Program to implement following operations on singly linked list:
i) Create ii) Delete iii) Insert iv) Display v) Search.
b) Program to add two polynomials using linked list.
- 6) a) Program to implement stack using : i) Array ii) Linked List.
b) Program to convert an infix expression to postfix expression & evaluate the resultant expression.
- 7) Program to Implement Queue using: i) Array ii) Linked List.
- 8) Program to create a Binary Search Tree & Perform following primitive operations on it :
i) Search ii) Delete iii) Traversals (inorder, preorder, postorder - recursive) and
iv) Non-recursive in-order traversal
- 9) Program to create a graph using adjacency matrix/ adjacency list & traverse it using BFS & DPS methods.

204191: ANALOG COMMUNICATION

Teaching Scheme: Examination Scheme:

Lectures: 04 Hrs/week Paper: 100 Marks

Practical: - 02 Hrs/week Oral: 50 Marks

UNIT 1: INTRODUCTION TO COMMUNICATION/ PULSE MODULATION

Block Schematic of Communication System, Base Band Signals and their bandwidth requirements, RF Bands, Types of Communication Channels (Transmission Lines, Parallel wires, Co-axial Cables, Waveguides and Optical Fiber). Necessity of Modulation, Types of Modulation: AM, FM, PM and Pulse Modulation.

Block Schematic of PAM, PWM, PPM.
Multiplexing: TDM, FDM.

UNIT 2: AMPLITUDE MODULATION

Mathematical treatment and expression for AM, Frequency Spectrum, Modulation Index, Power Relation as applied to Sinusoidal Signals, Representation of AM wave, Mathematical treatment as applied to general signals in Communication, Generation of AM using non-linear property.

Types of AM Transmitters : DSB-FC, DSB-SC, SSB, ISB & VSB, their generation methods and Comparison in terms of Bandwidth and Transmission Power requirements & Complexity (Block diagram Treatment only).

UNIT 3 : ANGLE MODULATION

Mathematical analysis of FM and PM using Sinusoidal Signals, Frequency Spectrum, Mathematical treatment as applied to general non-sinusoidal Signals, Modulation Index, Bandwidth requirements (all three relations), Narrowband and Wideband FM, Comparison of FM and PM, Direct and Indirect methods of FM generation, Need for Pre-emphasis, Comparison of AM and FM.

UNIT 4: AM & FM RECEIVERS

Block diagram of AM and FM Receivers, Super heterodyne Receiver, Performance characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection, IFRR. Tracking, De-emphasis, Mixers.

AM Detection: Envelope detection, Synchronous detection, Practical diode detection, AGC, SSB and DSB detection methods.

FM Detection: Phase discriminator and Ratio Detector, Mathematical analysis of FM Detection.

UNIT 5: NOISE

Sources of Noise, Types of Noise, White Noise, SNR, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth, Performance of AM (DSB, SSB & VSB) and FM in presence of Noise : Mathematical treatment.

UNIT 6: RADIATION AND PROPAGATION :

Concept of Radiation, Basic Antenna System (Dipole), Antenna parameters, Yagi-Antennas. Mechanism of Propagations: Ground Wave, Sky Wave, Space Wave, Duct, Tropospheric Scatter and Extraterrestrial Propagation. Concept of Fading and diversity reception.

Text Books

- 1) B. P. Lathi : Modern Digital and Analog. Communication Systems: Oxford Press Publication
- 2) Kennedy & Devis - Electronic Communication Systems
-PHI

Reference Books

- 1) Dennis Roddy & Coolen - Electronic Communication
- PHI
- 2) Proakis and Salehi - Communication Systems Engineering - Pearson

3) Louis Frenzel - Communication Electronics - TMH

List of Practicals :

1. Study of AM Generation (DSB-FC).
2. Study of AM transmitter using Spectrum Analyzer.
3. Study of Envelope Detector - Practical diode detector.
4. Study of FM Generation.
5. Study of FM Transmitter using Spectrum Analyzer.
6. Study of FM detection - Radio Detector.
7. Measurement of Receiver Characteristics: Sensitivity, Selectivity, Fidelity.
8. Study of DSB-SC & SSB Generator using Spectrum Analyser.
9. Study of DSB-SC & SSB Detector.
10. Measurement of Antenna radiation pattern for different antennas.

Note: Transmitter and Receiver experiments shall mandatorily be carried out at **Radio Frequency** (preferably above 500 KHz).

204192: ELECTRONICS SOFTWARE WORKSHOP

Teaching scheme: Examination scheme:

Tutorial: 1 hr/week

Practical: 2 hrs/week Term Work: 50 marks

Objective:

To make the students aware of:

1. Programming practice in C for Numerical Methods,
2. Use of application specific software tools in the design. development, simulation and testing of electronic circuits.
3. Use of Mathematical software packages for understanding and modeling electrical signals and linear systems

Section A: Numerical computational techniques:

Instruction of following techniques assisted by C program/function implementation of at least THREE of them is expected.

Solution of Transcendental and polynomial equations, bisection method, Newton-Raphson, Secant, Successive methods, Solution of Linear equations using Gauss-elimination .Gauss-Jordan methods, Newton's forward and Backward difference equations, Interpolation, Numerical Integration and Differentiation: Trapezoidal rule Simpson's 1/3 and 3/8 rule, Euler's Method.

List of suggested assignments:

Program to solve numerical methods: Bisection method, Newton Raphson method using user defined functions. Functions should incorporate parameter passing techniques.

Program using Function to solve Differential Equation by Euler's modified method.

Program using Function to find integration by Simpson's 1/3rd and 3/8th method.

Section B: Simulation of typical circuits using Circuit Simulation tools such as pSpice, MultiSim, Simulink, Proteus

(a) Transistorized circuits, i) Two stage amplifier, ii) Series regulator, iii) Audio Driver / Audio Power Amplifiers

(b) IC Based Circuits

i) Sequential Digital Circuits ii) Combinational Logic iii) Timer circuit

Section C: MATLAB/OCTAVE 20 SIM based Experiments/ Assignments:

Assignments related to Control Systems, Signal and Systems and Network theory