

SEMESTER - IV

THEORY

EC1401 - ELECTROMAGNETICS

(2-1-0)

Scalar and vector fields, vector representation of surfaces, physical interpretation of gradient, divergence and curl, Gauss's law, Stokes theorem, Helmholtz theorem, different co-ordinate systems, points pointing vector.

Time varying fields: Gauss's flux theorem, Laplace and Poisson's equation, Continuity equation, displacement current, Maxwell's equation "boundary condition wave equation and its solution in different media, phasor notation, polarization, reflection and refraction of traveling waves at plane boundaries, phase and group velocity.

Transmission lines: Evaluation of line parameters, design concept, cutoff frequency, attenuation, dispersion, power handling capacity, traveling wave, standing waves, Smith chart and matching techniques, wave guide.

Antenna: Radiation concept, Elementary dipole, half wave dipole, radiation pattern, gain, pattern multiplication, basic antenna.

Operational Amplifiers

Ideal op-amp, characteristics, Inverting and non-inverting op-amp; difference Amplifier – Transfer characteristics; offset error voltages and currents, CMRR, PSRR, slew rate; measurement of op-amp. parameters.

Analog System with Operations Amplifier As a Building Block

Basic applications – Inverter, scale changer, adder, voltage to current / current to voltage converter, voltage follower; Differential amplifier, Bridge amplifier; Instrumentation amplifier; analog Integrator and Differentiator; Nonlinear systems – comparator, zero crossing detector, timing mark generator, sample & hold circuit, precision diode, precision rectifier, average detector, peak detector, Logarithmic amplifier, anti-log amplifier, logarithmic multiplier.

Active filters

Introduction, Frequency response characteristics, First order LP and HP filter. Second order filter model, Sallen – Key unity gain filters, Sallen – key equal component filters, higher order filter, Band pass and Band reject filters.

Wave shaping and waveform Generation

Oscillators – RC phase shift oscillator, Colpitts and Hartley oscillator, square wave generator, pulse generator, triangular wave generator, Schmitt Trigger, voltage controller oscillator.

Regulated Power Supplies

Transistorized Series pass regulator; overload, short – circuited and thermal shutdown protection; three terminal IC regulators, Basic idea of switching regulators.

Analog to Digital / Digital to Analog Conversion

Weighted resistor and Binary ladder D/A converters; Single and dual slope integration, counter, servo, successive approx., Resistor type Analog to digital converters.

Suggested books and references

- Millman, and Halkias, C.C., "Integrated electronics", Tata McGraw Hill, 1998.
- Schilling and Belove, C., "Electronics Circuit: Discrete and integrated", McGraw Hill, 1989
- Soclof, " Applications of Analog Integrated Circuits", Prantice Hall of India, 1996.
- Franco, "Design with Op-amps & Analog Ice", Tata McGraw Hill, 1997.
- Jacob, "Applications & design with analog Ics", Prantice Hall of India, 1996.
- Tietze and Schenk, "Advanced Electronics Circuits", Springer – Verlag, 1978.

Power supplies

Rectifiers – Half wave Rectifiers – Average and RMS values – Ripple factor – Regulation – Rectification – Efficiency – Transformer utility factor – filters – Inductors, capacitors, L type, PI type – Ripple factor and regulation – Need for voltage regulator – Series and Shunt regulators – Comparison – Current limiting and protection – circuits – Switched mode power supplies (qualitative).

Small signal amplifiers

General principle of operation – classifications – RC coupled amplifiers – Gain frequency response – Input and output impedance calculations – Transfor coupled amplifier – Equivalent circuit at low medium and high frequencies – Analysis and frequency response.

DC Amplifiers

Problems in DC Amplifiers – Minimisation – Chopper Amplifiers – Differential and common mode gain CMRR – Cascode and Darlington pair Amplifiers.

Feedback Amplifiers

Basic concept of Feed back amplifiers – Characterization – Effect of negative feed back on gain, gain stability distortion and bandwidth- Voltage and current feed back circuits.

Harmonic Oscillators

Barkhausen criteria – Hartley, Clapp and Collpit's oscillators – RC Phase shift oscillators – Wein bridge oscillators – Frequency stability of oscillators – Crystal oscillators.

Power Amplifiers

Classification – Class A/B/C – Single ended and Push – Pull configuration – Power dissipation and output power Conversion efficiencies – Complementary symmetry power amplifier.

Suggested textbooks & References:

- Millman, and Halkias, "Integrated Electronics", Mc graw Hill, Fifth Reprint, 1993.
- Boylestad, Robert L. and Louis Nashelsk, "Electronic Devices and Circuit Theory", Prantice Hall of India New Delhi, 1997.
- Schillin g., and Belove., "Electronic Circuits – Discrete and integrated" MacGraw Hill international edition 1989.
- Mottershead, A., "Electronic Devices & Circuits: As Introduction", Prantice Hall of India, 18th Reprint, 1996.

EC 1404 - SOLID STATE DEVICES

(3-1-0)

Semiconductors: Energy band diagram, covalent band, bond and free electrons, and hole mobilities, intrinsic and extrinsic semiconductors, Fermi and impurity levels, impurity compensation, charge neutrality equation and semiconductor conductivity, Einstein relation, drift and diffusion, photoconductivity and hall effect.

Semiconductor Diode: Theory and band diagram of p-n junction as a diode, current component and I-V characteristics of p-n diode, effect of temperature on diode current, breakdown mechanisms, avalanche and zener diode LED, optical absorption in a semiconductor, photovoltaic effect, solar cell, photodiode, avalanche photodiode, negative conductor in semiconductor, transit time devices, IMPATT, TRAPATT, Gunn device.

Transistor: Basic structure and principle of operation of BJT. Current components and amplifying property of BJT, CB, CE & CC configuration and its I/P, O/P characteristics, current gain, and active, saturation and cutoff region of O/P char. .

FET: Basic structure, characteristics of JFET, drain conductance and trans conductance of JFET, important properties of JFET. Static and dynamic characteristics MOS structure MOS capacitance, MOS static char. and equivalent ckt.

Suggested textbooks & References:

- Dekker, A.J., "Electronic Engineering Materials", PHI, New Delhi, 1998.
- Allision, A.J., "Electronic Engineering Materials and Devices", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1998.
- Millman, J. and Halkias C.C., "Electronic Devices and Circuits", Tata McGraw Hill, 1998.
- Runyan, W.R., "Semiconductor Measurements and Instrumentation", McGraw Hill, New York, 1975.
- Millman, J. and Halkias, C.C., "Electronic Devices and circuits", Tata McGraw Hill, 1998.

EC 1405 - NETWORK THEORY

(3-1-0)

Network theorems: Superposition theorem, Thevenin's & Norton's theorem, maximum power transfer theorem, Tellegen's theorem.

Coupled circuits: Self inductance, coefficient of coupling, dot conversion, analogy of coupled circuits.

Network Transients: Transient response of simple RL, RC & RLC series & parallel circuits, solution of RL, RC, RLC series & parallel circuit for step & sinusoidal excitation using Laplace's transform method.

Two Port Network: Open & Short circuit parameters, transmission & Hybrid parameter & their interrelations.

Network Function: Two port network parameters –poles and zeros, properties of network functions, time domain behaviour for pole zero plot

Network synthesis: stability concept –Hurwitz property, positive realness properties of positive real functions. Synthesis of RL, RC, LC driving point impedance function using simple canonical networks-Foster and Caour forms.

Suggested textbooks & References:

- Paranjothi, S.R., "Electric Circuit Analysis", New age International Publishers, Madras, 1996.
- Sinha, Umesh., "Network Analysis and systhesis", Satya Prakashan, New Delhi, Reprinted Edition, 1997.
- Arumugam, M., and Premkumar, N., "Electric circuit theory", Khanna Publishers, New Delhi, 1987.
- Loseph, A. Edminister., "Theory and problems of electric circuits", Tata McGraw Hill Publishing Compant, 1992.

Introduction a Digital Communication System.

Characterization of Signals and Systems

Representation of Band pass signals and systems; Representation of Digitally Modulated Signals; Linear. Less modulation, nonlinear modulation methods with memory, Base band signals, Spectral characteristics of the above Digitally Modulated Signals.

Modulation and Demodulation Schemes

Demodulation for completely known signals in Additive Gaussian noise; Binary antipodal . Binary orthogonal signals, Multiphase signals, QAM signals, M-ary orthogonal signals, M-ary orthogonal signals, Simplex signals; Probability of Error calculations for these signals

Carriers and Symbol Synchronization Schemes

Convolution Codes:

Transfer function of a Convolution code, optimum decoding of Convolution codes - Vitter algorithm; probability of Error for soft decision and hard decision decoding.

Digital Communication over Linear Band-limited Channels

Characteristics of Band limited channels; Signal design for band limited channels for no ISI and controlled ISI Optimum Demodulator for ISI and Additive Gaussian noise; Various methods of linear equalization, Decision -Feedback Equalization, Adaptive Equalization, Echo cancellation in Data transmission over telephone channels

PRACTICAL / DRAWING / DESIGN

EC 1407-P - Network Analysis Lab.

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List of Experiments:

- Measurement of Power in a three-phase circuit by two-wattmeter method for
- Balanced & Unbalanced Load and (i) Power Factor Calculation, (ii) Reactive Power Calculation.
- Polarity Test of Transformer.
- Transient Response of R-L, R-C and R-L-C Series & Parallel Circuits for (a) Step Input, (b) Sinusoidal method using Laplace Transform Method.
- Synthesis of R-L, R-C and Driving Point Impedance pull using Foster and Cauer Forms.

EC 1408-P - Electronics circuits Lab.

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List of experiments:

- Generation of square and triangular wave using op-amp IC.
- Study of Class A amplifier and its waveform.
- Study of Class B amplifier and its waveform
- Determining the frequency of a wein bridge oscillator.
- Determining the frequency of a phase shift oscillator.
- Determining the frequency of a Hartley oscillator.
- Determining the frequency of a Colpitt oscillator.

EC 1409-P - Solid State Devices Lab.

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List of experiments:

- Rectifying and Breakdown Characteristics of P-N Junction and Point Contact diodes.
- Input and Output characteristics of Bipolar Transistor in (a) Common base, and (b) Common Emitter configurations.
- Drain Current (I_D) – Drain to Source Voltage (V_{DS}), Characteristics of Junction Field Effect Transistor (JFET). Study of SCR Characteristics.
- Measurement of h-parameters of Bipolar Junction Transistor.
- Study of basic properties of Operational Amplifier.
- Measurement of Energy Band Gap and Resistivity of semiconductor sample.
- Measurement of Carrier Concentration in a semiconductor by Hall measurements.
- Measurement of Junction Capacitance and Ideality Factor of semiconductor diode.
- Study of effect of Temperature on Leakage current and Breakdown voltage of P-N Junction.
- Study of UJT and Relaxation Oscillator.
- Study of Frequency Response of R-C Coupled Amplifier.

EC 1410-P - Linear IC's & Applications Lab.

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List of experiments:

- Study of Transfer Characteristics of Op-amp.
- Fabrication of Voltage to Current / Current to Voltage Converter using Op-amp.
- Fabrication of Non-linear system Comparator, Zero Crossing Detector using Op-amp.
- Study of Band Pass & Band Reject Filter. Study of R-C Phase Shift Oscillator.
- To generate Square Wave, Pulse, Triangular Wave using C. R. O.
- Study of Switching Regulator.
- Study of Binary Ladder D/A Converters.

HS 1404 – P GENERAL PROFICIENCY IV

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