

### B.E. 401 - ENGINEERING MATHEMATICS III

#### Unit I

Functions of complex variables : Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula, Singular Points, Poles & Residues, Residue Theorem , Application of Residues theorem for evaluation of real integrals

#### Unit II

Errors & Approximations, Solution of Algebraic & Trancedental Equations (Regula Falsi , Newton-Raphson, Iterative, Secant Method), Solution of simultaneous linear equatins by Gauss Elimination, Gauss Jordan, Crout's methods , Jacobi's and Gauss-Siedel Iterative methods

#### Unit III

Difference Operators, Interpolation ( Newton Forward & Backward Formulae, Central Interpolation Formulae, Lagrange's and divided difference formulae ), Numerical Differentiation and Numerical Integration.

#### Unit IV

Solution of Ordinary Differential Equations(Taylor's Series, Picard's Method, Modified Euler's Method, Runge-Kutta Method, Milne's Predictor & Corrector method ), Correlation and Regression, Curve Fitting (Method of Least Square).

#### Unit V

Concept of Probability : Probability Mass function, Probability density function. Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution ,Gamma Distribution ,Beta Distribution ,Testing of Hypothesis |:Students t-test, Fisher's z-test, Chi-Square Method  
Reference:

- (i) Numerical Methods using Matlab by J.H.Mathews and K.D.Fink, P.H.I.
- (ii) Numerical Methods for Scientific and Engg. Computation by MKJain, Iyengar and RK Jain, New Age International Publication
- (iii) Mathematical Methods by KV Suryanarayan Rao, SCITECH Publuication
- (iv) Numerical Methods using Matlab by Yang,Wiley India
- (v) Pobability and Statistics by Ravichandran ,Wiley India
- (vi) Mathematical Statistics by George R., Springer

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**  
**PROGRAMME: Electronics and Communication Engineering**  
**COURSE: EC-402 Electromagnetic Theory**

**Course Contents**

**Unit I**

**Review of vector calculus:** orthogonal coordinate systems, gradient, divergence and curl. Laplacian operator for scalar and vectors. Vector integral and differential identities and theorems. Phasor representation of harmonic variation of scalar and vectors

**Static electric fields,** Columb's law, electric flux density and electric field intensity, permittivity, dielectric constant, field of distributed charges in free space, potential function, Laplace's and Poisson's equations, electric dipole, stored electric energy density. Boundary conditions at abrupt discontinuities between two media including conducting boundaries, surface charge distribution capacitance between two isolated conductors

**Unit II**

**Solution of Laplace's equations** in systems of dielectric and conducting boundaries, uniqueness theorem, two dimensional boundary condition problems, solution by symmetry, conformal transformation of functions, image theory etc. fields in parallel wire, parallel plane and coaxial systems.

**Static currents and magnetic fields-** flow of charge in conductive media, lossy conductive medium, current density, specific conductivity, mobility, explanation of Ohm's law employing mobility.

Magnetic effects of current flow, Biot-Savart's law in vector form magnetic field intensity, magnetic flux, and permeability, closed loop currents, Ampere's circuital law in integral and differential vector form, magnetic vector potential and related equations. Problems related to straight wire toroidal and cylindrical solenoids, inductance. Boundary conditions on magnetic field, equivalent surface currents for abrupt discontinuity of magnetic field.

**Unit III**

**Time varying fields** – Faraday's law in integral and differential forms, displacement current concept, Maxwell's equations in differential and integral forms, wave equations in source free region electric and magnetic stored energy density, continuity equation, Poynting vector theorem.

Time harmonic fields, r.m.s. phasor representation of field vectors, Maxwell's equations for TH field, average energy density, complex Poynting vector, duality concept.

Helmholtz wave equation, general solution in free space in various coordinates, plane polarized wave in free space, properties of plane waves, wave front, power flow, stored energy density.

**Unit IV**

**Circular and elliptic polarization,** resolution in terms of linear polarized waves and vice-versa.

Plane waves in lossy medium, low loss dielectric, good conducting and ionized media, complex permittivity, loss tangent, skin depth, transmission line analogy, boundary conditions at perfect conductor surface, surface current density Interference of two plane waves traveling at oblique directions.

**Unit V**

**Reflection and refraction of plane waves** at dielectric media and conducting Surfaces, Brewster's angle, total internal reflection, resultant fields and power flow in both media. Frequency dispersive propagation, phase velocity and group velocity. Magnetic vector potential for sources in free space, retarded potential, radiation principles, boundary condition at infinity

**References:**

1. Mathew N.O Sadiku: Elements of Electromagnetic, Oxford University Press
2. William H. Hayt: Engineering Electromagnetic, TMH.
3. John D. Kraus: Electromagnetics, Mc. Graw Hill.
4. Jordan Balmian: Electromagnetic wave and Radiating System, PHI.
5. David K. Cheng: Electromagnetic Fields and Wave, Addison Wesley.
6. Ramo, Whinnery and VanDuzzer " Fields and waves in communication electronics ", Wiley 1984
7. Harrington RF, "Electromagnetic fields" Mc Graw Hill

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**  
**PROGRAMME: Electronics and Communication Engineering**  
**COURSE: EC-403 Digital Electronics**

**Course Contents**

**Unit-I**

**Review of Number systems and Binary codes**, Binary arithmetic – addition, subtraction, multiplication and division algorithms. **Boolean algebra**: theorems and functions, Simplification of Boolean functions, minimization techniques, Karnaugh's map method, Quine and McCluskey's method, realization of various binary functions using AND, OR, NOT, XOR logic gates.

**Unit-II**

**Universal gates**: NAND, NOR, realization of boolean function using universal gates. Half and full adder, half and full subtractor, Series and parallel adder, BCD adders, lookahead carry generator. Decoders, Encoders, multiplexers and de-multiplexers. Analysis and design of combination circuits, realization of various Boolean functions using NAND, NOR gates and multiplexers.

**Unit-III**

**Multivibrators**: Astable, Monostable and bistable multivibrators, 555 timer chip and its application in multivibrators. **Flip-Flops**: R-S, Clocked R-S, T, D, J-K, race around problem, Master-slave J-K., State and Excitation Tables. **Shift registers and counters**: synchronous and asynchronous counters, Binary ripple counter, up-down counter, Johnson and ring counter. Analysis and Design of Sequential Circuits.

**Unit-IV**

**Semiconductor memories**: Organization and construction of RAM, SRAM, DRAM, RAMBUS ROM, PROM, EPROM, EEPROM, PAL and PLAs etc

**Unit-V**

**Logic families**: RTL, DTL, TTL, ECL, IIL, PMOS, NMOS and CMOS logic etc. Interfacing between TTL and MOS, vice-versa.

**References:**

1. M. Mano : Digital Logic and Computer Design, Pearson Education
2. W.H. Gothman : Digital Electronics, PHI.
3. Millman and Taub : Pulse, Digital and Switching Waveforms, MGH
4. Salivahanan and Ari Vahagan : Digital Circuits and Design, Vikas Publishing House
5. Leach and Malvino : Digital Principles and Applications, TMH

**List of Experiments (Expandable):**

All experiments (wherever applicable) should be performed through the following steps.

**Step 1:** Circuit should be designed/drafted on paper.

**Step 2:** The designed/drafted circuit should be tested on the bread board.

**Step 3:** The bread board circuit should be fabricated on PCB by one batch using PCB machine.

1. To test and study of operation of all logic Gates for various IC's.
2. Implementation of AND, OR, NOT, NOR, X-OR and X-NOR Gates by NAND and NOR Universal gates.
3. Binary Addition by Half Adder and Full Adder circuit.
4. Binary Subtraction by Half Subtractor and Full Subtractor circuit.
5. Design a BCD to excess-3 code converter.
6. Verification of the Demorgan's Theorem.
7. Study of RS, JK, T & D flip-flops.
8. Multiplexer/Demultiplexer based boolean function realization.
9. Study and Application of 555 timer (Astable, Monostable, Schmitt trigger, VCO

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**  
**PROGRAMME: Electronics and Communication Engineering**  
**COURSE: EC-404 Electronic Circuits**

**Course Contents**

**Unit-I**

**Amplifier Basics**, Transistor as an amplifier, load line, Q-point and its selection criteria, designing of fixed bias and self-bias, stability of biasing circuits, calculation of stability factor.

**Transistor at low frequency**: frequency response, bandwidth, h-parameter analysis of CC, CB and CE configuration, simplified model, gain and impedance calculation of single stage amplifier.

**Transistor at high frequency**, high frequency model (hybrid- $\pi$ ), Parameters and their definition, Miller capacitance and its effect on voltage gain,

**Unit-II**

**Feedback amplifier**: positive and negative feedback loop gain, effect of negative feedback on gain stability, distortion, bandwidth, input and output impedance of amplifier, types of feedback (voltage, current, series and shunt) and their analysis.

**Oscillators**: condition of sustained oscillation, RC phase shift, LC (Hartley and Collpit) Oscillators, Wein Bridge, Negative resistance (Tunnel diode and UJT) oscillators, crystal oscillators.

**Unit III**

**Power amplifier**, classification, operation, analysis and design of Class A, Class B, Class-AB, Class C, transformer coupled, push pull and complementary symmetry amplifiers, power dissipation in transistors ( $P_{dmax}$  rating) and efficiency calculations.

**Tuned amplifier** and its applications, Q factor, selectivity and bandwidth, effect of loading, double tuning (synchronous and stagger)

**Unit IV**

**Cascade amplifiers**, Calculation of gain, Input and output impedance, Effect of Cascading on bandwidth, Transformer, RC and direct-coupled amplifier and their performance.

**Darlington connection**, equivalent circuit and Calculation of gain and impedances, Cascade amplifier: advantage, circuit diagram and analysis, feedback pair and applications of BIFET, Bootstrapping technique.

**Differential amplifier** - configuration, transfer characteristics, DC analysis, h-parameter analysis, differential and common mode gain, CMRR, constant current source and current mirror, level shift.

**Unit-V**

**Operational amplifier** (IC741), specifications, ideal and practical characteristics, frequency response, unity gain bandwidth, limitations, slew rate and its effect on full power bandwidth, input offset voltage, bias and offset currents, compensation.

**Applications of Op-Amp**: Inverting and non-inverting amplifier Analog computation, summer (inverting and non-inverting), averager, integrator, differentiator, scalar, sign changer, phase changer, multiplier, buffer, Differential amplifier, instrumentation amplifier, comparator, Schmitt trigger, precision rectifier, log and antilog amplifier, voltage-to-current and current-to-voltage converter.

**References:**

1. Millman and Halkias : Integrated electronics, TMH
2. Gayakwad ; OPAMP and Linear Integrated Circuits, Pearson Education
3. Boylestad and Nashelsky : Electronic Devices and Circuit Theory, PHI
4. Sendra and Smith : Microelectronics, Oxford Press
5. Graham Bell : Electronic Devices and Circuits , PHI
6. Donald A Neamen : Electronic Circuits Analysis and Design, TMH

**List of Experiments (Expandable):**

All experiments (wherever applicable) should be performed through the following steps.

**Step 1:** Circuit should be designed/drafted on paper.

**Step 2:** The designed/drafted circuit should be tested on the bread board

**Step 3:** The bread board circuit should be fabricated on PCB by one batch using PCB machine.

1. Characteristics of Op-Amp (input offset voltage, slew rate, CMRR, BW, input bias current.
2. Linear application of Op-Amp (voltage follower, inverting and non-inverting amplifier and their frequency response, adder, subtractor, differential amplifier, integrator and differential frequency response)
3. To design and construct a shunt and series regulator and find line and load regulation.
4. Design and performance evaluation of transistor amplifiers in CE, CB and CC configuration
5. Design and performance evaluation of FET amplifiers.

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**  
**PROGRAMME: Electronics and Communication Engineering**  
**COURSE: EC-405 Analog Communication**

**Course Contents**

**Unit-I**

**Signal Analysis:** Vectors and signals, orthogonal functions, Fourier series, Complex Fourier spectrum, Fourier Transform, Time domain and frequency domain representation of a signal, Existence of the FT, FT of some useful functions like exponential signal single sided & double sided, Gate function, singularity functions, FT of various functions, Properties of FT, Convolution, Convolution with Impulse Function.

**Signal Energy and Power:** Spectral Density of various types of signals, Spectra (Parseval's Theorem), Density Spectra of Periodic Gate and Impulse train.

**Linear Time Invariant (LTI) Systems** Casual and Non Causal System, Distortion less System, Impulse Response of Distortion less System, Ideal Filter and Practical Filter.

**Unit-II**

**Modulation Techniques:** Need and types of modulation techniques, Amplitude Modulation, Frequency Spectrum, Power Distribution, Modulation by Complex Signal, Low Level and High Level AM Modulators, Linear Integrated Circuit AM Modulators, Suppressed Carrier Generation (Balance/Chopper and Square Law Modulation), SSB Generator (Phase and Frequency Discrimination Method), VSB Transmission and Application. Detection of AM signals: Envelope Detector Circuit, RC Time Constant, Synchronous Detection Technique, Error in Synchronous Detection, SSB signal detection, PLL and its use in demodulation.

**Unit-III**

**Angle Modulation:** Frequency and Phase Modulation Frequency spectrum, bandwidth requirement, Frequency and Phase Deviation, Modulation Index, NBFM and WBFM, Multiple frequencies FM. FM Modulators: Direct (Parameter Variation Method) and Indirect (Armstrong) Method of frequency modulation. FM Detector: Slope Detector, Foster Seely Discriminator, Ratio Detector and PLL detectors.

**Unit-IV**

**Radio Transmitters:** AM transmitter, block diagram and working of Low Level and High Level Transmitters, Trapezoidal Pattern and Carrier Shift, SSB Transmitters, FM transmitters - Frequency Multiplication Applied to FM Signals, FM transmitters.

**Radio Receivers:** Block Diagram of Radio Receiver, Receiver Characteristics (Selectivity, Fidelity and Sensitivity), AM Receiver, RF Receiver, Super-heterodyne Receiver, RF Amplifier, Frequency Mixer, AVC and AFC, Image Signal, Intermediate Frequency Selection, Diversity Reception, FM Receiver.

**Unit-V**

**Noise :** Sources and types of noise and their power density, White Noise, Noise from Single and Multiple noise source for Linear Systems, Super Position of Power Spectrum, Equivalent Noise Bandwidth, Noise Figure, and Equivalent Noise Temperature, their Relationship, Calculation of Noise Figure and Noise Temperature for Cascade Systems,

**References:**

1. B.P. Lathi : Communication Systems, BS Publication
2. Taub and Schilling : Principles of communication Systems, TMH
3. Singh and Sapre : Communication Systems, TMH
4. S Haykin : Communication Systems, John Wiley and Sons Inc
5. B.P. Lathi : Signal, Systems and Communication Systems, BS Publication

**List of Experiments (Expandable):**

All experiments (wherever applicable) should be performed through the following steps.

**Step 1:** Circuit should be designed/drafted on paper.

**Step 2:** The designed/drafted circuit should be tested on the bread board.

**Step 4:** The bread board circuit should be fabricated on PCB by one batch using PCB machine.

1. Analysis of AM Modulation and Demodulation Techniques (Transmitter and Receiver), Calculation of Parameters
2. Analysis of FM Modulation and Demodulation (Transmitter and Receiver) and Calculation of Parameters
3. To Construct and Verify Pre-emphasis and De-emphasis and Plot the Waveforms.
4. Study of Super-heterodyne Receiver and Characteristics of Radio Receiver.
5. To Construct Frequency Multiplier Circuit and to Observe the Waveform
6. Study of AVC and AFC.
7. Study of PLL chip (566) and its use in various systems

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL  
PROGRAMME: Electronics and Communication Engineering  
COURSE: EC-406 Software Lab-II**

**Course Contents**

**ADVANCED SIMULATION/ VERIFICATION SOFTWARE**

**Study of simulation/ verification software (any one- LAB-VIEW/KTECHLAB/ GNU CIRCUIT ANALYSIS PACKAGE/ LOGISIM/ MULTISIM/ SCILAB etc).**

Overview and Study of the key features and applications of the software.

Application of the software in the field of Electronic Circuits, Digital Electronics and Analog Communication.

Design, Optimization, simulation and verification of

1. Electronic circuits (example amplifiers, oscillators etc).
2. Realization and verification of various digital electronic circuits (example logic gates, adders, subtractors etc)
3. Realization of various signals and communication link etc.

Students should simulate and verify atleast six circuits they are learning in the current semester.