# BE 401 Engineering Mathematics – II

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

**Unit II : 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 III : Introduction of Fourier series:**
Fourier series for Discontinuous functions, Fourier series for even and odd function, Half range series Fourier Transform: Definition and properties of Fourier. Fourier transform, Sine and Cosine transform.

**Unit IV: Laplace Transform:**
Introduction of Laplace Transform, Laplace Transform of elementary functions, properties of Laplace Transform, Change of scale property, second shifting property, Laplace transform of the derivative, Inverse Laplace transform & its properties, Convolution theorem, Applications of L.T. to solve the ordinary differential equations.

**Unit V : Vector Calculus:**
Differentiation of vectors, scalar and vector point function, geometrical meaning of Gradient, unit normal vector and directional derivative, physical interpretation of divergence and Curl. Line integral, surface integral and volume integral, Green's, Stoke's and Gauss divergence theorem.

**References:-**

1)Higher Engineering Mathematics by B.S. Grewal, Khanna Publication.

2)Engineering mathematics volume II & III by D.K. Jain

3)Engineering mathematics volume II by D.C. Agrawal

# EI 402 Electromagnetic Theory

**Unit I : Co-ordinate systems**

Cartesian, cylindrical and spherical Co-ordinate systems, vector&scaler fields, gradient, divergence & curl of a vector field, Divergence theorem &Stokes's theorem, Electrostatic Fields – Coulomb's law, electric field intensity due to different charge distribution viz. line charge, sheet charge, volume charge, equipotential surfaces, line of force, Gauss law, applications of Gauss law, Gauss law in point form, method of images.

**Unit II : Laplace's & Poisson's equations**

Laplace's & Poisson's equations, Electric dipole, dipole moment, potential & electric field intensity due to dipole, Behavior of conductors in an electric field. Conductor & insulator, polarization, Boundary value conditions for electric Field, Capacitance & Capacitances of various types of capacitors, Energy stored and energy density in static electric field, Current density, conduction & convection current density ohms law in point form, equation of continuity.

**Unit III : Magnetic Fields**

Magnetic Fields, Biot-Savart's law, Magnetic Field intensity due to straight current carrying filament, circular, square and solenoid current carrying wire, Relationship between magnetic flux, flux density & magnetic Field intensity;Magnetic Boundary conditions.Ampere's circuital law and its applications, magnetic Field intensity due to infinite sheet, Magnetic force, moving charge in a magnetic field, Lorentz Force on straight and long current carrying conductors in magnetic field, force between two long & parallel current carrying conductors. Magnetic dipole & dipole moment, torque on a current carrying loop in magnetic field.

**Unit IV : Magnetic Potential**

Scalar magnetic potential and its limitations, Vector magnetic potential and its properties, vector magnetic potential due to different simple configurations; Self and Mutual inductances, self inductance of solenoid, toroid coils, mutual inductance between a straight long wire & a square loop. Energy stored in magnetic Field & energy density, Faraday's Law, Displacement current, Maxwell's equations for different types- free space, harmonically varying Field, static and steady fields, differential & integral form.

**Unit V : Electro Magnetic Waves :**

Electro Magnetic Waves : Uniform plane wave in time domain in free space, Sinusoidally time varying uniform plane wave in free space, Wave equation and solution for material medium, Uniform plane wave in dielectrics and conductors, Pointing Vector theorem, instantaneous, average and complex poynting vector, power loss in a plane conductor, , Polarization of waves, Reflection by conductors and dielectric – Normal & Oblique incidence, Reflection at surface of a conducting medium, transmission line analogy.

**References**:

1. P.V. Gupta; Electromagnetic Fields; DhanpatRai
2.Mathew N.O Sadiku; Elements of Electromagnetic; Oxford
3.S.P. Seth; Electromagnetic Field ;DhanpatRai& Sons
4.Sandeep wali ; Elements of Electromagnetic; Oxford
5. N.N. Rao; Element of Engineering Electromagnetic; PHI.
6. John D. Kraus; Electromagnetic; TMH.

# EI 403 Electronics Circuits

**Unit-I: Operational Amplifier and its Applications**
Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower/Buffer circuits. Application of Operational amplifiers: Adder, Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Antilog amplifier, Trans-conductance multiplier, Voltage to current & Current to voltage converter.

**Unit-II: Feedback Amplifier and Oscillator**
Feedback Amplifier: The general feedback structure, properties of negative feed back, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt- series feedback amplifier. Oscillators: Basic principles of sinusoidal oscillators, op-amp RC oscillator circuits, LC oscillator.

**Unit-III: Voltage & Power Amplifier**
Transistor amplifier: RC coupled amplifier, Function of all components, Equivalent circuit, derivation of voltage gain, Current gain, Input impedance & output impedance, Frequency response characteristics, Lower & upper half frequencies, Bandwidth, Concept of Wide band amplifier. Power amplifier: Class A, B, AB, C, Conversion efficiency, Tuned amplifier.

**Unit-IV: Active Filters and Wave Shaping Circuits:**
Introduction to active filters, their Characteristics, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, notch filter, All pass filters, self-tuned filters, Band reject filters. Zero Crossing Detector, Monostable and Astable Multivibrator ,Schmitt Trigger, Voltage limiters, Clipper and clampers, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision rectifiers.

**Unit-V:FET Amplifier:**
FET Parameters, JFET As An Amplifier, FET Small Signal Mode Common Source A.C. Amplifier, The Common Drain Or Source Follower, Common Gate Amplifier, General Treatment Of Low Frequency Common Source And Common Drain Amplifier, Common Source Amplifier at High Frequencies.

**References** :
1. Microelectronic Circuits, Sedra & Smith, Oxford University Press.
2. Integrated Electronics, Milman & Halkias, Mc Graw Hill Company.
3. Electronic devices & Circuits, Balbir Kumar & Shail B. Jain, PHI.
4. Op-amps and Linear IC's, R.A. Gayakwad, PHI.
5.Ramakant A. Gayakwad, "op-amps & liner ICS" PHI ,4th edition,1987
6.R.F Coughlin & Fredric DRISCOLL,"Operational Amplifiers & Linear Integrated Circits"6thedition,PHP
7.DavidA.Bell."operational Amplifiers & Analog Intrgrated Circuits: Megraw HILL.
8 Sergio Franco."Design with operational Amplifiers & Analog Integrated circuits"Megraw Hill.
9 C.G Clayton "operationals".Butterworth &Compny Publ. Lit./Elsevier.1971

**List of Experiments:** Practicals may be performed on kit or on Simulation Software

1) Measurement of Op-amp Parameters. (Gain, Input offset Voltage, CMRR, Slew rate)
2) Design and Study of Op-Amp as Inverting and Non-Inverting Amplifier
3) Design and Study of Op-Amp as Difference & summing amplifier
4) Design and Study of Op-Amp as differentiator& Integrator
5) Design and Study of power amplifiers.
6) Design and Study of Oscillators.
7) Design and Study of Active Filters.
8) Design and Study of RC coupled amplifier
9) Design and Study of Multi vibrators
10) Design and Study of a function generator.
11) Design and Study of a Voltage Controlled Oscillator.
12) Design and Study of Phase Locked Loop.

# EI 404 Digital Circuits and System Design

**Unit I State Machines & sequential systems**

The Need for State Machines, The State Machine, Basic Concepts in State Machine Analysis. Characterizing equation & definition of synchronous sequential machines. Realization of state diagram and state table from verbal description, Mealy and Moore model machines state table and transition diagram. Minimization of the state table of completely and incompletely specified sequential machines.

**Unit II Asynchronous Sequential Machine**

The Fundamental-Mode Model, Problems of Asynchronous Circuits Basic Design Principles, Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards. An Asynchronous Design Example.

**Unit III Synchronous State Machine Design:**

Sequential Counters, State Changes Referenced to Clock, Number of State Flip-Flops, Input Forming Logic, Output Forming Logic, Generation of a State Diagram from a Timing Chart, Redundant States, General State Machine Architecture, A synchronous Design Example.

**Unit IV Fault Detection in combinational circuit**

Introduction of fault, reason of fault, Types of faults, Fault detection using Boolean Difference and path sensitization method.

**Unit V Designing with Verilog HDL**

Basic Concepts, Design Modeling, Modeling Style, Data Types, Tasks And Functions, Timing And Delays, User-Defined Primitives, PLI, Simulation And Synthesis Tools.

**References**

1. Kohavi: Switching & Finite Automata Theory, TMH.
3. Lee: Digital Circuits and Logic Design, PHI Learning..
4. Roth Jr.: Fundamentals of Logic Design, Jaico Publishing House.
5. Parag K. Lala: Fault Tolerant and Fault Testable Hardware Design, BS Publication.
6. Verilog HDL A Guide To Digital Design And Synthesis, Edition: 2 by Samir Palnitkar.
7. A Verilog HDL Primer, Third Edition, by J. Bhasker

**List of Experiments:**

i. Designing and Simulation of Logic Gates with Verilog HDL
ii. Designing and Simulation of Adders with Verilog HDL
iii. Designing and Simulation of Subtractors with Verilog HDL
iv. Designing and Simulation of Multiplexers with Verilog HDL
v. Designing and Simulation of Demultiplexers with Verilog HDL
vi. Designing and Simulation of Decoders with Verilog HDL
vii. Designing and Simulation of encoders & Priority encoder with Verilog HDL
viii. Designing and Simulation of Comparators with Verilog HDL

ix. Designing and Simulation of Flip-flops with Verilog HDL
x. Designing and Simulation of counters with Verilog HDL

# EI 405 Electronic Instrumentation

**Unit-I : Introduction:**
Introduction to Measurement and electronic measurement tecniques, Elements of generalized measurement **Course** system. Static and Dynamic characteristichs, Types of error in measurement, combination of component errors in overall system accuracy calculations, calculate errors in measurement. Calibration of instruments, standards of calibration, least square calibration curve method.
**Measurement and Error:** Accuracy and Precision, Sensitivity, Linearity, Resolution, Hysterisis, Loading Effect. Measurements of Current, Voltage, Power and Impedance: DC and AC Ammeter, DC Voltmeter- Chopper type and solid-state, AC voltmeter using Rectifier, Average, RMS, Peak Responding voltmeters, Multi-meter, Power meter, Bolometer and Calorimeter.

**Unit-II : Measurement of Resistance, Inductance and Capacitance:**
DC bridges: Wheat Stone bridge,problems, Megger, Strain gauge measurement using Wheatstone bridge, Earth resistance measurements.
**AC Bridges**: Maxwell's bridge (Inductance and Inductance-Capacitance), Hay's bridge, Schering bridge (High voltage and Relative permittivity), Wein bridge, Wagner earth detector, Impedance measurement by Q-meter.
**Non-Electrical Quantities (Transducer):**
Classification of Transducers, Strain gauge, Displacement Transducer- Linear Variable Differential Transformer (LVDT) and Rotary Variable Differential Transformer (RVDT), Temperature Transducer- Resistance Temperature Detector (RTD), Thermistor, Thermocouple, Piezo-electric transducer, Optical Transducer- Photo emissive, Photo conductive, Photo voltaic, Photo-diode, Photo Transistor, Nuclear Radiation Detector.

**Unit-III : Signal generator & Display:**
Signal and Function Generators, Sweep Frequency Generator, Pulse andSquare Wave Generator, Beat Frequency Oscillator, Digital display system and indicators, Classificationof Displays, Display devices, Light Emitting diodes(LED), Liquid Crystal Display(LCD).

**Unit-IV : Digital Measurement and Instruments**, Function **Generator& Data converters:**
Function generator. Signal generator& its types. **ADCs**: Classification, specifications, Flash Type ADC, Dual slope type ADC, successive approximation ADC, General Applications of ADCs. **DACs**: Classification, specifications, binary weighted type DAC, R-2R type DAC, DAC 0800, General Applications of DACs., Binary ladder, Practical DAC. Analog-to-digital Conversion (ADC) -Ramp
Technique, Integrating Type (voltage to frequency), digital voltmeters and multi-meters, Resolution and sensitivity of digital meter, PLCstructure, principle of operation, response time and application.

**Unit-V : Data Sampling & Acquisition Systems**
**Data** Sampling fundamentals, Samples and hold circuits, specifications and accuracy **Acquisition Systems**: Introducing concepts, Block diagram, Analog Switches and Multiplexers, considerations. Example of typical data acquisition systems, data loggers.

**References:**

1. H. S. Kalsi: Electronics Instrumentation, TMH.
2. K. Sawhney: Instrumentation and Measurements, Dhanpat Rai and Co.
3. Helfric and Cooper: Modern Electronic Instrumentation and Measurement Techniques; Pearson.

**List of Experiments:**

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 simulated using Simulation Software

**Step 3:** The designed/drafted circuit should be tested on the bread board and compare the results with the simulated results.

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

1. Study of CRO and Function Generator.
2. Displacement measurement by LVDT.
3. Force measurement by strain gauge.
4. Measurement of Capacitor, Self-induction using Q-meter.
5. Temperature measurement by thermistor, RTD and thermocouple.
6. Optical Transducer- Photo conductive, Photo voltaic, Photo-diode, Photo-Transistor
7. Design of digital to analog converter.
8. PLC operation and applications (for example: relay, timer, level, traffic light etc.)

# EI 406 Software Lab –II (MATLAB)

**List of Experiments**

1. Study of MATLAB with tools
2. Arithmetic Operation on Matrices and Numbers
3. Equation Writing and determining values
4. Generating Signal and Sequences
5. Arithmetic operations on Signal and Sequences
6. Generating M-files and simulation for small examples
7. Designing and modeling with Simulink model for simple example