# 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

# EE 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; Dhanpat Rai
2.Mathew N.O Sadiku; Elements of Electromagnetic; Oxford
3.S.P. Seth; Electromagnetic Field ;Dhanpa Rai & Sons
4.Sandeep wali ; Elements of Electromagnetic; Oxford
5. N.N. Rao; Element of Engineering Electromagnetic; PHI.
6. John D. Kraus; Electromagnetic; TMH.

# EE 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.

# EE 404 Power System - I

**Unit I : Introduction**: Typical Layout of an Electrical Power System–Present Power Scenario in India.
Generation of Electric Power: Conventional Sources (Qualitative):Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant.
Non Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

**Unit II : Economics of Generation:**
Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

**Unit III : Transmission Systems:**
Various system of transmission & their comparison, HVDC transmission Converter, inverter, filters & substation layout. Voltage and Reactive Power control.

**Unit IV : Distribution Systems:**
Primary and secondary distribution systems, concentrated & uniformly distributed loads on distributors fed at one and both ends, ring distribution, sub mains and tapered mains, voltage drop and power loss calculations, voltage regulators, Feeders Kelvin's law and modified Kelvin's law for feeder conductor size and its limitations.

**Unit V : Overhead Transmission Lines:** Types of Conductors, Line Parameters: calculation of inductance and capacitance of single and double circuit transmission lines, three phase lines withstranded and bundle conductors, Generalized ABCD constants and equivalent circuits of short ,medium & long lines. Line Performance: circle diagram, regulation and efficiency of short, medium and long lines.

**References:-**
1. Ashfaque hussain , CBS Publication
2. C.L. Wadhwa –Generation, Distribution and Utilization of Electrical Energy, Second Edition, New Age International, 2009
3. C.L. Wadhwa –Electrical Power Systems, Fifth Edition, New Age International, 2009
4. M.V. Deshpande –Elements of Electrical Power Station Design, Third Edition, WheelerPub. 1998
5. V.K. Mehta principal of electrical power system, S Chand Publication
6. J.B. Gupta electrical power system,kataria and sons publication

**List of Experiments:**
1. To study of Typical Layout of an Electrical Power System
2. Simulation of three phase bridge rectifier using Pspice
3. To study of AC distribution, Single phase, 3-phase, 3 phase 4 wire system
4. To study of different type of electrical cable
5. To study of different type of insulator
6. To study of lay out of substation
7. To study of different types of towers

# EE 405 Electrical Machines-I

**Unit I : Transformer:**
3-ϕ transformer construction, working principal, connections & applications, Scott connection, polarity test, parallel operation of 1-ϕ & 3-ϕ transformer, condition for maximum efficiency & regulation, cooling methods, harmonics in 3-ϕ transformers, dry type transformer, Auto-transformers.

**Unit II : DC Machines:**
Construction & working principle of dc machine, classification of dc machine, characteristics of dc machines, emf eq. of dc machine, lap & wave windings, torque eq. of dc motor, starting of dc motor, speed control of dc motor, losses & efficiency of dc machines, applications.

**Unit III : Induction motor-I:**
Construction, working principle & classification of 3-ϕ induction motor, phasor diagram ,equivalent circuit, developed torque, power flow diagram, speed /torque & torque/slip characteristics, rotational losses & applications.

**Unit IV : Induction motor-II:**
Starting of 3-ϕ induction motor, no load and blocked rotor test, cogging & crawling, circle diagram, speed control of induction motor, power factor control, Induction generator.

**Unit V : Single phase motors:**
1-ϕ induction motor, double revolving field theory, equivalent circuit & determination, performance calculation, starting methods & types of 1-ϕ induction motor, their construction, working principle & applications, 1-ϕ series motor, servomotors.

**References:**
1. M. G. Say, Alternating Current Machines', (5th Ed.) ELBS, 1986.
2. V.Del Toro, "Electrical Machines & Power Systems", 1985, Prentice-Hall, Inc., Englewood Cliffs.
3. V.Del Toro,"Electromechanical Devices for Energy Conversion & Control Systems", PHI Pvt. Ltd.,1975.
4. Electrical Machines by Nagrath and Kothari (TMH).
5. A.C. Machines by Langs dorf (mcgraw-Hill).
6. Electrical Machines by Dr.P.S.Bimbhra (Khanna).
7. Electrical Machines by Ashfaq Hussain (Dhanpat Rai ).

**List of Experiments:** Experiments can cover any of the above topics, following is a suggestive list:
1. Perform turn ratio and polarity test on 1-phase transformer
2. Perform load test on a 1-phase transformer and plot its load characteristic
3. Perform OC and SC tests on a 1-phase transformer and determine its equivalent circuit. Also find its efficiency and regulation at different load and power factor.
4. Perform OC and SC tests on a 3-phase transformer and determine its equivalent circuit. Also find its efficiency and regulation at different load and power factor.
5. Perform Sumpner's test on two 1-phase transformer and determine its efficiency at various load.
6. Perform No-load and block rotor test on a 3- phase IM and determine its equivalent circuit.

7. Perform load test on a 3- phase IM and plot its performance characteristics.
8. Study various types of starters used for 3- IMs.
9. Perform No-load and block rotor test on a 1- phase IM and determine its equivalent circuit.

# EX 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