## 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

# EI- 402 Signals and Systems

**UNIT I**

Representation of signals and systems : Signals and classification of signals, basic continuous-time signals, basic discrete time signals, sampling theorem, systems and classification of systems, response of a continuous-time LTI system and the convolution integral, properties of continuous-time LTI systems, Eigen functions of continuous-time LTI systems, systems described by differential equations, response of a discrete-time LTI system and convolution sum, properties of discrete-time LTI systems, Eigen functions of discrete-time LTI systems, Transmission of signals through a LTI system.

**UNIT II**

Fourier Analysis of continuous-time signals and systems :Introduction, Fourier series representation of periodic signals, the Fourier Transform, properties of the continuous-time Fourier Transform, the frequency response of continuous-time LTI systems, filtering, bandwidth.

**UNIT III**

Fourier analysis of discrete-time signals and systems :Introduction, Discrete Fourier Series, the Fourier Transform, properties of the Fourier Transform, the frequency response of discrete-time LTI systems, system response to Sampled continuous-time sinusoids, the Discrete Fourier Transform.

**UNIT IV**

The Z-Transform :Introduction, the Z-Transform, Relation between Z-Transform and Fourier Transform-Transforms of some common sequences, properties of the Z-Transform, the inverse Z-Transform, the system function of discrete-time LTI systems, the unilateral Z-Transform .

**UNIT V**

Discrete Time Random Processes: Random variables –Definitions, ensemble averages, jointly distributed random variables, joint moments, independent, uncorrelated and orthogonal random variables, Gaussian random variables. Random Processes – Ensemble averages, stationary processes, the auto covariance and autocorrelation matrices, ergodicity, white noise, frequency domain description of random processes, transmission of random signals through a LTI system.

**References:**

1. Oppenheim AV, Willisky AS and Nawab SH; Signals and systems; Pearson.
2. Proakis JP,.Manolakis; Digital Signal Processing principles…; Pearson.
3. Hwei.P .Hsu; Signals and systems, Schaum`s outlines; TMH.

# EI – 403-New (Electronic Devices )

**Unit-I**

**Semiconductor** intrinsic and extrinsic, p-type and n-type, energy band diagrams, majority and minority carrier, charge density in semiconductor, generation and recombination of charges, process of diffusion, diffusion and drift currents, Hall effects and its applications. p-n junction, depletion layer, potential barrier, electric field, forward and reverse biased junction, current components in p-n diode, current equation, V-I characteristics, cut in voltages of Si and Ge diode, transition and diffusion capacitance, power dissipation.

**Unit-II**

**Diode Family and Applications: Diodes Family**: Characteristics and application of p-n junction diode, Zener diode, avalanche diode, Varactor diode, Schottky diode, Tunnel Diode, PIN diode, LED, photodiodes, phototransistors, p-n junction. **Applications:** diode as rectifier, clipper and clamper, The diode as a circuit element, The Load line concept, The Pieceswise linear diode modal, Clipping circuits, Clipping at two independent levels, Comparators, Sampling Gate, Rectifiers, Other full wave circuits, Capacitor filter additional diodes circuits.

**Unit-III**

**Bipolar junction transistor** - Construction, basic operation, current components and equations,. CB, CE and CC-configuration, input and output characteristics, Early effect, region of operation, active, cutoff and saturation region Ebers-Moll model, , power dissipation in transistor (Pdmax rating), Photo transistor, Uni-junction Transistor (UJT) : Principle of operation, characteristics.

**Unit-IV**

**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-π), Parameters and their definition, Miller capacitance and its effect on voltage gain.

**Unit-V**

**FET construction**- Construction, n channel and p channel, characteristics, parameters, Equivalent model and voltage gain, Enhancement and depletion MOSFET and its Characteristics, analysis of FET in various configuration.

**References**:

1. Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education

2. Millman and Halkias: Integrated electronics, TMH

3. Graham Bell: Electronic Devices and Circuits, PHI

4. Sendra and Smith: Microelectronics, Oxford Press.

5. 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 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. V-I characteristics of various Diodes (p-n, Zener, Varactor, Schottky, Tunnel, Photodiode etc)

2. Characteristics of Transistors (BJT and FET)

3. Study of Power electronic devices (Diac, Triac, SCR, Power MOSFET, IGBT etc).

# EI-404-New ( Linear Integrated Circuits and its Applications)

**UNIT-I: Introduction to Operational Amplifiers and Characteristics**
Introduction, Block diagram, characteristics and equivalent circuits of an ideal op-amp, various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, inverting and non-inverting amplifier configurations.

**UNIT-II: The Practical op-amp** Introduction, Input offset voltage, offset current, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and gain –bandwidth product, frequency limitations and compensations, transient response, interpretation of TL082 datasheet.

**UNIT-III: Amplifiers and Oscillators** Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, isolation amplifiers, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO.

**UNIT-IV: Active Filters**
Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, notch filter, All pass filters, self-tuned filters .

**UNIT-V: Comparators and Converters:**
Comparator, 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, Voltage-to-current converter, Current-to-voltage converter.

**UNIT-VI: Advanced applications**
Applications as Frequency Divider, PLL, AGC,AVC using op-AMP and analog multipliers, Amplitude modulation using analog multiplier, Frequency Shift Keying, simple OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs – TPS40200, TPS40210.

## List of Experiments

Tools Required –Function Generator, TL082, MPY634/ASLK Pro, Power Supply, Oscilloscopes, Connecting wires.

1. Study the characteristics of negative feedback amplifier
2. Design of an instrumentation amplifier.
3. Study the characteristics of regenerative feedback system with extension to design an astable multivibrator.
4. Study the characteristics of integrator circuit.
5. Design of Analog filters – I.
6. Design of Analog filters – II.
7. Design of a self-tuned Filter.

8. Design of a function generator.
9. Design of a Voltage Controlled Oscillator.
10. Design of a Phase Locked Loop (PLL).
11. Automatic Gain Control (AGC) Automatic Volume Control (AVC).
12. Design of a low drop out regulator.
13. DC-DC Converter.

TEXT Books:

1. D. Roy Chowdhury, " Linear Integrated Circuits", New Age International (P) Ltd, 2nd Edition, 2003.
2. K. Lal Kishore, " Operational Amplifiers and Linear Integrated Circuits", Pearson Education, 2007.
3. L. k. Maheshwari, M M S Anand , Analog Electronics, PHI

4. TL082:Data Sheet:http://www.ti.com/lit/ds/symlink/t1082.pdf
   Application Note:http://www.ti.com/lit/an/sloa020a/sloa020a.pdf
5. MYP634: Data Sheet:http://www.ti.com/lit/ds/symlink/mpy634.pdf
   Application Note:http://www.ticom/lit/an/sbfa006/sbfa006.pdf

REFERENCES :

1. Ramakanth A. Gayakwad, "Op-Amps & Linear ICS", PHI, 4th edition, 1987.
2. R.F. Coughlin & Fredrick Driscoll, "Operational Amplifiers & Linear Integrated Circuits" , 6th Edition, PHI
3. David A. Bell, "Operational Amplifiers & Linear ICs", Oxford University Press, 2nd edition, 2010.
4. Sergio Franco, "Design with Operational Amplifiers & Analog Integrated Circuits" Mcgraw Hill, 1988.
5. C.G. Clayton , "Operational Amplifiers " , Butterworth & Company Publ. Ltd./Elsevier, 1971.

# EI - 405 Mechanical Measurement

**Unit I**
Motion and Vibration Measurement: Translational and rotational displacement using potentiometers, Strain Gauges, Differential transformer, Synchros and induction potentiometer, Capacitance, Digital displacement transducers, Photo elastic, Moire fringe, Holographic technique, Different types of tachometers, Accelerometer, Gyroscope.

**Unit II**
Force, Torque and Shaft Power Measurement: Elastic, Vibrating wire, Gyroscopic force transducers, Torque measurement in rotating shafts, gyroscopic torque measurement, Shaft power measurement (Dynamometers)

**Unit III**
Pressure and sound measurement: Moderate pressure-Bourdon tube, Bellows & diaphragms, High pressure measurement-Piezo electric, Electric resistance, Low pressure measurement-Mcleod gauge, Knudsen gauge, Viscosity gauge, Thermal conductivity, Ionization gauge, Dead weight gauge, sound level measurement using different types of microphones.

**Unit IV**
Flow measurement: Obstruction meter: Orifice, Nozzle, venturi, Pitot tube, Annubar tubes, Target, rotameter, Turbine, Electromagnetic, Vortex, Positive displacement, Anemometers, Weirs & flumes, Laser Doppler, Anemometer, Ultrasonic flow meter, fluidic oscillator, Mass flow meter, Flow visualization, Level measurement: Visual level indicators, Ordinary float type, Purge method, Buoyancy method, resistance, Capacitance and inductive Probes, Ultrasonic, Laser, Optical fiber.Thermal, Radar radiation.

**Unit V**
Temperature measurement: Bimetallic thermometers, Liquid in glass, Pressure thermometer, thermocouples, RTD, Thermistors, Semiconductor sensors, Digital thermometers, Pyrometers, Miscellaneous Measurement: Humidity, Dew point, Viscosity, Thermal and nuclear radiation measurements.

**References:**
1. H.N. Norton “Handbook of transducers”
2. E.O. Doebelin “Measurement systems applications and design”
3. DVS Murthy “Transducers and instrumentation”
4. Nakra and Chaudhry “Instrumentation measurement and analysis

**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 simulated using Simulation S/W (TINA-V7/ PSPICE/ Labview/ CIRCUIT MAKER). **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 prepared on PCB machine.
1. Calibration of strain gauges
2. Calibration of LVDT
3. Pressure measurement Instruments
4. Flow measurement instruments

5. Temperature measurement instruments.

## EI - 406 Software Lab-I

**SECTION-A MATLAB**

Introduction to MATLAB, Study of MATLAB programming environment, Modeling, Design and development of Programs.
Programs Related to Analog Electronics, Electronic circuits and other topics covered in the syllabus.

**SECTION-B CIRCUIT SIMULATION/ PCB DESIGNING SOFTWARES**

Study of Circuit Simulation Software (any one - TINA-V7/ PSPICE/ Labview/ CIRCUIT MAKER).
PCB Layout Software (any one - PROTEL/ ORCADE/ ALTERA).
Design and Simulation of basic Electronic Circuits (Example Rectifiers, Amplifiers, Oscillators, Digital Circuits, Transient and steady state analysis of RC/RL/RLC circuits etc). Design and fabrication of PCB pertaining to various circuits studied on PCB machine.

**References:**

1. Chapman Stephen J.: MATLAB Programming for Engineers, 3rd Edition, Thomson /Cengage.
2. Rudra Pratap: Getting Started with MATLAB 7, Oxford University Press (Indian Edition).
3. Palm; Matlab 7.4; TMH.
4. Simulation/Designing Software Manuals.

**List of Experiments/ Programs:**

Programs to be performed based on the topics contained in the syllabus.