Other university B.E./B.Tech - G
EEE Level 2 syllabus

Engineering Mathematics - III

207005: Engineering Mathematics - III

Credit 04 + 01 = 05

Unit I Linear Differential Equations (LDE) and Applications
LDE of nth order with constant coefficients, Complementary Function, Particular Integral, General method,
Short methods, Method of variation of parameters, Cauchy‟s and Legendre‟s DE, Simultaneous and
Symmetric simultaneous DE. Modeling of Electrical circuits.

Mapping of Course Outcomes for Unit I CO1: Solve higher order linear differential equation using appropriate techniques for modelling, analyzing of electrical circuits and control systems.

Unit II Transforms
Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier
Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses.
Z - Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their
inverses. Solution of difference equations.
Mapping of Course Outcomes for Unit II CO2: Apply concept of Fourier transform & Z-transform and its applications to continuous & discrete systems, signal & image processing and communication systems.

Unit III Numerical Methods
Interpolation: Finite Differences, Newton‟s and Lagrange‟s Interpolation formulae, Numerical
Differentiation.
Numerical Integration: Trapezoidal and Simpson‟s rules, Bound of

truncation error,
Solution of Ordinary differential equations: Euler‟s, Modified Euler‟s, Runge-Kutta 4th order methods and Predictor-Corrector methods.
Mapping of Course
Outcomes for Unit III CO3: Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.

Unit IV Vector Differential Calculus
Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and
Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector
identities.
Mapping of Course Outcomes for Unit IV CO4: Perform vector differentiation & integration, analyze the vector fields and apply to electro- magnetic fields & wave theory.

Unit V Vector Integral Calculus & Applications
Line, Surface and Volume integrals, Work-done, Green‟s Lemma, Gauss‟s Divergence theorem, Stoke‟s
theorem. Applications to problems in Electro-magnetic fields.
Mapping of Course Outcomes for Unit V CO4: Perform vector differentiation & integration, analyze the vector fields and apply to electro- magnetic fields & wave theory.

Unit VI Complex Variables
Functions of a Complex variable, Analytic functions, Cauchy-Riemann equations, Conformal mapping,
Bilinear transformation, Cauchy‟s integral theorem, Cauchy‟s integral formula and Residue theorem.

Mapping of Course Outcomes for Unit VI CO5: Analyze Complex functions, Conformal mappings, Contour
integration applicable to electrostatics, digital filters, signal and image processing.

Learning Resources

Text Books:
1. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill.

2. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publication, New Delhi.

Reference Books:

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India,10th Edition.
2. M.D. Greenberg, “Advanced Engineering Mathematics”, Pearson Education, 2nd Edition.
3. Peter. V and O‟Neil, “Advanced Engineering Mathematics”, Cengage Learning,7th Edition.

4. S.L. Ross, “Differential Equations”, Wiley India, 3rd Edition.

5. S. C. Chapra and R. P. Canale, “Numerical Methods for Engineers”, McGraw-Hill, 7th Edition.
6. J. W. Brown and R. V. Churchill, “Complex Variables and Applications”, McGraw-Hill Inc, 8thEdition.

Mathematics-IV

Subject Code KAS302/KAS402

Mathematics-IV

(PDE, Probability and Statistics)

Module I: Partial Differential Equations

Origin of Partial Differential Equations, Linear and Non Linear Partial Equations of first order,
Lagrange’s Equations, Charpit’s method, Cauchy’s method of Characteristics, Solution of Linear
Partial Differential Equation of Higher order with constant coefficients, Equations reducible to
linear partial differential equations with constant coefficients.

Module II: Applications of Partial Differential Equations:

Classification of linear partial differential equation of second order, Method of separation of
variables, Solution of wave and heat conduction equation up to two dimension, Laplace equation
in two dimensions, Equations of Transmission lines.

Module III: Statistical Techniques I:

Introduction: Measures of central tendency, Moments, Moment generating function (MGF) ,

Skewness, Kurtosis, Curve Fitting , Method of least squares, Fitting of straight lines, Fitting of
second degree parabola, Exponential curves ,Correlation and Rank correlation, Regression
Analysis: Regression lines of y on x and x on y, regression coefficients, properties of regressions
coefficients and non linear regression.

Module IV: Statistical Techniques II:
Probability and Distribution: Introduction, Addition and multiplication law of probability,
Conditional probability, Baye's theorem, Random variables (Discrete and Continuous Random
variable) Probability mass function and Probability density function, Expectation and variance,
Discrete and Continuous Probability distribution: Binomial, Poission and Normal distributions.

Module V: Statistical Techniques III:
Sampling, Testing of Hypothesis and Statistical Quality Control: Introduction , Sampling
Theory (Small and Large) , Hypothesis, Null hypothesis, Alternative hypothesis, Testing a
Hypothesis, Level of significance, Confidence limits, Test of significance of difference of means,
T-test, F-test and Chi-square test, One way Analysis of Variance (ANOVA).Statistical Quality
Control (SQC) , Control Charts , Control Charts for variables (X and R Charts), Control Charts
for Variables (p, np and C charts).

Text Books
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley &
Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory,
Universal Book Stall, 2003(Reprint).
3. S. Ross: A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd
Ed., Wiley, 1968.

Reference Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
2.T.Veerarajan : Engineering Mathematics (for semester III), Tata McGraw-Hill, New
Delhi.
3. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics; Narosa Publishing
House, New Delhi.
4. J.N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.
5. D.N.Elhance,V. Elhance & B.M. Aggarwal: Fundamentals of Statistics; Kitab Mahal
Distributers, New Delhi

Sensor and Instrumentation

Unit- I:

Sensors & Transducer: Definition, Classification & selection of sensors, Measurement of displacement
using Potentiometer, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement
of pressure using LVDT based diaphragm & piezoelectric sensor.

Unit-II:

Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging,
Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of
proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level
Sensors: Ultrasonic & Capacitive.

Unit -III:

Virtual Instrumentation: Graphical programming techniques, Data types, Advantage of Virtual
Instrumentation techniques, Concept of WHILE & FOR loops, Arrays, Clusters & graphs,
Structures: Case, Sequence & Formula nodes, Need of software based instruments for industrial
automation.

Unit-IV:

Data Acquisition Methods: Basic block diagram, Analog and Digital IO, Counters, Timers, Types of
ADC: successive approximation and sigma-delta, Types of DAC:

Weighted Resistor and R-2R
Ladder type, Use of Data Sockets for Networked Communication.

Unit V:

Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors:
Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot
control & automobile engine control.

Digital Circuits

EC104 Digital Circuits

1 Digital Principle : Analog vs Digital, Number system, Computer Codes, Digital Signals, Waveforms Positive and Negative logic, Logic Gate : basic, universal and others, Truth Table, Logic functions, IC Chips, Timing Diagram, Electrical analogy.

2 Boolean laws and theorems : Logic functions, Conversion of logic functions into truth table and vice versa. SOP and POS forms of representation, Canonical form, minterms and maxterms, Simplification of logic functions bytheorems and Karnaugh's map, don't care conditions.

3 Analysis and synthesis of Combinational logic circuits: Comparators, Multiplexers, Encoder, Decoder, 7 Segment Display, Half Adder and Full Adder, Subtractors, Serial and Parallel Adders, BCD Adder

4 Sequential circuit blocks and latches : Flip-Flops-Race around condition, Master-Slave and Edge triggered SR, JK, D and T Flip Flop, Shift registers, Counters-Synchronous and Asynchronous: Design of ripple counter

5 Timing circuit : Multivibrators, Monostable and Astable timer: LM555

6 Integrated circuit logic families : RTL, DTL, TTL, CMOS, IIL/I2L (In-tegrated Injection logic and Emitter Coupled logic).

7 Use of building blocks : Designing larger systems such as Digital-to-Analog Converters (DAC) : Weighted resistors and R-2R, Analog-to-Digital(ADC)- converter, counter and succession.

Name of Authors / Books /Publishers

1 “Digital Fundamentals”, Floyd and Jain., Pearson
2 “Digital Logic and Computer Design”, M.Morris Mano, Pearson
3 “Fundamentals of Digital Circuits”, A.Anand Kumar, PHI
4 “Digital Systems”, Ronald J.Tocci, Neal S.Widmer, Pearson

Analog Communication

EC107 Analog Communication

1. Introduction to the communication system : Block diagram of communication system and comparative study of analog and digital communication.

2 Modulation(upward frequency translation) and demodulation (downward frequency translation) and the need for modulation: broad classification of modulation [linear (amplitude-AM) and exponential (frequency-FM and phase-PM)]

3 Generation of double side band (DSB) with carrier, double side band with suppressed carrier (DSB-SC) and single side band with suppressed carrier: De-modulation of double side band with carrier –incoherent detector or envelope detector, peak diode detector, coherent or synchronous detection of DSBSC and single side band with suppressed carrier.

4 Superhetrodyne Receivers : Characteristics , Intermediate Frequency and its advantages, image rejection of the Receiver.

5 Generation of FM signals(direct and indirect methods) and Demodulation.

6 Noise: Different types of Noise, SNR in AM, FM and PM System and use of emphasis Circuit in FM for SNR optimization.

7 Analog pulse modulation : PAM, PWM, PPM and demodulation; comparative study of various analog pulse modulation

Analog Circuits

EC105 Analog Circuits

UNIT-1

Small signal amplifiers: CB, CE, CC configurations, hybrid model for

transistor at low frequencies, RC coupled amplifiers, mid-band model, gain
and impedance, comparisons of different configurations, Emitter follower, Dar- lington pair (derive voltage gain, current gain, input, and output impedance). Hybrid-model at high frequencies (pi - model).

UNIT- 2
Multistage Amplifiers: Cascade and Cascode amplifiers, Calculations of
gain, impedance, and bandwidth. Design of multistage amplifiers. Feedback Amplifiers: Feedback concept, Classification of Feedback amplifiers, Properties of negative Feedback amplifiers, Impedance considerations in different configurations. Analysis of feedback Amplifiers.

UNIT-3
Field Effect Transistor: Introduction, Classification, FET characteristics,
The operating point, Biasing, FET small-signal Model, Enhancement and Depletion type MOSFETs, FET Amplifier configurations (CD, CG, and CS).

UNIT 4
Oscillators: Barkhausen criterion, Sinusoidal Oscillators, the RC phaseshift oscillator, resonant circuit Oscillators, a general form of the oscillator circuit, the Wien -bridge oscillator, Crystal oscillators, Hartley, Colpitt's and Clapp's Oscillator.

UNIT 5
Power Amplifiers: Power dissipations in transistors, Amplifiers Classification, (Class-A, Class-B, Class-C, Class-AB) Efficiency analysis, Push-Pull and Complementary Push-pull amplifiers Cross over distortion and Harmonic dis-portion in Push-Pull amplifier. Tuned amplifiers (single, double, and stagger tuned amplifier).

Semiconductor Physics and Devices

EC106 Semiconductor Physics and Devices

1 Basics of Semiconductor Physics : Semiconductor carrier modelling- Bonding model, Energy band model, Carriers, Band gap, Carrier properties (Effective mass, Intrinsic carrier concentration,

Doping), Density of states, Fermi function, Equilibrium carrier concentration (formula for n and p and np product), Charge neutrality relationship, Determination of Fermi level, Carrier concentration, Temperature dependence.
Carrier Action - Drift, Mobility, Drift Current, Resistivity, Diffusion Current, Total current, Relation between the diffusion constants and mobility (Einstein's relationship), Recombination-Generation (Band-to-Band, R-G Centres, Auger, Impact Ionization). Equation of state, Continuity equation, Minority Carrier Diffusion Equation.

2 PN Junction Diode : Step junction, Built-in potential, Depletion width, Depletion Approximation, Electrostatic relationship (Charge density, Depletion width, Potential, Electric field) for Va = 0, Va ¡ 0 and Va ¿ 0, Ideal Diode Equation (Qualitative and Quantitative derivation : Band Model, Assumptions, Approximation, Boundary condition), Deviation from Ideal (R-G Current, Series resistance, High Level Injection), Junction Breakdown (Avalanche and Zener), Reverse Bias Junction Capacitance, forward Bias Diffusion Capacitance, Qualitative understanding of Turn on and Turn-off transients. Zener Diode, Tunnel diode, Varactor diode, Schottky diode.

3 Physics and technologies of BJT : Operational considerations, Modes and Configurations, Performance Parameters (Emitter Efficiency, Base Transport Factor, Common Base Current Gain, Common Emitter Current Gain and their derivation for an ideal transistor, Deviation from ideal (Base Width Modulation Punch Through, Avalanche Breakdown, Geometrical effects, R-G current), Small signal modelling.

4 Physics and technologies of FET : JUNCTION FET (Theory of operation, I-V relationship), MOS CAPACITOR (Energy Band diagram, Gate-Voltage relationship, Capacitance-Voltage characteristics), MOSFET (Theory of operation, Threshold voltage, I-V characteristics), NON IDEAL MOS (M-S work function difference, oxide charges, threshold adjustment and considerations)

5 Introduction to UJT, SCR, Triac and Diac (Construction, Working, Characteristics and Application), UJT Relaxation oscillator.

Optoelectronic Devices : Photo diodes (PIN and Avalanche), Solar cell, LED, Solid State LASER diodes.