SPPU B.E./B.Tech ENTC Sem 3 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.

Electronic Circuits

204181: Electronic Circuits

Credit 03

Unit I MOSFET & its Analysis

Enhancement MOSFET: Construction, Characteristics, DC Load line, AC equivalent ckt, Parameters,
Parasitics.

Non ideal characteristics: Finite output resistance, Body effect, Sub-threshold conduction, breakdown
effects, temperature effect, effect of W/L ratio, Common source amplifier & analysis, Source follower:
circuit diagram, comparison with common source, Frequency response for amplifier

Mapping of Course Outcomes for Unit I CO1: Assimilate the physics, characteristics and parameters of MOSFET towards its application as amplifier.

Unit II MOSFET Circuits

MOSFET as switch, CMOS inverter, resistor & diode. Current sink & source, Current mirror. Four types of
feedback amplifiers, Effects of feedback, Voltage series & current series feedback amplifiers and analysis,
Barkhausen criterion, Wein bridge & phase shift oscillator.

Mapping of Course Outcomes for Unit II CO2: Design MOSFET

amplifiers, with and without feedback, & MOSFET oscillators, for given specifications.

Unit III Voltage Regulators

Three terminal voltage regulators (317 & 337): Block diagram of linear voltage regulator, IC 317 and
IC337, Features and specifications, typical circuits, current boosting, Low Dropout Regulator (LDO).

SMPS: Block diagram, Types, features and specifications, typical circuits buck and boost converter.

Mapping of Course Outcomes for Unit III CO3: Analyze and assess the performance of linear and switching regulators, with their variants, towards applications in regulated power supplies.

Unit IV Operational Amplifier

Block diagram, Differential amplifier analysis for Dual input Balanced output mode - AC analysis (using r
parameters) & DC analysis, Level shifter, Op amp parameters, Current mirror, Op-amp characteristics (AC
& DC). Voltage series & voltage shunt feedback amplifiers, Effect on Ri, Ro, gain & bandwidth.

Mapping of Course Outcomes for Unit IV CO4: Explain internal schematic of Op-Amp and define its performance parameters.

Unit V Op-Amp Applications

Inverting amplifier, non-inverting amplifier, Voltage follower, Summing amplifier, Differential amplifier,
Practical integrator, Practical differentiator, Instrumentation amplifier, Comparator, Schmitt trigger, Square & triangular wave generator.

Mapping of Course Outcomes for Unit V CO5: Design, Build and test Op-amp based analog signal processing and conditioning circuits towards various real time applications.

Unit VI Converters & PLL

Voltage to Current, Current to Voltage converters.

DAC & ADC: Resistor weighted and R-2R DAC, SAR, Flash and dual slope ADC Types / Techniques,
Characteristics, block diagrams, Circuits, Specifications, Merits, Demerits, Comparisons.

PLL: Block Diagram, Characteristics, phase detectors, Details of PLL IC 565 Applications, Typical
circuits.

Mapping of Course Outcomes for Unit VI CO6: Understand and compare the principles of various data conversion techniques and PLL with their applications.

Learning Resources

Text Books:
1. Donald Neaman, “Electronic Circuits - Analysis and Design”, Mc Graw Hill, 3rd Edition.
2. Ramakant Gaikwad, “Op Amps & Linear Integrated Circuits”, Pearson Education.

Reference Books:
1. Millman Halkias, “Integrated Electronics”.
2. Phillip E. Allen and Douglas R. Holberg, “CMOS Analog Circuit Design”, Oxford, 2nd Edition.
3. Salivahan and Kanchana Bhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill.

Digital Circuits

204182: Digital Circuits

Credit 03

Unit I Digital Logic Families
Classification and Characteristics of digital Logic Families: Speed, power dissipation, figure of merit,
fan in, fan out, current, voltage, noise immunity, operating temperatures and power supply requirements.
TTL logic. Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected
inputs. Tri-State logic. CMOS logic: CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic,
open drain output. Interfacing CMOS and TTL, Data sheet specifications.
Mapping of Course Outcomes for Unit I CO1: Identify and prevent various hazards and timing problems in a digital design.

Unit II Combinational Logic Design
Definition of combinational logic, canonical forms, Standard representations for logic functions, k-map
representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms
and max-terms (upto 4 variables), don‟t care conditions, Design

Examples: Arithmetic Circuits, BCD to
7 segment decoder, Code converters. Introduction to Quine-McCluskey method, Quine McCluskey
using don‟t care terms, Reduced prime implicants Tables.
Mapping of Course Outcomes for Unit II CO2: Use the basic logic gates and various reduction techniques of digital logic circuit.

Unit III Combinational Circuits
Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees, De- multiplexers and their use in combinational logic designs, Decoders, Demultiplexer trees.

Mapping of Course Outcomes for Unit III CO3: Analyze, design and implement combinational logic circuits.

Unit IV Sequential Logic Design

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear
terminals, hold and setup time and metastability.
Excitation Table for flip flop, Conversion of flip flops, Typical data sheet specifications of Flip flop
application of Flip flops.
Registers, Shift registers, Counters (ring counters, twisted ring counters), ripple counters, Mod-n counters,
up/down counters, synchronous counters, lock out, Clock Skew, Clock jitter. Effect on synchronous
designs, Sequence Generators.
Mapping of Course Outcomes for Unit IV CO4: Analyze, design and implement sequential circuits.

Unit V State Machines
Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore
machines representation, Implementation, finite state machine implementation, Sequence detector.
Introduction to Algorithmic state machines- construction of ASM chart and realization for sequential
circuits
Mapping of Course Outcomes for Unit V CO5: Differentiate between Mealy and Moore machines.

Unit VI Programmable Logic Devices
Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, General Architecture,
features and typical specifications of FPGA and CPLD. Semiconductor memories: memory
organization and operation, expanding memory size, Classification and characteristics of memories,
RAM ROM, EPROM, EEPROM, NVRAM, SRAM, and DRAM.
Designing combinational circuits
using PLDs.
Mapping of Course Outcomes for Unit VI CO6: Analyze digital system design using PLD.

Learning Resources

Text Books:
1. R.P. Jain, “Modern Digital Electronics”, Tata McGraw Hill Publication, 3rd Edition.

2. Thomas Floyd, “Digital Electronics”, 11th Edition.
3. M. Morris Mano, “Digital Logic and Computer Design”, Prentice Hall of India, 4th Edition.

4. Taub and Schilling, “Digital Principles and Applications,” TMH.
Reference Books:
1. Anand Kumar, “Fundamentals of Digital Circuits”, Prentice Hall of India, 1st Edition.

2. J. F. Wakerly, “Digital Design- Principles and Practices,”, Pearson, 3rd Edition.

3. M. M. Mano, “Digital Design,” Prentice Hall India.

Electrical Circuits

204183: Electrical Circuits

Credit 03

Unit I Basic Circuit analysis & Simplification Techniques
Kirchhoff‟s Current and Voltage Laws, Independent and Dependent sources and their interconnection,
power calculations.
Network Analysis: Mesh, Super mesh, Node and Super Node

analysis. Source transformation and source
shifting.
Network Theorems: Superposition, Thevenin‟s, Norton‟s and Maximum Power Transfer. **(Analysis of simple DC circuits using all above techniques & Analysis of simple AC circuits using only Mesh analysis)**
Mapping of Course Outcomes for Unit I CO1: Analyze the simple DC and AC circuit with circuit simplification techniques.

Unit II Transient Analysis of Basic RL, RC and RLC Circuits
Initial conditions, Driven RL and RC circuits, source free RL and RC circuits, properties of exponential
response, Natural and Forced response of RL and RC circuits.
Introduction to driven & Source free series
RLC circuit. Over damped and Under damped series RLC circuit.
Mapping of Course Outcomes for Unit II CO2: Formulate and analyze driven and source free RL and RC circuits.

Unit III Two Port Network Parameters and Functions
Terminal characteristics of network, Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions,
Applications of the parameters.
Application of Laplace Transforms to circuit analysis, network functions for one port and two port
networks, poles and zeros of network functions and network stability.
Mapping of Course Outcomes for Unit III CO3: Formulate & determine network parameters for given network and analyze the given network using Laplace Transform to find the network transfer function.

Unit IV DC Machines
Construction, working principle, derivation of emf equation, types, voltage equation of DC generator.
Working principle, derivation of Torque equation, types, voltage equation & speed equation of DC Motor.
Basic characteristics & different methods of speed control of DC Shunt and Series motor, Power flow
diagram of DC motor, Numericals on speed & torque.
Need of starter, three point & four point starters for DC shunt motor, applications of DC Motors.
Permanent Magnet DC motors (PMDC): Construction, Working and applications.
Mapping of Course Outcomes for Unit IV CO4: Explain construction, working and applications of DC Machines / Single Phase & Three

Phase AC Motors.
CO6: Analyze and select a suitable motor for different applications.

Unit V AC Motors (Single phase & Three phase)
Three phase Induction motors: Construction, working principle, types, concept of slip, effect of slip on
rotor parameters, derivation of torque equation, condition for maximum torque, torque ratios, Torque-slip
characteristics, Power flow diagram with numerical.
Single phase Induction motor: Construction, working principle, types and applications
Necessity of starters: Study of DOL & Star-Delta starters, speed control using V/f method, Applications.
Mapping of Course Outcomes for Unit V CO4: Explain construction, working and applications of DC Machines / Single Phase & Three Phase AC Motors.
CO6: Analyze and select a suitable motor for different applications.

Unit VI Special Purpose Motors
BLDC Motor: Types, Construction, working principle, Bipolar control circuit, torque-speed
characteristics and applications.
Stepper Motor: Types, Construction, working principle, different modes of operation, control circuit,
applications.
Introduction to Electric vehicle, block diagram, case study of any one electric vehicle with respect to
specifications of motor, battery and controller.
Mapping of Course
Outcomes for Unit VI CO5: Explain construction, working and applications of special purpose motors & understand motors used in electrical vehicles.
CO6: Analyze and select a suitable motor for different applications.

Learning Resources

Text Books:
1. Ravish R Singh, “Network Analysis & Synthesis”, McGraw-Hill Education.
2. B.L. Theraja, A.K. Theraja, “Electrical Technology”, Vol II, AC & DC Machines, S. Chand
Reference Books:
1. I.J Nagarath and D.P Kothari, “Electrical Machines”,Tata McGraw-Hill Publication 4th Edition.

2. William H. Hayt, Jack E. Kimmerly and Steven M. Durbin, “Electrical Circuit Analysis”, Tata
McGraw Hill publication, 7th Edition.
3. V K Mehta and Rohit Mehta, “Principles of Electrical Machines”, S Chand Publications.
4. A K Babu, “Electric & Hybrid Vehicle”, Khanna Publishing.

Data Structures

204184: Data Structures

Credit 03

Unit I Introduction to C Programming
C Fundamentals: Constants, Variables and Keywords in C, Operators, Bitwise Operations, Decision
Control and Looping Statements.
Arrays & Pointers: Arrays, Functions, Recursive Functions, Pointers, String Manipulations, Structures,
Union, Enumeration, MACROS.
File Handling: File Operations- Open, Close, Read, Write and Append.
Mapping of Course Outcomes for Unit I CO1: Solve mathematical problems using C programming language.

Unit II Searching and Sorting Algorithms
Algorithms: Analysis of Iterative and Recursive algorithms, Space & Time complexity, Asymptotic
notation- Big-O, Theta and Omega notations.
Searching methods: Linear, Binary and Fibonacci Search.
Sorting methods: Bubble, Insertion, Selection, Merge, and Quick Sort.
Mapping of Course Outcomes for Unit II CO2: Implement sorting and searching algorithms and calculate their complexity.

Unit III Stack and Queue
Stack: Concept, Basic Stack operations, Array representation of stack, Stack as ADT, Stack Applications:
Reversing data, Arithmetic expressions conversion and evaluation.
Queue: Concept, Queue operations, Array representation of queue, Queue as ADT, Circular queue, Priority
Queue, Applications of queue: Categorizing data, Simulation of queue.

Mapping of Course Outcomes for Unit III CO3: Develop applications of stack and queue using array.

Unit IV Linked List

Concept of linked organization, Singly Linked List, Stack using linked list, Queue using linked list,
Doubly Linked List, Circular Linked List, Linked list as ADT.
Representation and manipulations of
polynomials using linked list, comparison of sequential and linked organization.
Mapping of Course Outcomes for Unit IV CO4: Demonstrate applicability of Linked List.

Unit V Trees

Introduction to trees: Basic Tree Concepts.
Binary Trees: Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary
tree.
Binary Search Trees (BST): Basic Concepts, BST operations, Concept of Threaded Binary Search Tree
AVL Tree: Basic concepts and rotations of a Tree.
Mapping of Course Outcomes for Unit V CO5: Demonstrate applicability of nonlinear data structures - Binary Tree with respect to its time complexity.

Unit VI Graphs

Graph: Basic Concepts & terminology.
Representation of graphs: Adjacency matrix, Adjacency list.
Operations on graph: Traversing a graph.
Spanning trees: Minimum Spanning tree- Kruskal‟s Algorithm, Prim‟s Algorithm and Dijkstra‟s Shortest Path Algorithm.
Mapping of Course Outcomes for Unit VI CO6: Apply the knowledge of graph for solving the problems of spanning tree and shortest path algorithm.

Learning Resources

Text Books:

1. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures”, Galgotia Books Source,2nd Edition
2. Richard. F. Gilberg and Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C,”
Cengage Learning, 2nd Edition.

Reference Books:

1. E Balgurusamy, “Programming in ANSI C”, Tata McGraw-Hill, 3rd Edition.

2. Yedidyah Langsam, Moshe J Augenstein and Aaron M Tenenbaum “Data structures using C and C++”
PHI Publications, 2nd Edition.

3. Reema Thareja, “Data Structures using C”, Oxford University Press, 2nd Edition.