ENGINEERING MATHEMATICS III
SH 501

Lecture : 3 | **Year : II**
Tutorial : 2 | **Part : I**
Practical : 0

Course Objective:
The purpose of this course is to round out the students' preparation for more sophisticated applications with an introduction to linear algebra, Fourier Series, Laplace Transforms, integral transformation theorems and linear programming.

1. Determinants and Matrices (11 hours)
- 1.1. Determinant and its properties
- 1.2. Solution of system of linear equations
- 1.3. Algebra of matrices
- 1.4. Complex matrices
- 1.5. Rank of matrices
- 1.6. System of linear equations
- 1.7. Vector spaces
- 1.8. Linear transformations
- 1.9. Eigen value and Eigen vectors
- 1.10. The Cayley-Hamilton theorem and its uses
- 1.11. Diagonalization of matrices and its applications

2. Line, Surface and Volume Integrals (12 hours)
- 2.1. Line integrals
- 2.2. Evaluation of line integrals
- 2.3. Line integrals independent of path
- 2.4. Surfaces and surface integrals
- 2.5. Green's theorem in the plane and its applications
- 2.6. Stoke's theorem (without proof) and its applications
- 2.7. Volume integrals; Divergence theorem of Gauss (without proof) and its applications

3. Laplace Transform (8 hours)
- 3.1. Definitions and properties of Laplace Transform
- 3.2. Derivations of basic formulae of Laplace Transform
- 3.3. Inverse Laplace Transform: Definition and standard formulae of inverse Laplace Transform
- 3.4. Theorems on Laplace transform and its inverse
- 3.5. Convolution and related problems
- 3.6. Applications of Laplace Transform to ordinary differential equations

4. Fourier Series ` (5 hours)
- 4.1. Fourier Series
- 4.2. Periodic functions
- 4.3. Odd and even functions
- 4.4. Fourier series for arbitrary range
- 4.5. Half range Fourier series

5. Linear Programming (9 hours)
- 5.1. System of Linear Inequalities in two variables
- 5.2. Linear Programming in two dimensions: A Geometrical Approach
- 5.3. A Geometric introduction to the Simplex method
- 5.4. The Simplex method: Maximization with Problem constraints of the form "≤"
- 5.5. The Dual: Maximization with Problem Constraints of the form "≥"
- 5.6. Maximization and Minimization with mixed Constraints. The two-phase method(Analternative to the Big M Method)

References :

1. E. Kreszig, "Advance Engineering Mathematics", Willey, New York.
2. M.M Gutterman and Z.N.Nitecki, "Differential Equation, a First Course", 2nd Edition, saunders, New York.

Evaluation Scheme:

The questions will cover all the chapters of syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	11	20
2	12	20
3	8	15
4	5	10
5	9	15
Total	**45**	**80**

*There may be minor deviation in marks distribution.

OBJECT ORIENTED PROGRAMMING
CT 501

Lecture : 3 **Year : II**
Tutorial : 0 **Part : I**
Practical : 3

Course Objective:
The objective of the course is to familiarize students with the C++ programming language and use the language to develop pure object oriented programs.

1. Introduction to Object Oriented Programming (3 hours)
- 1.1 Issues with Procedure Oriented Programming
- 1.2 Basic of Object Oriented Programming (OOP)
- 1.3 Procedure Oriented versus Object Oriented Programming
- 1.4 Concept of Object Oriented Programming
  - 1.4.1 Object
  - 1.4.2 Class
  - 1.4.3 Abstraction
  - 1.4.4 Encapsulation
  - 1.4.5 Inheritance
  - 1.4.6 Polymorphism
- 1.5 Example of Some Object Oriented Languages
- 1.6 Advantages and Disadvantages of OOP

2. Introduction to C++ (2 hours)
- 2.1 The Need of C++
- 2.2 Features of C++
- 2.3 C++ Versus C
- 2.4 History of C++

3. C++ Language Constructs (6 hours)
- 3.1 C++ Program Structure
- 3.2 Character Set and Tokens
  - 3.2.1 Keywords
  - 3.2.2 Identifiers
  - 3.2.3 Literals
  - 3.2.4 Operators and Punctuators
- 3.3 Variable Declaration and Expression
- 3.4 Statements
- 3.5 Data Type
- 3.6 Type Conversion and Promotion Rules
- 3.7 Preprocessor Directives
- 3.8 Namespace
- 3.9 User Defined Constant const
- 3.10 Input/Output Streams and Manipulators
- 3.11 Dynamic Memory Allocation with new and delete
- 3.12 Condition and Looping
- 3.13 Functions
  - 3.13.1 Function Syntax
  - 3.13.2 Function Overloading
  - 3.13.3 Inline Functions
  - 3.13.4 Default Argument
  - 3.13.5 Pass by Reference
  - 3.13.6 Return by Reference
- 3.14 Array, Pointer and String
- 3.15 Structure, Union and Enumeration

4. Objects and Classes (6 hours)
- 4.1 C++ Classes
- 4.2 Access Specifiers
- 4.3 Objects and the Member Access
- 4.4 Defining Member Function
- 4.5 Constructor
  - 4.5.1 Default Constructor
  - 4.5.2 Parameterized Constructor
  - 4.5.3 Copy Constructor
- 4.6 Destructors
- 4.7 Object as Function Arguments and Return Type
- 4.8 Array of Objects
- 4.9 Pointer to Objects and Member Access
- 4.10 Dynamic Memory Allocation for Objects and Object Array
- 4.11 this Pointer
- 4.12 static Data Member and static Function
- 4.13 Constant Member Functions and Constant Objects
- 4.14 Friend Function and Friend Classes

5. Operator Overloading (5 hours)
- 5.1 Overloadable Operators
- 5.2 Syntax of Operator Overloading
- 5.3 Rules of Operator Overloading
- 5.4 Unary Operator Overloading
- 5.5 Binary Operator Overloading

5.6 Operator Overloading with Member and Non Member Functions
5.7 Data Conversion: Basic – User Defined and User Defined – User Defined
5.8 Explicit Constructors

6. Inheritance (5 hours)

6.1 Base and Derived Class
6.2 protected Access Specifier
6.3 Derived Class Declaration
6.4 Member Function Overriding
6.5 Forms of Inheritance: single, multiple, multilevel, hierarchical, hybrid, multipath
6.6 Multipath Inheritance and Virtual Base Class
6.7 Constructor Invocation in Single and Multiple Inheritances
6.8 Destructor in Single and Multiple Inheritances

7. Polymorphism and Dynamic Binding (4 hours)

7.1 Need of Virtual Function
7.2 Pointer to Derived Class
7.3 Definition of Virtual Functions
7.4 Array of Pointers to Base Class
7.5 Pure Virtual functions and Abstract Class
7.6 Virtual Destructor
7.7 reinterpret_cast Operator
7.8 Run-Time Type Information
7.8.1 dynamic_cast Operator
7.8.2 typeid Operator

8. Stream Computation for Console and File Input /Output (5 hours)

8.1 Stream Class Hierarchy for Console Input /Output
8.2 Testing Stream Errors
8.3 Unformatted Input /Output
8.4 Formatted Input /Output with ios Member functions and Flags
8.5 Formatting with Manipulators
8.6 Stream Operator Overloading
8.7 File Input/output with Streams
8.8 File Stream Class Hierarchy
8.9 Opening and Closing files
8.10 Read/Write from File
8.11 File Access Pointers and their Manipulators
8.12 Sequential and Random Access to File
8.13 Testing Errors during File Operations

9. Templates (5 hours)

9.1 Function Template
9.2 Overloading Function Template
9.2.1 Overloading with Functions
9.2.2 Overloading with other Template
9.3 Class Template
9.3.1 Function Definition of Class Template
9.3.2 Non-Template Type Arguments
9.3.3 Default Arguments with Class Template
9.4 Derived Class Template
9.5 Introduction to Standard Template Library
9.5.1 Containers
9.5.2 Algorithms
9.5.3 Iterators

10. Exception Handling (4 hours)

10.1 Error Handling
10.2 Exception Handling Constructs (try, catch, throw)
10.3 Advantage over Conventional Error Handling
10.4 Multiple Exception Handling
10.5 Rethrowing Exception
10.6 Catching All Exceptions
10.7 Exception with Arguments
10.8 Exceptions Specification for Function
10.9 Handling Uncaught and Unexpected Exceptions

Practical:

There will be about 12 lab exercises covering the course. At the end of the course students must complete a programming project on object oriented programming with C++.

References :

1 Robert Lafore, “Object Oriented Programming in C++”, 4th Edition 2002, Sams Publication

2 Daya Sagar Baral and Diwakar Baral, “The Secrets of Object Oriented Programming in C++”, 1st Edition 2010, Bhundipuran Prakasan
3 Harvey M. Deitel and Paul J. Deitel, “C++ How to Program”, 3rd Edition 2001, Pearson Education Inc.
4 D. S. Malik, “C++ Programming”, 3rd Edition 2007, Thomson Course Technology
5 Herbert Schildt, “C++: The Complete Reference”, 4th Edition 2003, Tata McGraw Hill

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1,2,4	11	20
3	6	10
5	5	10
6	5	10
8	5	10
7,9,10	13	20
Total	**45**	**80**

*There may be minor deviation in marks distribution

ELECTRIC CIRCUIT THEORY
EE 501

Lecture : 3 **Year : II**
Tutorial : 1 **Part : I**
Practical : 1.5

Course Objectives:
To continue work in Basic Electrical Engineering including the use of the Laplace Transform to determine the time and frequency domain responses of electric circuits.

1. Network Analysis of AC circuit & dependent sources (8 hours)
- 1.1 Mesh Analysis
- 1.2 Nodal Analysis
- 1.3 Series & parallel resonance in RLC circuits
  - 1.3.1 Impedance and phase angle of series Resonant Circuit
  - 1.3.2 Voltage and current in series resonant circuit
  - 1.3.3 Band width of the RLC circuit.
  - 1.3.4 High-Q and Low-Q circuits

2. Initial Conditions:
- 2.1 Characteristics of various network elements
- 2.2 Initial value of derivatives
- 2.3 Procedure for evaluating initial conditions
- 2.4 Initial condition in the case of R-L-C network

3. Transient analysis in RLC circuit by direct solution (10 hours)
- 3.1 Introduction
- 3.2 First order differential equation
- 3.3 Higher order homogeneous and non-homogeneous differential equations
- 3.4 Particular integral by method of undetermined coefficients
- 3.5 Response of R-L circuit with
  - 3.5.1 DC excitation
  - 3.5.2 Exponential excitation
  - 3.5.3 Sinusoidal excitation
- 3.6 Response of R-C circuit with
  - 3.6.1 DC excitation
  - 3.6.2 Exponential excitation
  - 3.6.3 Sinusoidal excitation
- 3.7 Response of series R-L-C circuit with
  - 3.7.1 DC excitation
  - 3.7.2 Exponential excitation
  - 3.7.3 Sinusoidal excitation
- 3.8 Response of parallel R-L-C circuit with DC excitation

4. Transient analysis in RLC circuit by Laplace Transform (8 hours)
- 4.1 Introduction
- 4.2 The Laplace Transformation
- 4.3 Important properties of Laplace transformation
- 4.4 Use of Partial Fraction expansion in analysis using Laplace Transformations
- 4.5 Heaviside's partial fraction expansion theorem
- 4.6 Response of R-L circuit with
  - 4.6.1 DC excitation
  - 4.6.2 Exponential excitation
  - 4.6.3 Sinusoidal excitation
- 4.7 Response of R-C circuit with
  - 4.7.1 DC excitation
  - 4.7.2 Exponential excitation **(2 hou**
  - 4.7.3 Sinusoidal excitation
- 4.8 Response of series R-L-C circuit with
  - 4.8.1 DC excitation
  - 4.8.2 Exponential excitation
  - 4.8.3 Sinusoidal excitation
- 4.9 Response of parallel R-L-C circuit with exponential excitation
- 4.10 Transfer functions Poles and Zeros of Networks

5. Frequency Response of Network (6 hours)
- 5.1 Introduction
- 5.2 Magnitude and phase response
- 5.3 Bode diagrams
- 5.4 Band width of Series & parallel Resonance circuits
- 5.5 Basic concept of filters, high pass, low pass, band pass and band stop filters

6. Fourier Series and transform (5 hours)

6.1 Basic concept of Fourier series and analysis
6.2 Evaluation of Fourier coefficients for periodic non-sinusoidal waveforms in electric networks
6.3 Introduction of Fourier transforms

7. Two-port Parameter of Networks (6 Hours)

7.1 Definition of two-port networks
7.2 Short circuit admittance parameters
7.3 Open circuits impedance parameters
7.4 Transmission Short circuit admittance parameters
7.5 Hybrid parameters
7.6 Relationship and transformations between sets of parameters
7.7 Application to filters
7.8 Applications to transmission lines
7.9 Interconnection of two-port network (Cascade, series, parallel)

Practical:

1. Resonance in RLC series circuit

- measurement of resonant frequency

2. Transient Response in first Order System passive circuits

- measure step and impulse response of RL and RC circuit using oscilloscope
- relate time response to analytical transfer functions calculations

3. Transient Response in Second Order System passive circuits

- measure step and impulse response of RLC series and parallel circuits using oscilloscope
- relate time response to transfer functions and pole-zero configuration

4. Frequency Response of first order passive circuits

- measure amplitude and phase response and plot bode diagrams for RL, RC and RLC circuits
- relate Bode diagrams to transfer functions and pole zero configuration circuit

5. Frequency Response of second order passive circuits

- measure amplitude and phase response and plot bode diagrams for RL, RC and RLC circuits
- relate Bode diagrams to transfer functions and pole zero configuration circuit

References:

1. M. E. Van Valkenburg, "Network Analysis", third edition Prentice Hall, 2010.
2. William H. Hyat. Jr. & Jack E. Kemmerly, "Engineering Circuits Analysis", Fourth edition, McGraw Hill International Editions, Electrical Engineering Series, 1987.
3. Michel D. Cilletti, "Introduction to Circuit Analysis and Design", Holt, Hot Rinehart and Winston International Edition, New York, 1988.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	8	12
2	2	6
3	10	16
4	8	12
5	6	12
6	5	10
7	6	12
Total	**45**	**80**

* There could be a minor deviation in the marks distribution.

THEORY OF COMPUTATION
CT 502

Lecture : 3 **year : II**
Tutorial : 1 **Part : I**
Practical : 0

Course Objectives:
To provide basic understanding of theory of automata, formal languages, turing machines and computational complexity.

1. Introduction (4 hours)
- 1.1 Set, relation, function, Proof techniques.
- 1.2 Alphabets, language, regular expression.

2. Finite Automata (12 hours)
- 2.1 Deterministic Finite Automata.
- 2.2 Non-Deterministic Finite Automata.
- 2.3 Equivalence of regular language and finite automata.
- 2.4 Regular language, properties of regular language.
- 2.5 Pumping lemma for regular language.
- 2.6 Decision algorithms for regular languages.

3. Context free language (12 hours)
- 3.1 Context free grammar.
- 3.2 Derivative trees, simplification of context free grammar.
- 3.3 Chomsky normal form.
- 3.4 Push down automata.
- 3.5 Equivalence of context free language and push down automata.
- 3.6 Pumping lemma for context free language.
- 3.7 Properties of context free language.
- 3.8 Decision algorithms for context free language.

4. Turing machine (10 hours)
- 4.1 Definition of Turing machine, notation for Turing machine.
- 4.2 Computing with Turing machine.
- 4.3 Extensions of Turing machine.
- 4.4 Unrestricted grammar.
- 4.5 Recursive function theory.

5. Undecidability (5 hours)
- 5.1 The Church-Turing thesis.
- 5.2 Halting Problem, Universal Turing machine.
- 5.3 Undecidable problems about Turing machines, grammars.
- 5.4 Properties of Recursive, Recursively enumerable languages.

6. Computational Complexity (2 hours)
- 6.1 Class P, Class NP, NP-complete problems.

References

1. H. R. Lewis, C. H. Papadimitriou, “Elements of theory of computation”, Pearson Education.
2. Michael Sipser, “Introduction to the Theory of Computation”, Thomson Course Technology.

Evaluation Scheme
The questions will cover all the chapters of syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	4	7
2	12	21
3	12	21
4	10	17
5	5	9
6	2	5
Total	**45**	**80**

* There could be a minor deviation in the marks distribution.

ELECTRONIC DEVICES AND CIRCUITS
EX 501

Lecture : 3 **Year : II**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

- To introduce the fundamentals of analysis of electronic circuits
- To provide basic understanding of semiconductor devices and analog integrated circuits

1. Diodes (5 hours)

1.1 The Ideal Diode
1.2 Terminal Characteristics of Junction Diodes
1.3 Physical Operation of Diodes
1.4 Analysis of Diode Circuits
1.5 Small Signal Model and Its Application
1.6 Operation in the Reverse Breakdown Region - Zener Diodes

2. The Bipolar Junction Transistor (10 hours)

2.1 Operation of the npn transistor in the Active Mode
2.2 Graphical Representation of Transistor Characteristics
2.3 Analysis of Transistor Circuits at DC
2.4 Transistor as an Amplifier
2.5 Small Signal Equivalent Circuit Models
2.6 Graphical Load Line Analysis
2.7 Biasing BJT for Discrete-Circuit Design
2.8 Basic Single-Stage BJT Amplifier Configurations (C-B, C-E, C-C)
2.9 Transistor as a Switch – Cutoff and Saturation
2.10 A General Large-Signal Model for the BJT: The Ebers-Moll Model

3. Field-Effect Transistor (9 hours)

3.1 Structure and Physical Operation of Enhancement-Type MOSFET
3.2 Current-Voltage Characteristics of Enhancement-Type MOSFET
3.3 The Depletion-Type MOSFET
3.4 MOSFET Circuits at DC
3.5 MOSFET as an Amplifier
3.6 Biasing in MOS Amplifier Circuits
3.7 Junction Field-Effect Transistor

4. Output Stages and Power Amplifiers (9 hours)

4.1 Classification of Output Stages
4.2 Class A Output Stage
4.3 Class B Output Stage
4.4 Class AB Output Stage
4.5 Biasing the Class AB Stage
4.6 Power BJTs
4.7 Transformer-Coupled Push-Pull Stages *
4.8 Tuned Amplifiers

5. Signal Generator and Waveform-Shaping Circuits (6 hours)

5.1 Basic Principles of Sinusoidal Oscillator
5.2 Op Amp-RC Oscillator Circuits
5.3 LC and Crystal Oscillators
5.4 Generation of Square and Triangular Waveforms Using Astable Multivibrators
5.5 Integrated Circuit Timers
5.6 Precision Rectifier Circuits

6. Power Supplies, Breakdown Diodes, and Voltage Regulators* (6 hours)

6.1 Unregulated Power Supply
6.2 Bandgap Voltage Reference, a Constant Current Diodes
6.3 Transistor Series Regulators
6.4 Improving Regulator Performance
6.5 Current Limiting
6.6 Integrated Circuit Voltage Regulator

Practical:

1. Bipolar Junction Transistor Characteristics and Single Stage Amplifier
2. Field-Effect Transistor Characteristics and Single Stage Amplifier
3. Power Amplifiers
4. Relaxation Oscillator and Sinusoidal Oscillator
5. Series and Shunt Voltage Regulators

References:

1. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", 6th Edition, Oxford University Press, 2006
2. David A. Bell, " Electronics Device and Circuits ", PHI; 3rd Edition, 1999.
3. Robert Boylestad and Louis Nashelsky, " Electronic Device and Circuit Theory", PHI; 9th Edition, 2007
4. Thomas L. Floyd, "Electronic Devices", 8th Edition, Pearson Education Inc., 2007
5. Mark N. Horenstein, "Microelectronic Circuits and Devices", PHI; 2nd Edition, 1997

6. Paul Horowitz and Winfield Fill, “The Art of Electornics”, Cambridge Publication; 2 Edition
7. Jacob Millman and Christos C. Halkias,and Satyabrata Jit “Millman’s Electronic Device and Circuits”, Tata McGraw- Hill; 2nd Edition, 2007

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Hours	Marks distribution*
1	6	8
2	10	16
3	9	16
4	9	14
5	6	8
6	6	8
1,2, 3, 4, 5, 6		10
Total	**45**	**80**

* There could be a minor deviation in the marks distribution.

DIGITAL LOGIC
EX 502

Lecture : 3 **Year : II**
Tutorial : 0 **Part : I**
Practical : 3

Course Objective:
To introduce basic principles of digital logic design, its implementation and applications.

1. Introduction (3 hours)
- 1.1. Definitions for Digital Signals
- 1.2. Digital Waveforms
- 1.3. Digital Logic
- 1.4. Moving and Storing Digital Information
- 1.5. Digital Operations
- 1.6. Digital Computer
- 1.7. Digital Integrated Circuits
- 1.8. Digital IC Signal Levels
- 1.9. Clock wave form
- 1.10. Coding
  - 1.10.1. ASCII Code
  - 1.10.2. BCD
  - 1.10.3. The Excess – 3 Code
  - 1.10.4. The Gray Code

2. Digital Logic (1 hours)
- 2.1. The Basic Gates – NOT, OR, AND
- 2.2. Universal Logic Gates – NOR, NAND
- 2.3. AND-OR-INVERT Gates
- 2.4. Positive and Negative Logic
- 2.5. Introduction to HDL

3. Combinational Logic Circuits (5 hours)
- 3.1. Boolean Laws and Theorems
- 3.2. Sum-of-Products Method
- 3.3. Truth Table to Karnaugh Map
- 3.4. Pairs, Quads, and Octets
- 3.5. Karnaugh Simplifications
- 3.6. Don't Care Conditions
- 3.7. Product-of-Sums Method
- 3.8. Product-of-Sums Simplification
- 3.9. Hazards and Hazard Covers
- 3.10. HDL Implementation Models

4. Data Processing Circuits (5 hours)
- 4.1. Multiplexetures
- 4.2. Demultiplexetures
- 4.3. Decoder
- 4.4. BCD-to-Decimal Decoders
- 4.5. Seven-Segment Decoders
- 4.6. Encoder
- 4.7. Exclusive-OR Gates
- 4.8. Parity Generators and Checkers
- 4.9. Magnitude Comparator
- 4.10. Read-Only Memory
- 4.11. Programmable Array Logic
- 4.12. Programmable Logic Arrays
- 4.13. Troubleshooting with a Logic Probe
- 4.14. HDL Implementation of Data Processing Circuits

5. Arithmetic Circuits (5 hours)
- 5.1. Binary Addition
- 5.2. Binary Subtraction
- 5.3. Unsigned Binary Numbers
- 5.4. Sign-Magnitude Numbers
- 5.5. 2's Complement Representation
- 5.6. 2's Complement Arithmetic
- 5.7. Arithmetic Building Blocks
- 5.8. The Adder-Subtracter
- 5.9. Fast Adder
- 5.10. Arithmetic Logic Unit
- 5.11. Binary Multiplication and Division
- 5.12. Arithmetic Circuits Using HDL

6. Flip Flops (5 hours)
- 6.1. RS Flip-Flops
- 6.2. Gated Flip-Flops
- 6.3. Edge-Triggered RS Flip-Flops
- 6.4. Egde Triggered D Flip-Flops
- 6.5. Egde Triggered J K Flip-Flops
- 6.6. Flip-Flop Timing
- 6.7. J K Mater- Slave Flip-Flops

6.8. Switch Contacts Bounds Circuits
6.9. Varius Representation of Flip-Flops
6.10. Analysis of Sequencial Circuits

7. Registers **(2 hours)**

7.1. Types of Registers
7.2. Serial In – Serial Out
7.3. Serial In – Parallel Out
7.4. Parallel In – Serial Out
7.5. Parallel In – Parallel Out
7.6. Applications of Shift Registers

8. Counters **(5 hours)**

8.1. Asynchronous Counters
8.2. Decoding Gates
8.3. Synchronous Counters
8.4. Changing the Counter Modulus
8.5. Decade Counters
8.6. Presettable Counters
8.7. Counter Design as a Synthesis Problem
8.8. A Digital Clock

9. Sequential Machines **(8 hours)**

9.1. Synchronous machines
  9.1.1. Clock driven models and state diagrams
  9.1.2. Transition tables, Redundant states
  9.1.3. Binary assignment
  9.1.4. Use of flip-flops in realizing the models
9.2. Asynchronous machines
  9.2.1. Hazards in asynchronous system and use of redundant branch
  9.2.2. Allowable transitions
  9.2.3. Flow tables and merger diagrams
  9.2.4. Excitation maps and realization of the models

10. Digital Integrate Circuits **(4 hours)**

10.1. Switching Circuits
10.2. 7400 TTL
10.3. TTL parameters
10.4. TTL Overvew
10.5. Open Collecter Gates
10.6. Three-state TTL Devices
10.7. External Drive for TTL Lods
10.8. TTL Driving External Loads
10.9. 74C00 CMOS
10.10. CMOS Characteristics
10.11. TTL- to –CMOS Interface
10.12. CMOS- to- TTL Interface

11. Applications **(2 hours)**

11.1. Multiplexing Displays
11.2. Frequency Counters
11.3. Time Measurement

Practical:

1. DeMorgan’s law and it’s familiarization with NAND and NOR gates
2. Encoder, Decoder, and Multiplexer
3. Familiarization with Binary Addition and Subtraction
4. Construction of true complement generator
5. Latches, RS, Master-Slave and T type flip flops
6. D and JK type flip flops
7. Ripple Counter, Synchronous counter
8. Familiarization with computer package for logic circuit design
9. Design digital circuits using hardware and software tools
10. Use of PLAs and PLDs

References:

1. Donald P. Leach, Albert Paul Malvino and Goutam Saha, “ Digital Principles and Applications”, 6th edition , Tata McGraw-Hill, 2006
2. David J Comer “Digital Logic And State Machine Design” 3rd edition, Oxfored University Press, 2002
3. William I. Fletcher “An Engineering Approach to Digital Design” Printice Hall of India, New Delhi 1990
4. William H. Gothmann, “Digital Electronics, An Introduction to Theory and Practice”, 2nd edition, PHI, 2009

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Hours	Marks distribution*
1	3	6
2	1	4
3	5	8
4	5	10
5	5	8
6	5	8
7	2	4
8	5	8
9	8	12
10	4	8
11	2	4
Total	**45**	**80**

* There could be a minor deviation in the marks distribution.

ELECTROMAGNETICS
EX 503

Lecture : 3 **year : II**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:
To provide basic understanding of the fundamentals of Electromagnetics.

1. Introduction **(3 hours)**
- 1.1 Co-ordinate system.
- 1.2 Scalar and vector fields.
- 1.3 Operations on scalar and vector fields.

2. Electric field **(11 hours)**
- 2.1 Coulomb's law.
- 2.2 Electric field intensity.
- 2.3 Electric flux density.
- 2.4 Gauss's law and applications.
- 2.5 Physical significance of divergence, Divergence theorem.
- 2.6 Electric potential, potential gradient.
- 2.7 Energy density in electrostatic field.
- 2.8 Electric properties of material medium.
- 2.9 Free and bound charges, polarization, relative permittivity, electric dipole.
- 2.10 Electric Boundary conditions.
- 2.11 Current, current density, conservation of charge, continuity equation, relaxation time.
- 2.12 Boundary value problems, Laplace and Poisson equations and their solutions, uniqueness theorem.
- 2.13 Graphical field plotting, numerical integration.

3. Magnetic field **(9 hours)**
- 3.1 Biot-Savart's law.
- 3.2 Magnetic field intensity.
- 3.3 Ampere's circuital law and its application.
- 3.4 Magnetic flux density.
- 3.5 Physical significance of curl, Stoke's theorem.
- 3.6 Scalar and magnetic vector potential.
- 3.7 Magnetic properties of material medium.
- 3.8 Magnetic force, magnetic torque, magnetic moment, magnetic dipole, magnetization.
- 3.9 Magnetic boundary condition.

4. Wave equation and wave propagation **(12 hours)**
- 4.1 Faraday's law, transformer emf, motional emf.
- 4.2 Displacement current.
- 4.3 Maxwell's equations in integral and point forms.
- 4.4 Wave propagation in lossless and lossy dielectric.
- 4.5 Plane waves in free space, lossless dielectric, good conductor.
- 4.6 Power and pointing vector.
- 4.7 Reflection of plane wave at normal and oblique incidence.

5. Transmission lines **(5 hours)**
- 5.1 Transmission line equations.
- 5.2 Input impedance, reflection coefficient, standing wave ratio.
- 5.3 Impedance matching, quarter wave transformer, single stub matching, double stub matching.

6. Wave guides **(4 hours)**
- 6.1 Rectangular wave guide.
- 6.2 Transverse electric mode, transverse magnetic mode.

7. Antennas **(1 hour)**
- 7.1 Introduction to antenna, antenna types and properties.

Practical:
1. Teledeltos (electro-conductive) paper mapping of electrostatic fields.
2. Determination of dielectric constant, display of a magnetic Hysteresis loop
3. studies of wave propagation on a lumped parameter transmission line
4. microwave sources, detectors, transmission lines
5. Standing wave patterns on transmission lines, reflections, power patterns on transmission lines, reflections, power measurement.
6. Magnetic field measurements in a static magnetic circuit, inductance, leakage flux.

References:

1. W. H. Hayt, “Engineering Electromagnetics”, McGraw-Hill Book Company.
2. J. D. Kraus, “Electromagnetics”, McGraw-Hill Book Company.
3. N. N. Rao, “Elements of Engineering Electromagnetics”, Prentice Hall.
4. Devid K. Cheng, “Field and Wave Electromagnetics”, Addison-Wesley.
5. M. N. O. Sadiku, “Elements of Electromagnetics”, Oxford University Press.

Evaluation Scheme

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Hours	Marks distribution*
1	3	5
2	11	20
3	9	16
4	12	21
5, 6, 7	10	16
Total	45	80

* There could be a minor deviation in the marks distribution.

ELECTRICAL MACHINES
EE 554

Lecture : 3 **Year : II**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

To impart knowledge on constructional details, operating principle and performance of Transformers, DC Machines, 1-phase and 3-phase Induction Machines, 3-phase Synchronous Machines and Fractional Kilowatt Motors.

1. Magnetic Circuits and Induction (4hours)

1.1 Magnetic Circuits
1.2 Ohm's Law for Magnetic Circuits
1.3 Series and Parallel magnetic circuits
1.4 Core with air gap
1.5 B-H relationship (Magnetization Characteristics)
1.6 Hysteresis with DC and AC excitation
1.7 Hysteresis Loss and Eddy Current Loss
1.8 Faraday's Law of Electromagnetic Induction, Statically and Dynamically Induced EMF
1.9 Force on Current Carrying Conductor

2. Transformer (8 hours)

2.1 Constructional Details, recent trends
2.2 Working principle and EMF equation
2.3 Ideal Transformer
2.4 No load and load Operation
2.5 Operation of Transformer with load
2.6 Equivalent Circuits and Phasor Diagram
2.7 Tests: Polarity Test, Open Circuit test, Short Circuit test and Equivalent Circuit Parameters
2.8 Voltage Regulation
2.9 Losses in a transformer
2.10 Efficiency, condition for maximum efficiency and all day efficiency
2.11 Instrument Transformers: Potential Transformer (PT) and Current Transformer (CT)
2.12 Auto transformer: construction, working principle and Cu saving
2.13 Three phase Transformers

3. DC Generator (6 hours)

3.1 Constructional Details and Armature Winding
3.2 Working principle and Commutator Action
3.3 EMF equation
3.4 Method of excitation: separately and self excited, Types of DC Generator
3.5 Characteristics of series, shunt and compound generator
3.6 Losses in DC generators
3.7 Efficiency and Voltage Regulation

4. DC Motor (6 hours)

4.1 Working principle and Torque equation
4.2 Back EMF
4.3 Method of excitation, Types of DC motor
4.4 Performance Characteristics of D.C. motors
4.5 Starting of D.C. Motors: 3 point and 4 point starters
4,6 Speed control of D.C. motors: Field Control, Armature Control
4.7 Losses and Efficiency

5. Three Phase Induction Machines (6 hours)

5.1 Three Phase Induction Motor
   5.1.1 Constructional Details and Types
   5.1.2 Operating Principle, Rotating Magnetic Field, Synchronous Speed, Slip, Induced EMF, Rotor Current and its frequency, Torque Equation
   5.1.3 Torque-Slip characteristics
5.2 Three Phase Induction Generator
   5.2.1 Working Principle, voltage build up in an Induction Generator
   5.2.2 Power Stages

6. Three Phase Synchronous Machines (6 hours)

6.1 Three Phase Synchronous Generator
   6.1.1 Constructional Details, Armature Windings, Types of Rotor, Exciter
   6.1.2 Working Principle
   6.1.3 EMF equation, distribution factor, pitch factor
   6.1.4 Armature Reaction and its effects
   6.1.5 Alternator with load and its phasor diagram
6.2 Three Phase Synchronous Motor
   6.2.1 Principle of operation
   6.2.2 Starting methods

6.2.3 No load and Load operation, Phasor Diagram
6.2.4 Effect of Excitation and power factor control

7. Fractional Kilowatt Motors (6 hours)

2.14 Single phase Induction Motors: Construction and Characteristics
2.15 Double Field Revolving Theory
2.16 Split phase Induction Motor
7.1.1 Capacitors start and run motor
7.1.2 Reluctance start motor
2.17 Alternating Current Series motor and Universal motor
2.18 Special Purpose Machines: Stepper motor, Schrage motor and Servo motor

Practical:

1. **Magnetic Circuits**
   - To draw B-H curve for two different sample of Iron Core
   - Compare their relative permeability
2. **Two Winding Transformers**
   - To perform turn ratio test
   - To perform open circuit (OC) and short circuit (SC) test to determine equivalent circuit parameter of a transformer and hence to determine the regulation and efficiency at full load
3. **DC Generator**
   - To draw open circuit characteristic (OCC) of a DC shunt generator
   - To draw load characteristic of shunt generator
4. **DC Motor**
   - Speed control of DC Shunt motor by (a) armature control method (b) field control method
   - To observe the effect of increasing load on DC shunt motor's speed, armature current, and field current.
5. **3-phase Machines**
   - To draw torque-speed characteristics and to observe the effect of rotor resistance on torque-speed characteristics of a 3-phase Induction Motor
   - To study load characteristics of synchronous generator with (a) resistive load (b) inductive load and (c) capacitive load

6. **Fractional Kilowatt Motors**
   - To study the effect of a capacitor on the starting and running of a single-phase induction motor
   - Reversing the direction of rotation of a single phase capacitor induct

References:

1 I.J. Nagrath & D.P.Kothari," Electrical Machines", Tata McGraw Hill
2 S. K. Bhattacharya, "Electrical Machines", Tata McGraw Hill
3 B. L. Theraja and A. K. Theraja, "Electrical Technology (Vol-II)", S. Chand
4 Husain Ashfaq ," Electrical Machines", Dhanpat Rai & Sons
5 A.E. Fitzgerald, C.Kingsley Jr and Stephen D. Umans,"Electric Machinery", Tata McGraw Hill
6 B.R. Gupta & Vandana Singhal, "Fundamentals of Electrical Machines, New Age International
7 P. S. Bhimbra, "Electrical Machines"' Khanna Publishers
8 Irving L.Kosow, "Electric Machine and Tranformers", Prentice Hall of India.
9 M.G. Say, "The Performance and Design of AC machines", Pit man & Sons.
10 Bhag S. Guru and Huseyin R. Hizirogulu, "Electric Machinery and Transformers" Oxford University Press, 2001.

Evaluation Scheme

The questions will cover all the chapters of syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Hours	Marks distribution*
1	4	8
2	8	16
3	6	12
4	6	12
5	6	10
6	6	10
7	6	12
Total	**42**	**80**

* There could be a minor deviation in the marks distribution.

NUMERICAL METHODS
SH 553

Lecture : 3 **Year : II**
Tutorial : 1 **Part : II**
Practical : 3

Course objective:
The course aims to introduce numerical methods used for the solution of engineering problems. The course emphasizes algorithm development and programming and application to realistic engineering problems.

1. **Introduction, Approximation and errors of computation (4 hours)**
   1.1. Introduction, Importance of Numerical Methods
   1.2. Approximation and Errors in computation
   1.3. Taylor's series
   1.4. Newton's Finite differences (forward , Backward, central difference, divided difference)
   1.5. Difference operators, shift operators, differential operators
   1.6. Uses and Importance of Computer programming in Numerical Methods.
2. **Solutions of Nonlinear Equations (5 hours)**
   2.1. Bisection Method
   2.2. Newton Raphson method (two equation solution)
   2.3. Regula-Falsi Method , Secant method
   2.4. Fixed point iteration method
   2.5. Rate of convergence and comparisons of these Methods
3. **Solution of system of linear algebraic equations (8 hours)**
   3.1. Gauss elimination method with pivoting strategies
   3.2. Gauss-Jordan method
   3.3. LU Factorization
   3.4. Iterative methods (Jacobi method, Gauss-Seidel method)
   3.5. Eigen value and Eigen vector using Power method
4. **Interpolation (8 hours)**
   4.1. Newton's Interpolation (forward, backward)
   4.2. Central difference interpolation: Stirling's Formula, Bessel's Formula
   4.3. Lagrange interpolation
   4.4. Least square method of fitting linear and nonlinear curve for discrete data and continuous function
   4.5. Spline Interpolation (Cubic Spline)
5. **Numerical Differentiation and Integration (6 hours)**
   5.1. Numerical Differentiation formulae
   5.2. Maxima and minima
   5.3. Newton-Cote general quadrature formula
   5.4. Trapezoidal, Simpson's 1/3, 3/8 rule
   5.5. Romberg integration
   5.6. Gaussian integration (Gaussian – Legendre Formula 2 point and 3 point)
6. **Solution of ordinary differential equations (6 hours)**
   6.1. Euler's and modified Euler's method
   6.2. Runge Kutta methods for 1st and 2nd order ordinary differential equations
   6.3. Solution of boundary value problem by finite difference method and shooting method.
7. **Numerical solution of Partial differential Equation (8 hours)**
   7.1. Classification of partial differential equation(Elliptic, parabolic, and Hyperbolic)
   7.2. Solution of Laplace equation (standard five point formula with iterative method)
   7.3. Solution of Poisson equation (finite difference approximation)
   7.4. Solution of Elliptic equation by Relaxation Method
   7.5. Solution of one dimensional Heat equation by Schmidt method

Practical:
Algorithm and program development in C programming language of following:
1. Generate difference table.
2. At least two from Bisection method, Newton Raphson method, Secant method
3. At least one from Gauss elimination method or Gauss Jordan method. Finding largest Eigen value and corresponding vector by Power method.
4. Lagrange interpolation. Curve fitting by Least square method.
5. Differentiation by Newton's finite difference method. Integration using Simpson's 3/8 rule
6. Solution of 1st order differential equation using RK-4 method
7. Partial differential equation (Laplace equation)
8. Numerical solutions using Matlab.

References:

1. Dr. B.S.Grewal, " Numerical Methods in Engineering and Science ", Khanna Publication, 7th edition.
2. Robert J schilling, Sandra l harries , " Applied Numerical Methods for Engineers using MATLAB and C.", 3rd edition Thomson Brooks/cole.
3. Richard L. Burden, J.Douglas Faires, "Numerical Analysis 7th edition" , Thomson / Brooks/cole
4. John. H. Mathews, Kurtis Fink ," Numerical Methods Using MATLAB 3rd edition " ,Prentice Hall publication
5. JAAN KIUSALAAS , " Numerical Methods in Engineering with MATLAB" , Cambridge Publication

Evaluation scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Hours	Marks distribution*
1	9	16
2		
3	8	16
4	8	16
5	6	10
6	6	10
7	8	12
Total	**45**	**80**

* There could be a minor deviation in the marks distribution

APPLIED MATHEMATICS
SH 551

Lecture : 3 | **Year : II**
Tutorial : 1 | **Part : II**
Practical : 0

Course Objective

This course focuses on several branches of applied mathematics. The students are exposed to complex variable theory and a study of the Fourier and Z-Transforms, topics of current importance in signal processing. The course concludes with studies of the wave and heat equations in Cartesian and polar coordinates.

1. Complex Analysis (18 hours)

1.1 Complex Analytic Functions
- 1.1.1 Functions and sets in the complex plane
- 1.1.2 Limits and Derivatives of complex functions
- 1.1.3 Analytic functions. The Cauchy –Riemann equations
- 1.1.4 Harmonic functions and it's conjugate

1.2 Conformal Mapping
- 1.2.1 Mapping
- 1.2.2 Some familiar functions as mappings
- 1.2.3 Conformal mappings and special linear functional transformations
- 1.2.4 Constructing conformal mappings between given domains

1.3 Integral in the Complex Plane
- 1.3.1 Line integrals in the complex plane
- 1.3.2 Basic Problems of the complex line integrals
- 1.3.3 Cauchy's integral theorem
- 1.3.4 Cauchy's integral formula
- 1.3.5 Supplementary problems

1.4 Complex Power Series, Complex Taylor series and Lauren series
- 1.4.1 Complex power series
- 1.4.2 Functions represented by power series
- 1.4.3 Taylor series, Taylor series of elementary functions
- 1.4.4 Practical methods for obtaining power series, Laurent series
- 1.4.5 Analyticity at infinity, zeros, singularities, residues, Cauchy's residue theorem
- 1.4.6 Evaluation of real integrals

2. The Z-Transform (9 hours)

- 2.1 Introduction
- 2.2 Properties of Z-Transform
- 2.3 Z- transform of elementary functions
- 2.4 Linearity properties
- 2.5 First shifting theorem, second shifting theorem, Initial value theorem,
- 2.6 Final value theorem, Convolution theorem
- 2.7 Some standard Z- transform
- 2.8 Inverse Z-Transform
- 2.9 Method for finding Inverse Z-Transform
- 2.10 Application of Z-Transform to difference equations

3. Partial Differential Equations (12 hours)

- 3.1 Linear partial differential equation of second order, their classification and solution
- 3.2 Solution of one dimensional wave equation, one dimensional heat equation, two dimensional heat equation and Laplace equation (Cartesian and polar form) by variable separation method

4. Fourier Transform (6 hours)

- 4.1 Fourier integral theorem, Fourier sine and cosine integral; complex form of Fourier integral
- 4.2 Fourier transform, Fourier sine transform, Fourier cosine transform and their properties
- 4.3 Convolution, Parseval's identity for Fourier transforms
- 4.4 Relation between Fourier transform and Laplace transform

References:

1. E. Kreyszig, "Advance Engineering Mathematics", Fifth Edition, Wiley, New York.
2. A. V. Oppenheim, "Discrete-Time Signal Processing", Prentice Hall, 1990.
3. K. Ogata, "Discrete-Time Control System", Prentice Hall, Englewood Cliffs, New Jersey, 1987.

Evaluation Scheme

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hour	Marks distribution*
1	18	30
2	9	20
3	12	20
4	6	10
Total	**45**	**80**

*There may be minor deviation in marks distribution.

INSTRUMENTATION I
EE 552

Lecture : 3 **Year : II**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:
Comprehensive treatment of methods and instrument for a wide range of measurement problems.

1. **Instrumentations Systems** **(2 hours)**
   1.1 Functions of components of instrumentation system introduction, signal processing , Signal transmission ,output indication
   1.2 Need for electrical, electronics, pneumatic and hydraulic working media systems and conversion devices
   1.3 Analog and digital systems
2. **Theory of measurement** **(10 hours)**
   2.1 Static performance parameters - accuracy, precision, sensitivity, resolution and linearity
   2.2 Dynamic performance parameters - response time, frequency response and bandwidth
   2.3 Error in measurement
   2.4 Statistical analysis of error in measurement
   2.5 Measurement of voltage & current (moving coil & moving iron instruments)
   2.6 Measurement of low, high & medium resistances
   2.7 AC bridge & measurement of inductance and capacitance
3. **Transducer** **(8 hours)**
   3.1 Introduction
   3.2 Classification
   3.3 Application
      3.3.1 Measurement of mechanical variables, displacement, strain. velocity. acceleration and vibration
      3.3.2 Measurement of process variables - temperature pressure, level, fluid flow, chemical constituents in gases or liquids, pH and humidity.
      3.3.3 Measurement of bio-physical variables blood pressure and myoelectric potentials
4. **Electrical Signal Processing and transmission** **(6 hours)**
   4.1 Basic Op-amp characteristics
   4.2 Instrumentation amplifier
   4.3 Signal amplification, attenuation, integration, differentiation, network isolation, wave shaping
   4.4 Effect of noise, analog filtering, digital filtering
   4.5 Optical communication, fibre optics, electro-optic conversion devices
5. **Analog - Digital and Digital - Analog Conversion** **(6 hours)**
   5.1 Analog signal and digital signal
   5.2 Digital to analog convertors - weighted resistor type, R-2R ladder type, DAC Errors
   5.3 Analog to digital convertors - successive approximation type, ramp type, dual ramp type, flash type, ADC errors
6. **Digital Instrumentation** **(5 hours)**
   6.1 Sample data system, sample and hold circuit
   6.2 Components of data acquisition system
   6.3 Interfacing to the computer
7. **Electrical equipment** **(8 hours)**
   7.1 Wattmeter
      7.1.1 Types
      7.1.2 Working principles
   7.2 Energy meter
      7.2.1 Types
      7.2.2 Working principles
   7.3 Frequency meter
      7.3.1 Types
      7.3.2 Working principles
   7.4 Power factor meter
   7.5 Instrument transformers

Practical:
1. **Accuracy test in analog meters**
2. **Operational Amplifiers in Circuits**
   - Use of Op amp as a summer, inverter, integrator and differentiator
3. **Use resistive, inductive and capacitive transducers to measure displacement**
   - Use strain gauge transducers to measure force
4. **Study of Various transducers for measurement of Angular displacement, Angular Velocity, Pressure and Flow**

- Use optical, Hall effect and inductive transducer to measure angular displacement
- Use tacho - generator to measure angular velocity
- Use RTD transducers to measure pressure and flow

5. Digital to Analog Conversion

- Perform static testing of D/A converter

6. Analog to Digital Conversion

- Perform static testing of A/D converter

References:

1. D.M Considine "Process Instruments and Controls Handbook" third edition McGraw Hill, 1985
2. S. Wolf and R.F.M. Smith "Students Reference Manual for Electronics Instrumentation Laboratories", Prentice Hall, 1990
3. E.O Deobelin "Measurement System, Application and Design" McGraw Hill, 1990
4. A.K Sawhney "A Course in Electronic Measurement and Instrumentation " Dhanpat Rai and Sons,1988
5. C.S. Rangan, G.R Sharma and V.S.V. Mani, "Instrumentation Devices and Systems" Tata McGraw Hill publishing Company Limited New Delhi,1992.
6. J.B. Gupta. "A Course in Electrical & Electronics Measurement & Instrumentation, thirteenth edition, 2008, Kataria & Sons.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	2	6
2	10	16
3	8	16
4	6	10
5	6	10
6	5	10
7	8	12
Total	**45**	**80**

* There could be a minor deviation in the marks distribution.

DATA STRUCTURE AND ALGORITHMS
CT 552

Lecture : 3 | **Year : II**
Tutorial : 0 | **Part : II**
Practical : 3

Course Objectives:

- To provide fundamental knowledge of various data structures and their implementation
- To provide the fundamental knowledge of various algorithms and their analysis

1. Concept of data structure **(2 hours)**
- 1.1 Introduction: data types, data structures and abstract data types
- 1.2 Introduction to algorithms

2. The Stack and Queue **(6 hours)**
- 2.1 Stack operation
- 2.2 Stack application: Evaluation of Infix, Postfix and Prefix expressions
- 2.3 Operations in queue, Enqueue and Dequeue
- 2.4 Linear and circular queue
- 2.5 Priority queue

3. List **(3 hours)**
- 3.1 Definition
  - 3.1.1 Static and dynamic list structure
  - 3.1.2 Array implementation of lists
  - 3.1.3 Queues as list

4. Linked lists **(5 hours)**
- 4.1 Dynamic implementation
- 4.2 Operations in linked list
- 4.3 Linked stacks and queues
- 4.4 Doubly linked lists and its applications

5. Recursion **(4 hours)**
- 5.1 Principle of recursion
- 5.2 TOH and Fibonacci sequence
- 5.3 Applications of recursion

6. Trees **(7 hours)**
- 6.1 Concept
- 6.2 Operation in Binary tree
- 6.3 Tree search, insertion/deletions
- 6.4 Tree traversals (pre-order, post-order and in-order)
- 6.5 Height, level and depth of a tree
- 6.6 AVL balanced trees and Balancing algorithm
- 6.7 The Huffman algorithm
- 6.8 B-Tree
- 6.9 Red Black Tree

7. Sorting **(5 hours)**
- 7.1 Types of sorting: internal and external
- 7.2 Insertion and selection sort
- 7.3 Exchange sort
- 7.4 Merge and Redix sort
- 7.5 Shell sort
- 7.6 Heap sort as a priority queue
- 7.7 Big ‘O’ notation and Efficiency of sorting

8. Searching **(5 hours)**
- 8.1 Search technique
- 8.2 Sequential, Binary and Tree search
- 8.3 General search tree
- 8.4 Hashing
  - 8.4.1 Hash function and hash tables
  - 8.4.2 Collision resolution technique

9. Growth Functions **(2 hours)**

Asymptotic notations: θ, O, Ω, o, ω notations and their properties

10. Graphs **(6 hours)**
- 10.1 Representation and applications
- 10.2 Transitive closure
- 10.3 Warshall’s algorithm
- 10.4 Graphs type
- 10.5 Graph traversal and Spanning forests
  - 10.5.1 Depth First Traversal and Breadth First Traversal
  - 10.5.2 Topological sorting: Depth first, Breadth first topological sorting
  - 10.5.3 Minimum spanning trees, Prim’s, Kruskal’s and Round-Robin algorithms
- 10.6 Shortest-path algorithm
  - 10.6.1 Greedy algorithm
  - 10.6.2 Dijkstra’s Algorithm

Practical:

There shall be 10 to 12 lab exercises based on C or C++

1. Implementation of stack
2. Implementations of linear and circular queues
3. Solutions of TOH and Fibonacci sequence by Recursion
4. Implementations of linked list: singly and doubly linked list
5. Implementation of trees: AVL trees, and balancing
6. Implementation of Merge sort
7. Implementation of search: sequential, Binary and Tree search
8. Implementation of Graphs: Graph Traversals
9. Implementation of hashing
10. Implementation of Heap

References

1. Y. Langsam, M. J. Augenstein and A. M Tenenbaum, "Data Structures using C and C++", PHI
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, "Introduction to Algorithms", PHI
3. G.W. Rowe, "Introduction to Data Structure and Algorithms with C and C++", PHI
4. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structure and Program design in C", PHI
5. G. Brassard and P. Bratley, "Fundamentals of Algorithms", PHI

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	2	4
2	6	10
3	3	6
4	5	10
5	4	8
6	7	12
7	5	8
8	5	8
9	2	4
10	6	10
Total	**45**	**80**

* There could be a minor deviation in the marks distribution.

MICROPROCESSORS
EX 551

Lecture : 3 | **Year : II**
Tutorial : 1 | **Part : II**
Practical : 3

Course Objective:
The objective of the course is to familiarize students with programming, hardware and application of microprocessor.

1. Introduction (4 hours)

1.1 Introduction and History of Microprocessors
1.2 Basic Block Diagram of a Computer
1.3 Organization of Microprocessor Based System
1.4 Bus Organization
1.5 Stored program Concept and Von Neumann Machine
1.6 Processing Cycle of a Stored Program Computer
1.7 Microinstructions and Hardwired/Microprogrammed Control Unit
1.8 Introduction to Register Transfer Language

2. Programming with 8085 Microprocessor (10 hours)

2.1 Internal Architecture and Features of 8085 microprocessor
2.2 Instruction Format and Data Format
2.3 Addressing Modes of 8085
2.4 Intel 8085 Instruction Set
2.5 Various Programs in 8085
- 2.5.1 Simple Programs with Arithmetic and Logical Operations
- 2.5.2 Conditions and Loops
- 2.5.3 Array and Table Processing
- 2.5.4 Decimal BCD Conversion
- 2.5.5 Multiplication and Division

3. Programming with 8086 Microprocessor (12 hours)

3.1 Internal Architecture and Features of 8086 Microprocessor
- 3.1.1 BIU and Components
- 3.1.2 EU and Components
- 3.1.3 EU and BIU Operations
- 3.1.4 Segment and Offset Address

3.2 Addressing Modes of 8086
3.3 Assembly Language Programming
3.4 High Level versus Low Level Programming
3.5 Assembly Language Syntax
- 3.5.1 Comments
- 3.5.2 Reserved words
- 3.5.3 Identifiers
- 3.5.4 Statements
- 3.5.5 Directives
- 3.5.6 Operators
- 3.5.7 Instructions

3.6 EXE and COM programs
3.7 Assembling, Linking and Executing
3.8 One Pass and Two Pass Assemblers
3.9 Keyboard and Video Services
3.10 Various Programs in 8086
- 3.10.1 Simple Programs for Arithmetic, Logical, String Input/Output
- 3.10.2 Conditions and Loops
- 3.10.3 Array and String Processing
- 3.10.4 Read and Display ASCII and Decimal Numbers
- 3.10.5 Displaying Numbers in Binary and Hexadecimal Formats

4. Microprocessor System (10 hours)

4.1 Pin Configuration of 8085 and 8086 Microprocessors
4.2 Bus Structure
- 4.2.1 Synchronous Bus
- 4.2.2 Asynchronous Bus
- 4.2.3 Read and Write Bus Timing of 8085 and 8086 Microprocessors

4.3 Memory Device Classification and Hierarchy
4.4 Interfacing I/O and Memory
- 4.4.1 Address Decoding
- 4.4.2 Unique and Non Unique Address Decoding
- 4.4.3 I/O Mapped I/O and Memory Mapped I/O
- 4.4.4 Serial and Parallel Interfaces
- 4.4.5 I/O Address Decoding with NAND and Block Decoders (8085, 8086)
- 4.4.6 Memory Address Decoding with NAND, Block and PROM Decoders (8085, 8086)

4.5 Parallel Interface
   4.5.1 Modes: Simple, Wait, Single Handshaking and Double Handshaking
   4.5.2 Introduction to Programmable Peripheral Interface (PPI)
4.6 Serial Interface
   4.6.1 Synchronous and Asynchronous Transmission
   4.6.2 Serial Interface Standards: RS232, RS423, RS422, USB
   4.6.3 Introduction to USART
4.7 Introduction to Direct Memory Access (DMA) and DMA Controllers

5. Interrupt Operations (5 hours)

5.1 Polling versus Interrupt
5.2 Interrupt Processing Sequence
5.3 Interrupt Service Routine
5.4 Interrupt Processing in 8085
   5.4.1 Interrupt Pins and Priorities
   5.4.2 Using Programmable Interrupt Controllers (PIC)
   5.4.3 Interrupt Instructions
5.5 Interrupt Processing in 8086
   5.5.1 Interrupt Pins
   5.5.2 Interrupt Vector Table and its Organization
   5.5.3 Software and Hardware Interrupts
   5.5.4 Interrupt Priorities

6. Advanced Topics (4 hours)

6.1 Multiprocessing Systems
   6.1.1 Real and Pseudo-Parallelism
   6.1.2 Flynn's Classification
   6.1.3 Instruction Level, Thread Level and Process Level Parallelism
   6.1.4 Interprocess Communication, Resource Allocation and Deadlock
   6.1.5 Features of Typical Operating System
6.2 Different Microprocessor Architectures
   6.2.1 Register Based and Accumulator Based Architecture
   6.2.2 RISC and CISC Architectures
   6.2.3 Digital Signal Processors

Practical:

There will be about 12 lab exercises to program 8085 and 8086 microprocessors.

References:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Application with 8085", 5th Edition 2002, Prentice Hall
2. Peter Abel, "IBM PC Assembly Language and Programming", 5th Edition 2001, Pearson Education Inc.
3. D. V. Hall, "Microprocessor and Interfacing, Programming and Hardware", 2nd Edition 1999, Tata McGraw Hill
4. John Uffenbeck, "Microcomputers and Microprocessors, The 8080, 8085 and Z-80 Programming, Interfacing and Troubleshooting" 3rd Edition 1999, Prentice Hall
5. Walter A. Triebel and Avtar Singh, "The 8088 and 8086 Microprocessors, Programming, Interfacing, Software, Hardware and Applications", 4th Edition 2003, Prentice Hall
6. William Stalling, "Computer Organization and Architecture", 8th Edition 2009, Prentice Hall

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	4	8
2	10	16
3	12	16
4	10	16
5	5	8
6	4	8
1,2,3,4,5,6	-	8
Total	**45**	**80**

*There could be a minor deviation in Marks distribution

DISCRETE STRUCTURE
CT 551

Lecture : 3 **Year : II**
Tutorial : 0 **Part : II**
Practical : 0

Course Objectives:

- To gain knowledge in discrete mathematics and finite state automata in an algorithmic approach.
- To gain fundamental and conceptual clarity in the area of Logic, Reasoning, Algorithms, Recurrence Relation, Graph Theory, and Theory of Automata.

1. Logic, Induction and Reasoning (12 hours)

1.1. Proposition and Truth function
1.2. Propositional Logic
1.3. Expressing statements in Logic Propositional Logic
1.4. The predicate Logic
1.5. Validity
1.6. Informal Deduction in Predicate Logic
1.7. Rules of Inference and Proofs
1.8. Informal Proofs and Formal Proofs
1.9. Elementary Induction and Complete Induction
1.10. Methods of Tableaux
1.11. Consistency and Completeness of the System

2. Finite State Automata (10 hours)

2.1. Sequential Circuits and Finite state Machine
2.2. Finite State Automata
2.3. Language and Grammars
2.4. Non-deterministic Finite State Automata
2.5. Language and Automata
2.6. Regular Expression and its characteristics

3. Recurrence Relation (8 hours)

3.1. Recursive Definition of Sequences
3.2. Solution of Linear recurrence relations
3.3. Solution to Nonlinear Recurrence Relations
3.4. Application to Algorithm Analysis

4. Graph Theory (15 hours)

4.1. Undirected and Directed Graphs
4.2. Walk Paths, Circuits, Components
4.3. Connectedness Algorithm
4.4. Shortest Path Algorithm
4.5. Bipartite Graphs, Planar Graphs, Regular Graphs
4.6. Planarity Testing Algorithms
4.7. Eulerian Graph
4.8. Hamiltonian Graph
4.9. Tree as a Directed Graph
4.10. Binary Tree, Spanning Tree
4.11. Cutsets and Cutvertices
4.12. Network Flows, Maxflow and Mincut Theorem
4.13. Data Structures Representing Trees and Graphs in Computer
4.14. Network Application of Trees and Graphs
4.15. Concept of Graph Coloring

References:

1. Kenth Rosen, "Discrete Mathematical Structures with Applications to Computer Science", WCB/ McGraw Hill
2. G. Birkhoff, T.C. Bartee, "Modern Applied Algebra", CBS Publishers.
3. R. Johnsonbaugh, "Discrete Mathematics", Prentice Hall Inc.
4. G.Chartand, B.R.Oller Mann, "Applied and Algorithmic Graph Theory", McGraw Hill
5. Joe L. Mott, Abrahan Kandel, and Theodore P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Prentice-Hall of India

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	12	24
2	10	16
3	8	8
4	15	32
Total	**45**	**80**

*There could be a minor deviation in Marks distribution