

**SEMESTER III (B. Sc. IT)**

**0202167: COMPUTATIONAL MATHEMATICS**

Full Marks: 100

**Introduction to Errors in Numerical Calculations**

Marks: 12

Errors and their Computation; Absolute, Relative and Percentage Errors; General Error Formulae; Errors in a Series Approximation

**Solution to Algebraic and Transcendental Equations**

Marks: 10

Bisection Method; Method of False Position; Newton -Raphson Method: Newton-Raphson Iteration

**Interpolation**

Marks: 15

Introduction; Forward Difference; Backward Difference; Newton's Forward Difference Interpolation; Newton's Backward Difference Interpolation; Lagrange's Interpolation

**Least Square Curve Fitting**

Marks: 15

Curve Fitting; Method of Least Square; Polynomials Least-Squares Fitting: The Least-Squares Line, The Least-Squares Parabola, The Least-Squares mth Degree Polynomials, Multiple Regression

**Solution of Simultaneous Algebraic Equation**

Marks: 14

Cramer's Rule; Gauss Elimination Method; Gauss Elimination with Partial Pivoting; Gauss-Jordan Method; Gauss Siedel Method

**Numerical Solution of 1<sup>st</sup> and 2<sup>nd</sup> Order Differential Equations**

Marks: 12

Taylor Series; Euler's Method; Modified Euler's Method; Runge-Kutta Method for 1<sup>st</sup> and 2<sup>nd</sup> Order Differential Equation; Picards Method

**Numerical Integration**

Marks: 10

Trapezoidal Rule; Simpson's 1/3 Rule; Simpson's 3/8 Rule

**Linear Programming**

Marks: 12

Linear Programming Model and their Graphical Solutions; Transportation Problems; PERT/CPM: Critical Path (CPM) Computations

**Reference Books:**

1. Ahmed, S. Q., 2009. *NUMERICAL AND STATISTICAL TECHNIQUES*, Ane Books Pvt Ltd.
2. Antia, M. H., 2002. *Numerical methods for scientists and engineers*, Vol. 1, Birkhäuser.
3. Braun, M., 1993. *Differential equations and their applications: an introduction to applied mathematics*, Springer.
4. Burden, L. R. and Faires, J. D., 2010. *Numerical Analysis*, Cengage Learning.
5. Cheney, W. E. and Kincaid, R. D., 2007. *Numerical mathematics and computing*, Cengage Learning.

## 0202168: SYSTEMS PROGRAMMING

Full Marks: 100

### **Overview of UNIX Operating System**

Marks: 12

Introduction; Overview: The Uniqueness of UNIX, UNIX Tools, Communications, System Architecture, Basic UNIX Elements; General UNIX Commands: Logging In and Logging Out, Getting the Login Prompt, Entering Userid and Password, Logging Out, UNIX Commands, The UNIX Shell, About UNIX Commands, Getting On-line Help with Commands, Special Keys and Control Characters, A Selected Command List

### **Fundamentals of UNIX Shell Programming**

Marks: 18

Variables: Defining Variables, Variable Names, Variable Values, Accessing Values, Array Variables, Accessing Array Values, Readonly Variables, Unsetting Variables, Exporting Environment Variables, Exporting Variables in ksh and bash, Shell Variables; Substitution: Filename Substitution (Globbing), Variable Substitution, Command and Arithmetic Substitution, Command Substitution, Arithmetic Substitution; Flow Control: The if Statement, Using test, The case Statement, Using Patterns; Loops: The while Loop, Nesting while Loops, The until Loop, The for Loop, The select Loop; Loop Control: Infinite Loops and the break Command, Breaking Out of Nested Loops, The continue Command; Functions: Creating and Using Functions, Invoking a Function, Function Examples, Moving Around the File System

### **Introduction to “vi editor”**

Marks: 15

Overview of vi; A Brief vi Session: Starting vi, Command Mode and Input Mode, Inserting Text, Using ex Commands, Cursor Movement, Deleting Text, Making Corrections, Undoing, Joining the Lines, Saving the Work; A Second Session: Repeating a Command, Line Numbers, Markers, Other Input Modes; Cut, Copy and Paste: Buffers, By Line Number; Cut and Copy (Delete and Yank): General, Using Markers, Paste; Search and Replace: Simple Search, Special Characters, Search and Replace, Special Flags, A Powerful Search and Replace

### **Security in UNIX and Elementary UNIX Networking**

Marks: 12

Introduction to The UNIX Security; The Purpose of Logging; Improving Security: Passwords, Selecting Passwords, Password Policies, Checking Password Security; Networking and UNIX: Packets and Protocols, Network Topologies; File and Directory Permissions: Wildcard Characters

### **Introduction to awk Utility**

Marks: 12

Overview; Getting Started with awk; How to Run awk Programs; Data Files for the Examples: A Simple Example, An Example with Two Rules; Other Features of awk: Using awk Variables, Regular Expressions, awk Combining Patterns, awk Built-in Variables, awk Assignment Operators, awk Built-in Arithmetic Operators, awk Built-in String Functions, awk Built-in Functions, awk Built-in Functions, awk User Defined Functions

### **Introduction to GNU C Compiler**

Marks: 15

A Brief History; Major Features; Programming in C; Compiling a C Program: Compiling a Simple C Program, Finding Errors in a Simple Program, Compiling Multiple Source Files, Compiling Files Independently, Creating Object Files from Source Files, Creating Executables from Object Files, Link Order of Object Files; C Language Standards; The Working of Compiler: An Overview of the Compilation Process, The Preprocessor, The Compiler, The Assembler, The Linker

## UNIX System Programming

Marks: 15

An Introduction to the UNIX File System: How the UNIX File System Works, The i-List, The File System Table, File System Quotas, File System Related Commands, A Brief Tour of the UNIX File System, Data Blocks and i-nodes, UNIX inode Structure, File Name Extensions; An Introduction to the Process: Viewing Processes, Killing Processes, Interaction and Job Control, Background and Foreground Jobs; Pipelines and Filters: The grep Command; Parent and Child Processes; Semaphores

### Reference Books:

1. Palmer, M., 2007. *Guide to UNIX Using Linux*, 4th ed., Cengage Learning.
2. Poniatoski, M., 2002. *Unix User's Handbook*, Prentice Hall
3. Raymond, 2004. *The Art Of Unix Programming*, Pearson Education India.
4. SRIRENGAN, K., 1998. *UNDERSTANDING UNIX*, PHI Learning Pvt. Ltd.
5. Stevens, W. R., Fenner, B. & Rudoff, A. M., 2004. *UNIX Network Programming, Volume 1: The Sockets Networking API*, 3rd ed., Addison-Wesley Professional.
6. Verma, A., 2006. *Unix and Shell Programming*, Laxmi Publications
7. Christian, K. & Richter, S., 1994. *The UNIX operating system*. J. Wiley.

## 0202021: OBJECT ORIENTED PROGRAMMING

Full Marks: 100

### Object Oriented Programming with Java

Marks: 12

Introduction; Object Oriented Programming Concepts; Object Oriented Programming; Programming Paradigm; Functional Programming; Logic Programming; Object Orientation as a New Paradigm; The Big Picture; Messages and Responsibilities; Classes and Instances; Objects and Classes; Encapsulation: Messages, Classes; Types

### Classes, Objects and Methods

Marks: 8

Introduction; Defining a Class; Fields Declaration; Methods Declaration; Creating Objects; Accessing Class Members; Constructors

### Inheritance

Marks: 12

Introduction: Example, Derivation Syntax, Effects; Protected Access; Overriding Methods: Dynamic Method Dispatching, The Super Keyword, Final Methods and Final Classes; Constructor Chaining; Inheritance and Finalization; Abstract Classes; Interfaces: The Implements Declaration; Casting between Class Types

### Polymorphism

Marks: 11

Introduction; Upcasting Revisited; Forgetting the Object Type; Method Calling Binding; Producing the Right Behaviour; Extensibility; Overriding vs Overloading; Abstract Classes and Methods; Constructors and Polymorphism: Order of Constructor Calls

## **Exception Handling**

Marks: 11

Introduction: Dealing with Errors; The Classification of Exceptions; Advertising the Exceptions that a Method Throws; How to Throw an Exception; Creating Exception Classes; Catching Exceptions; Catching Multiple Exceptions; Rethrowing Exceptions

## **Object Oriented Programming**

Marks: 16

Introduction: Class, Object, Method; Basic Concepts: Objects, Classes, Data Abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing; Paradigms of Programming Languages: Imperative Paradigms, Declarative Paradigm; Programming: Procedural Programming, Modular Programming, Data Abstraction, Object Oriented Programming; Objects: Object: The Soul of Object Oriented Programming, The Object Orientation; Classes: A Complete View of a Class, Scope Operator, Scope of Class and its Members; Object Oriented Programming; Object Oriented Programming Characteristics; Advantages

## **Classes and Objects**

Marks: 12

Introduction to Classes; Specifying; Creating Objects; Defining Member Functions; Static Data Members; Static Member Functions: Const Member Functions; Pointer to Members; Constructor: Copy Constructor; Destructors

## **Operator Overloading**

Marks: 10

Introduction; How to Overload Operators; Overloading Unary Operators; Overloading Binary Operators; Rules for Overloading Operators; Types Conversions

## **Inheritance, Multiple Inheritance and Polymorphism**

Marks: 8

Introduction to Inheritance; Defining Derived Classes; Single Inheritance; Multiple Inheritances; Polymorphism

## **Reference Books:**

1. Balagurusamy, E., 2006. *Object Oriented Programming with C++*. 3rd ed., Tata McGraw Hill Publishing Company Limited.
2. Barnes, D.J. & Kolling, M., 2008. *Objects First With Java: A Practical Introduction Using BlueJ*. 4th ed., Prentice Hall
3. Bronson, G. J., 2005. *Object-Oriented Program Development Using Java: A Class-Centered Approach*. 2nd ed., Course Technology
4. Cay S. Horstmann, Gary Cornell, 2001. *Core Java 2: Fundamentals*. Prentice Hall PTR.
5. David Barnes, David J. Barnes, 2000. *Object-oriented programming with Java: an introduction*. Prentice Hall.
6. Farrell. J., 2008. *Object Oriented Programming using C++*, 4th ed., Course Technology, USA; Cengage Learning. P.794.

## **0202020: COMPUTER NETWORKS**

Full Marks: 100

## **Fundamentals of Computer Network**

Marks: 18

Introduction to Computer Network; Historical Background; Classification Based on Transmission Technology; Classification Based on Scale; Metropolitan Area Networks (MAN); The Internet; Data Representation; Data

Communication; Communications Channels; Digital and Analog Transmission; Asynchronous and Synchronous Transmission; Types of Communication Services; Serial Communication

### **OSI Reference Model and Protocols**

Marks: 24

The Need For Standards; ISO - Organisation for Standardisation; The OSI Reference Model; A Layered Network Model; The Seven OSI Reference Model Layers; RS-232; Scope of the Standard; Stop-and-Wait Flow Control; Basic Idea of Flow Control; Basic Idea of Error Control; Frame Correct First Time; Automatic Repeat Request (ARQ); Frame Synchronisation; Framing Errors; DLC Standards; Control Frames; High-level Data Link Control (HDLC); X.25 Protocol; X.25 Devices and Protocol Operation; Packet Assembler/Disassembler (PAD); Four Types of PLP Packet Fields Exist; Token Ring

### **Multiplexing and Network Layers**

Marks: 20

Multiplexing; Time Division Multiplexing; Time Slots and Frames; Data Rate Management; Pulse Stuffing; Statistical Time-Division Multiplexing; Switched Network; Switching Technology; Network Layer in the Internet; IP Protocol; IP Addresses; Subnets; CIDR—Classless InterDomain Routing; Internet Control Protocols; ARP—The Address Resolution Protocol; RARP, BOOTP, and DHCP; OSPF—The Interior Gateway Routing Protocol; BGP—The Exterior Gateway Routing Protocol

### **Application Layer and Protocols**

Marks: 22

Introduction to Application Layer; Domain Name System; Structure of DNS; Simple Network Management Protocol; Overview and Basic Concepts of SNMP; Network Connecting Devices; LAN Connecting Devices; Internetworking Devices; Network Security; Cryptographic Algorithms; Secret Key Encryption (DES); Public-key Cryptography; Working of Public Key in Detail; Description of Public Key; ATM - Asynchronous Transfer Mode; Frame Relay; ISDN; Very Small Aperture Terminal (VSAT); Global Positioning System (GPS)

### **Distributed Computing**

Marks: 16

Introduction; Parallel and Distributed Computing; History; Applications; Theoretical Foundations; Other Problems; Properties of Distributed Systems; Architecture

### **Reference Books:**

1. Acharya. V., 2006. *TCP/IP Distributed System*. Laxmi Publications.
2. Banzal. S., 2007. *Data and Computer Network Communication*. Firewall Media.
3. Bidgoli. H., 2004. *The Internet encyclopedia, Volume 1*. John Wiley and Sons.
4. Black. U. D., 1993. *Computer networks: protocols, standards, and interfaces*. PTR Prentice Hall.
5. Carpenter. T., 2009. *CompTIA Convergence+ Certification Study Guide*. McGraw Hill Professional.
6. Garg. V., 2002. *Elements of distributed computing*. Wiley-IEEE.
7. Hsu. J. Y., 1996. *Computer networks: architecture, protocols, and software*. Artech house.
8. Jamas. K. A. and Klander. L., 2002. *Hacker proof: the ultimate guide to network security*. Cengage Learning.
9. Keidar. I., 2009. *Distributed Computing: 23rd International Symposium, DISC 2009, Elche, Spain, September 23-25, 2009, Proceedings*. Springer.

## 0202172: LOGIC, DISCREET MATHEMATICAL STRUCTURES

Full Marks: 100

### Set Theory

Marks: 7

Introduction; Sets and Operations on Sets: Notation, Specifying Sets; Subsets: Proper Subset, Equal Sets, Super Set, Null Set; Singleton; Finite Set; Infinite Set; Universal Set; Power Set; Disjoint Set 5; Cardinality of a Set; Operations On Sets: Union of Sets: Union, Intersection, Difference, Symmetry Difference, Complement of a Set

### Mathematical Logic

Marks: 7

Statement (Proposition); Logical Connectives/Operations: Negation, Conjunction, Disjunction; Conditional; Bi-Conditional; Converse; Inverse; Exclusive OR; NAND; NOR; Tautology; Contradiction; Duality Law; Algebra of Propositions: De Morgan's Laws; Mathematical Induction

### Techniques of Counting

Marks: 10

Introduction; Basic Counting Principles; Mathematical Functions: Factorial Functions, Binomial Coefficients, Binomial Coefficients and Pascal's Triangle; Permutations: Permutation with Repetitions; Combinations; The Pigeonhole Principle; Recurrence Relations; Linear Recurrence Relations with Constant coefficients

### Relations and Diagraph

Marks: 11

Concept of Relation; Properties: Reflexive Relation, Symmetric Relation, Transitive Relation, Equivalence Relation, Anti-Symmetric Relation, Inverse Relation; Pictorial Representatives of Relations: Relations on  $R$ , Directed Graphs of Relations in Sets, Pictures of Relations on Finite Sets; Composition of Relations; Relations and Digraphs; Paths in Relations and Digraph; Equivalence Relations: Equivalence Relations and Partitions; Transitive Extensions; Transition Closure; Matrix Representation of Relations

### Functions and Recurrence Relations

Marks: 12

Introduction; Function: Restriction and Extension; One-To-One Mapping (Injection One-To-One Function); Onto-Mapping (Surjection); One-To-One, Onto (Bijection); Identity Mapping; Composition of Function; Associative Mapping; Constant Function; Inverse Mapping; Mathematical Functions, Exponential and Logarithmic Functions: Floor and Ceiling Function, Integer and Absolute Value Functions, Remainder Function and Modular Arithmetic, Logarithmic Functions; Sequences, Indexed Classes of Sets: Sequences, Summation Symbol, Sums, Indexed Classes of Sets; Algorithms and Functions; Complexity of Algorithm: Complexity of Well-known Algorithms

### Graph Theory

Marks: 12

Introduction: Linked Lists and Pointers, Stacks, Queues and Priority Queues, Stack, Queue, Priority Queue; Graphs and Multigraphs: Multigraphs, Degree of a Vertex, Finite Graphs, Trivial Graphs; Subgraphs, Isomorphic and Homeomorphic Graphs: Subgraphs, Isomorphic Graphs, Homeomorphic Graphs; Paths, Connectivity: Connectivity, Connected Components, Distance and Diameter, Cutpoints and Bridges; Traversable and Eulerian Graphs, Bridges of Königsberg; Hamiltonian Graphs; Labelled and Weighted Graphs; Complete, Regular and Bipartite Graphs: Complete Graphs, Regular Graphs, Bipartite Graphs; Graphs Colourings: Dual Maps and the Four Colour Theorem

### Ordered Sets, Lattices and Boolean Algebra

Marks: 12

Ordered Sets: Dual Order, Ordered Subsets, Quasi-Order, Comparability, Linearly Ordered Sets; Hasse Diagrams of Partially Ordered Sets: Minimal and Maximal and First and Last Elements; Lattices: Axioms Defining Lattice, Duality

and the Idempotent Law, Lattices and Order, Sub-Lattices, Isomorphic Lattices; Bounded Lattices; Distributive Lattices; Complements, Complemented Lattices: Complemented Lattices; Boolean Algebra; Duality; Boolean Algebras as Lattices: Subalgebras, Isomorphic Boolean Algebras; Sum-Of-Products Form for Sets; Sum-Of-Products Form for Boolean Algebras; Logic Gates and Circuits: Logic Gates, OR Gate, AND Gate, NOT Gate, Logic Circuits, AND-OR Circuits, NAND and NOR Gates; Truth Tables, Boolean Functions: Boolean Functions

### **Binary Trees**

Marks: 10

Introduction; Binary Trees: Picture, Similar Binary Trees; Complete and Extended Binary Trees: Complete Binary Trees, Extended Binary Trees: 2-Trees; Representing Binary Trees in Memory: Linked Representation of Binary Trees, Sequential Representation of Binary Trees; Traversing Binary Trees; Binary Search Trees; General Trees and Binary Trees; Spanning Tree; Prim's Algorithm; Kruskal's Algorithm

### **Group Theory, Languages and Finite State Machines**

Marks: 12

Binary Operations; General Properties; Algebraic Structures (Algebraic Systems): Groupoid; Semi-Group; Homomorphism of Semi-Groups; Isomorphism of Semi-Groups; Monoid; Groups; Sub-Group; Centre of a Group; Index of a Sub-Group; Cosets; Normal Sub-Groups: Simple Group, Quotient Group; Alphabet, Words, Free Semi-Group; Languages: Operations on Languages; Regular Expressions, Regular Languages; Grammars: Language L (G) of a Grammar G, Types of Grammars, Machines and Grammars; Finite State Machines

### **Codes and Group Codes**

Marks: 7

Introduction; Terminologies; Error Correction; Group Codes; Weight of Code Word; Distance Between the Code Words; Error Correction for Block Code: Maximum Likelihood Criterion, Minimum Distance Decoding Criterion

### **Reference Books:**

1. *Mathematical Logic*. Available at: <[http://www.mathgoodies.com/lessons/toc\\_vol9.html](http://www.mathgoodies.com/lessons/toc_vol9.html)> [Accessed 7 April 2011].
2. *Monoids, Boolean Algebras, Materially Ordered Sets*. Available at: <<http://www.math.cmu.edu/~wn0g/noll/MBM.pdf>> [Accessed 11 April 2011].
3. Nanda, 2002. *Discrete Mathematics*, Allied Publishers.
4. Rosen, K., 2006. *Discrete Mathematics and Its Applications*, 6th Edition, McGraw-Hill.
5. Johnsonbaugh, R., 2008. *Discrete Mathematics*, 7th Edition, Prentice Hall.