

# JAMSHEDPUR WOMEN'S COLLEGE, JAMSHEDPUR

*(A Constituent Autonomous College of Kolhan University, Chaibasa)*

The BCA programme provides student with necessary skill to make successful career as a professional in competitive situation with satisfying jobs. It also prepares students with the requisite background to proceed with confidence for higher studies in the form of BCA and thus acquire greater competency. The BCA course structure is spread across six semesters in three years. Each semester comprises of seven papers with a balanced combination of theory and practical.

The Proposed Course Structure for Full Time 3 Years Bachelor of Computer Applications (BCA) programme is as follows: -

## Eligibility Criteria

- 10+2 Science with Mathematics or equivalent with minimum 45% marks

## THE BCA COURSE STRUCTURE

SEMESTER I	MARKS			PASSING %	CREDITS
THEORY	EXTERNAL	INTERNAL	TOTAL		
BCA 101 Mathematics -1	70	30	100	45%	4
BCA 102 Computer Fundamentals & Office Automation	50	0	50	45%	2
BCA 103 Programming in C	50	0	50	45%	2
BCA 104 Digital Electronics & Computer Organization	70	30	100	45%	4
BCA 105 Communication Skills/Technical English	70	30	100	45%	4
<b>SESSIONAL</b>					
BCA 106 Office Automation Lab	25	25	50	45%	2
BCA 107 C Programming Lab	25	25	50	45%	2
<b>SEMESTER-II</b>					
<b>THEORY</b>					
BCA 201 Mathematics -II	70	30	100	45%	4
BCA 202 Data Structures	50	0	50	45%	2
BCA 203 Database Management Systems	50	0	50	45%	2
BCA 204 Computer Architecture	70	30	100	45%	4
BCA 205 Managerial Economics	70	30	100	45%	4
<b>SESSIONAL</b>					
BCA 206 Data Structures Lab	25	25	50	45%	2
BCA 207 Database Lab	25	25	50	45%	2
<b>SEMESTER -III</b>					
<b>THEORY</b>					
BCA 301 Probability and Statistics	70	30	100	45%	4
BCA 302 Operating System	50	0	50	45%	2
BCA 303 Elective-1 (System Analysis And Designing)	70	30	100	45%	4
BCA 304 Object Oriented Programming Using C++	50	0	50	45%	2
BCA 305 Management Information System	70	30	100	45%	4
<b>SESSIONAL</b>					
BCA 302 Linux/Unix operating system	25	25	50	45%	2
BCA 304 C++ programming lab	25	25	50	45%	2

<b>SEMESTER –IV</b>					
<b>THEORY</b>					
BCA 401 Data Communication & Computer Networks	<b>70</b>	<b>30</b>	<b>100</b>	<b>45%</b>	<b>4</b>
BCA 402 Programming in JAVA	50	0	50	45%	2
BCA 403 Software Engineering Principles	<b>70</b>	<b>30</b>	<b>100</b>	<b>45%</b>	<b>4</b>
BCA 404 Environmental Science	<b>70</b>	<b>30</b>	<b>100</b>	<b>45%</b>	<b>4</b>
BCA 405 Elective-II(Computer Graphics and Multimedia)	50	0	50	45%	2
<b>SESSIONAL</b>				45%	
BCA 406 Java Programming Lab	25	25	50	45%	2
BCA 407 Computer Graphics Lab	25	25	50	45%	2
<b>SEMESTER V</b>					
<b>THEORY</b>					
BCA 501 Internet & Web Technology	50	0	50	45%	2
BCA 502 Advanced Database Management System	<b>70</b>	<b>30</b>	<b>100</b>	<b>45%</b>	<b>4</b>
BCA 503 Fundamentals of Computer Algorithms	<b>70</b>	<b>30</b>	<b>100</b>	<b>45%</b>	<b>4</b>
BCA 504 Elective-III (Mobile Computing)	<b>70</b>	<b>30</b>	<b>100</b>	<b>45%</b>	<b>4</b>
BCA 505 Programming in Visual Basic	50	0	50	45%	2
<b>SESSIONAL</b>					
BCA 506 Internet & Web Technology Lab	25	25	50	45%	2
BCA 507 Programming in Visual Basic	25	25	50	45%	2
<b>SEMESTER VI</b>					
<b>THEORY</b>					
BCA 601 Theory of Computation	<b>70</b>	<b>30</b>	<b>100</b>	<b>45%</b>	<b>4</b>
BCA 602 Elective-IV (Distributed System)	70	30	100	45%	4
BCA 603 e-Commerce And e-Business	<b>70</b>	<b>30</b>	<b>100</b>	<b>45%</b>	<b>4</b>
BCA 604 Accounting and Financial Management	<b>70</b>	<b>30</b>	<b>100</b>	<b>45%</b>	<b>2</b>
<b>SESSIONAL</b>					
BCA 605 INDUSTRIAL TRAINING	<b>25</b>	<b>0</b>	<b>25</b>	<b>45%</b>	<b>2</b>
BCA 606 PROJECT	<b>50</b>	<b>25</b>	<b>75</b>	<b>45%</b>	<b>4</b>
	<b>Total Marks</b>		<b>3000</b>	<b>Total Credit</b>	<b>120</b>

### List of Electives

1. Computer Graphics and Multimedia
2. Mobile Computing
3. Distributed System
4. Artificial Intelligence
5. Linear programming

## SEMESTER I

### **THEORY**

#### BCA 101 Mathematics -1

**Algebra:** Sets, Union, intersection, complement, mapping, notion of group, ring, field with simple examples; Polynomials, division algorithm, fundamental theorem of classical algebra (without proof), Descartes rule of sign and their application, relation between roots and coefficients, symmetric function of roots, transformation of polynomial equations, Cardan's solution of cubic equation. Matrices, addition and multiplication of matrices, inverse matrix, solution of linear equations in three variables by Cramer's rule, solution of three line linear equations by matrix inversion method.

**Differential calculus:** Limits of function and continuity, fundamental properties of continuous functions (without proof), geometric meaning of derivative and differential, rules of differentiation, successive differentiation, Rolle's theorem, mean value theorem, Taylor's and Maclaurin's theorems with Cauchy's and Lagrange's forms of remainder, Taylor's series, function of several variables, partial derivatives, total differential, Euler's theorem on homogeneous functions of two variables.

**Integral calculus:** Rules of integration of indefinite integrals, solution of definite integrals and their elementary properties, idea of improper integrals.

**Dimensional geometry:** Transformation of rectangular axes, invariants, general equation of second degree – reduction to standard forms and classification, plane polar equation of a straight line, circle and conic.

#### **Text Books:**

1. Engineering Mathematics, Vol:1 & Vol:2, Sastry, PHI
2. University Algebra through 600 Solved Problems, N. S. Gopalakrishnan, New Age International
3. Engineering Mathematics, Arumugam, SCITECH

#### BCA 102 Computer Fundamentals & Office Automation

**Computer Basic** Algorithms, A simple model of a Computer, Characteristic of Computer, Problem Solving Using Computer. Computer Generation and Classification

**Data representation** Representation of characters in Computer, Representation of Integers, Representation of Fractions, Hexadecimal Representation of Numbers, Error Detecting Codes)

**Binary Arithmetic** Binary Addition, Binary Subtraction, Signed numbers, Two's Complement Representation of number, Addition/Subtraction of numbers in 2's Complement Notation, Binary, octal, decimal & hexadecimal number system and their inter conversion. Floating point Representation.

**Input/output Units** Description of computer input units, other input methods, computer output units, Logic Circuits.

**Computer Memory** Memory cell, Memory organization, Read-only Memory, Serial Access Memory, Physical Devices used to construct Memory, Magnetic Hard Disk, Floppy Disk device, Compact Disk Read-Only Memory (DCROM), magnetic tape Devices.

**Processor** Structure of Instructions, Description of a Processor.

**Text Books:**

1. V. Rajaraman
2. B. Ram

## BCA 103 Programming in C

**Introduction:** Algorithms, Flow charts, Problem solving methods, Need for computer languages, Character set , Keywords, Identifiers, Constants, Variables, Storage class, Data types, Operators & expressions, Header files, Library files, Pre processor directives.

**Transfer of control:** Selection & iteration, Conditional and unconditional statements, Looping statements.

**Functions:** User defined and library functions, Recursion Vs Iteration, Passing parameters to the function.

**Arrays:** Defining and processing an array, Passing array to a function, Multi dimensional arrays, String handling, Operations on strings.

**Pointers:** Declarations, Passing pointer to a function, Operations on pointers, Pointers and arrays, Arrays of pointers.

**Structures and unions:** Defining and processing a structure, passing structure to a function, Pointers and structures, Unions.

**File Handling :** Open, Close, Create, File operations, Unformatted data files, Command line arguments.

**Text Books:**

1. Programming with C by Byron S. Gottfried, TMH Publishing Co. Ltd.
2. Programming with C by E. Balagurusamy, TMH Publishing Co. Ltd.

## BCA 104 Digital Electronics & Computer Organization

**Number System:** Binary Codes: BCD, Excess 3, parity, gray, ASCII AND EBCDIC codes, their advantages and disadvantages . Data Representation: positive, negative, maximum and minimum number representation ( related to 8 bit number) real number representation, underflow, overflow, range and accuracy of numbers.

### **Binary Arithmetic**

Binary Addition, decimal subtraction using 9's and 10's complement, binary subtraction using 1's and 2's complement, multiplication and division logic gates: truth table, properties and symbolic Representation of NOT , NAND , OR, NOR ,NAND , EX-OR, EX-NOR GATES.

### **Logic Family**

Construction and working of TTL NAND and NOR gates. Construction and working of CMOS TTL NAND AND NOR GATES. Concept of tri -state logic, comparison of TTL AND CMOS LOGIC family with respect to propagation delay time, power consumption , noise immunity, noise margin , fan-in and fan-out.

### **Boolean Algebra**

Laws and identities of Boolean algebra, Demorgan's theorem. Use of Boolean algebra for simplification of logic expression. Karnaugh map for 2,3,4 variable, simplification of SOP AND POS logic expression using k-map.

### **Combinational Circuits**

Half adder, Full adder, parallel adder, half subtractor, full subtractor , multiplexor, demultiplexer, decoder, encoder, parity detector, construction and working with timing diagram.

### **Books:**

1. Fundamentals of Digital Circuits, AnandKumar, PHI
2. Digital Electronics, Tokheim, TMH
3. Digital Electronics, S. Rangnekar, ISTE/EXCEL

## **BCA 105 Communication Skills/Technical English**

### **Introduction to Communication Meaning and Definition - Process ,Functions ,Objectives ,Importance, Essentials of good communication, Communication barriers, Overcoming communication barriers**

Spoken and conversation for Greetings, Requests, Invitation, Permission, Thanks etc.

Basic Sentence patterns

Agreement between Subject and Verb

Basic rule of Composition

Paragraph Development

Vocabulary Development

Model Auxiliary

Active and Passive voice

Conjunction and prepositions

### **Writing Skills**

Guidelines for effective writing

Writing style of application

Personal Resume

Business letter and Memo including Requests, Complains, asking quotation etc.

Technical Report writing

### **Speaking and Discussion Skills**

Components of Effective talk / presentation

Planning of content of a talk / presentation

Use of Visual aids

Effective speaking skills

Discussion skills

## Books

**Basic Managerial Skills for all - S. J. McGrath - PHI**  
**Reading to learn - Sheila Smith & Thomas M. Methuen (London)**  
**Communication conversation Practice \_ Tata McGraw Hil**

## SESSIONAL

### BCA 106 C Programming Lab

- Data types and variables, operators and expressions, evaluation of expressions
- Conditional operators, If-if else-if statement, nested if, iteration
- Repeat ion structure in C, modular programming, iteration function
- Recursion, Storage classes, arrays, structures, pointers, unions
- Searching, sorting, selection, linked list
- Searching sorting on strings, multidimensional arrays, operations on files
- Std. C library, Use of Std. C library.

### BCA 107 Office Automation Lab

Introduction MS Windows (Windows '98 Second Edition)  
Desktop, creation of folders and shortcuts, features of Windows explorer  
Familiarization and using MS packages  
Microsoft Word  
Microsoft Excel  
Microsoft PowerPoint (Version MS-Office'2000)

#### Books:

- 1.Introduction to Computers with MS-Office, Leon, TMH
- 2.Personal Computer Software, EXCEL BOOKS

## SEMESTER II

### THEORY

### BCA 201 Mathematics –II

**Differential equations:** order, degree, solution and formation of a differential equation, standard techniques of solving a linear differential equation with constant coefficients, Cauchy's and Lagrange's linear differential equations with variable coefficients.

**Linear Algebra:** Vector space, subspaces, bases and dimensions, co-ordinates, linear transformation, algebra of linear transformations, isomorphism, representation of transformation by matrices. Sequence and series: Bounded and unbounded sequences, convergence or divergence of a sequence, behaviour of monotone sequences

**Algebra Of Convergent Sequences** Cauchy's sequence, Cauchy's general principle of convergence, infinite series – its convergence and sum, series with positive terms and standard tests of convergence (without proof), alternating series, Leibnitz test, absolute convergence, rearrangement of absolutely convergent series, test of convergence of Abel and Dirichlet (without proof).

**Books:**

1. Engineering Mathematics, Vol:1 & 2, Sastry, PHI
2. Engineering Mathematics, Arumugam, Scitech
3. Higher Engineering Mathematics, Vol.2, Rathore, EPH

## BCA 202 Data Structures

**DS fundamentals:** Definition of data structure and storage structure, Classification of data structure, Selection of a data structure.

**Arrays (Vectors and matrices):** Vectors(1-D arrays), Row-major and column-major storage structures, Addition of two matrices, Multiplication of two matrices, Character arrays vs Strings.

**Stacks:** Arrays implementation, Linked-list implementation, Postfix, Prefix and Infix notation, Evaluation of postfix/prefix expression, Applications of stacks.

**Queues:** Array Implementation, Linked-list Implementation, Applications of queues.

**Linked Lists:** Singly, Doubly and Circularly linked lists.

**Trees:** Definition & Properties of binary tree, Pre-order, in-order, and post-order traversal of binary tree, Binary search tree.

**Sorting:** Bubble, Selection, Insertion, Quick & Merge Sort.

**Searching:** Sequential search & Binary Search.

### Text Books

1. Data Structures and Program Design in C, 2/e by Kruse PHI Pvt. Ltd.
2. C & Data Structures by P. S. Deshpande & O. G. Kakde, Dreamtech Pub.

### Reference Books

1. Data Structures using C by Tanenbaum, Langsam & Augenstein, PHI Pvt. Ltd.
2. Expert Data Structures with C by R. B. Patel, Khana Book Publishing Co. Pvt. Ltd.
3. Data Structures through C by G. S. Baluja, Dhanpat Rai Publication.

## BCA 203 Database Management Systems

### **Basic concepts**

Database & Database Users

Characteristics of the Database

Database Systems. Concepts & Architecture

Data Models, Schemas & Instances

DBMS Architecture & Data Independence

Data Modeling using the Entity-Relationship Approach

### **Relational Model, Languages & Systems**

Relational Data Model & Relational Algebra

Relational Model Concepts

Relational Model Constraints  
Relational Algebra  
SQL-A Relational Database Language  
Date Definition in SQL  
View & Queries in SQL  
Specifying Constraints & Indexes in SQL  
Specifying Constraints & Indexes in SQL  
A Relational Database Management Systems  
ORACLE/INGRES

### **Relational Data Base Design**

Function Dependencies & Normalization for Relational Databases  
Functional Dependencies  
Normal forms based on primary keys  
(1NF, 2NF, 3NF & BCNF)  
Lossless join & Dependency preserving decomposition

### **Concurrency Control & Recovery Techniques**

Concurrency Control Techniques  
Locking Techniques  
Time stamp ordering  
Granularity of Data items  
Recovery Techniques  
Recovery concepts  
Database backup and recovery from catastrophic failures

### **Text Book:**

1. Database Management System by Korth

### **Reference Books**

1. Desai, B., "An Introduction to Database Concepts", Galgotia Publications, New Delhi.
2. Elmsari and Navathe, "Fundamentals of Database Systems", Addison Wesley, New York.
- Ullman, J.D., "Principles of Database Systems", Galgotia Publications, New

## **BCA 204 Computer Architecture**

**Introduction:** Evolution of Computers, Stored program concept and Von-Neumann architecture, Information representation and codes, Building blocks of Computers. Register Transfer and micro operations: Concepts of bus, Data movement among registers, A language to represent conditional data transfer, Data movement from/to memory, Arithmetic and logical operations with register transfer, Timing in register transfer.

**CPU Architecture:** Instruction format, Addressing mode, Instruction execution, Fetch and execution cycles, Stacks and handling of interrupts and subroutines, Instruction pipelining: stages, hazards and methods to remove hazards.

Micro-programmed control unit: Basic organization of micro-programmed controller.

I/O Organization: Strobe based and handshake based communication, Vector and Priority interrupt, DMA based transfer.

**Microprocessors:** 8 bit microprocessor architecture; 8085 pin description



Programmers model of 8085, addressing modes of 8085; Instruction set of 8085; Assembly language program for 8085

**Memory interfacing:** I/O interfacing; Peripheral ICs; I/O memory Interfacing Chips, Bus structure of microprocessor systems, bus arbitration , Interrupt handling and DMA operation. Basic idea about microprogramming.

**Books:**

1. Structured Computer Organisation : A.S. Tanenbaum
2. Computer Organization, Hamacher, TMH
3. 8085 : Introduction to Microprocessors for Engineers & Scientists, Ghosh & Sridhar, PHI
4. Computer Organization & System Software, EXCEL BOOKS
5. System Architecture, Burd, VIKAS

## BCA 205 Managerial Economics

**Nature and Scope of Economics,** Nature of human wants, Concepts of wealth utility. Value and price, Microeconomics: Its principles, Limitation and importance, Difference between micro and macro economics.

**Managerial Economics:** Factors influencing managerial decisions, Managerial economics and order disciplines, Objectives of the firms, Managerial decisions Demand Analysis: Meaning and types of demand, Determinants of demand, Law of demand and exceptions to it, Law of diminishing marginal utility, Equi-marginal utility.

**Elasticity of demand:** determinants of Elasticity, Measurement of elasticity, Income elasticity and cross elasticity, Demand forecasting and its methods (in brief), Law of supply and exceptions to be the law of supply, Elasticity of supply.

**Production & Cost Analysis:** Production Function, Factors of production, Law of variable proportion, Returns to scale, Managerial uses of production function. Cost Concepts: Types of costs, short run cost curves and long run cost curves, Determinants of costs.

**Definition & Classification of Markets:** Revenue concepts of pricing, Average, Marginal and total revenue, Determinants of price, Pricing under different objectives, Pricing under different market structures and equilibrium of firm (perfect and monopoly) price discrimination.

**Books:**

1. Joel Dean – Managerial Economics
2. Dwivedi – Managerial Economics (Vikas)
3. Varshney & Maheshwari – Managerial Economics (SCS)
4. V.L. Mote Paul & Gupta – Managerial Economics Concepts and Cases.
5. Gokhel & Others – Business Economics
6. Ahuja – Micro Economics - S. Chand
7. Jhingan – Micro Economics - Vrinda
8. Samuelson & Mordthans – Economics

## **SESSIONAL**

### **BCA 206 Data Structures Lab**

Implementation of Stack Using Array  
Implementation of Queue Using Array  
Conversion of Infix to Postfix  
Single Linked list, Doubly Linked List  
Implementation of Stack Using Linked List  
Implementation of Queue Using Linked List  
Binary Tree Traversal, Binary Search Tree

#### **SORTING TECHNIQUES**

- a) Bubble Sort
- b) Merge Sort
- c) Quick Sort
- d) Radix Sort

#### **SEARCHING TECHNIQUES**

- a) Linear Search
- b) Binary Search

### **BCA 207 Database Lab**

Data definition language  
Data manipulation language  
Constraints and sub queries  
Basic of PL/SQL

## **SEMESTER –III**

### **THEORY**

### **BCA 301 Probability and Statistics**

Classical frequency and axiomatic approach to probability. Marginal and conditional probability. Baye's theorem and independence.

Expectation & Random Variable : Definition of random variable, discrete and continuous. Probability mass function and probability density function. Mathematical expectation. Moment, moment generating function, characteristics function.

Probability Distributions: Discrete-uniform, binomial, Poisson, distributions. Continuous - Exponential, normal (univariate & multi variate)

Correlation and Regression

Text Books:

1. J.N. Kapoor & H.C. Sexena, Mathematical Statistics, S. Chand & Co.
2. J. E. Freund : Mathematical Statistics, Prentice Hall of India.

3. Saxena&Surendram, Statistical Inference, S. Chand & Co.
4. A.A. Afifi& S.P. Azen, Statistical Analysis, Academic Press.
5. Fundamental of Mathematical Statistics by Kapur and Gupta, S. Chand & Co.

## BCA 302 Operating System

What is an operating system? Simple batch systems, multi-programmed batch systems, time sharing systems, Parallel systems, Distributed systems, real time systems.

Computer system structure—computer system operation. I/O structures storage structure, storage hierarchy and hardware protection.

Operating-system structure --- system components, system services, system calls, system programs, and system structure---simple structure.

Process concept, CPU---I/O burst cycle, scheduling algorithms (Non-pre-Emptive—FCFS, SJF, Pre-emptive—SJF, RR)

Memory management (contiguous allocation, paging, swapping, Segmentation). Virtual memory – Demand paging, page replacement, page replacement algorithms (FIFO, LRU) Thrashing.

File system structures, file allocation (contiguous, linked, and indexed), and free space management (bit vector, linked list, grouping, counting).

I/O Hardware, polling, interrupts, DMA, spooling, buffering.

Disk structure, disk scheduling (FCFS, SSTF, SCAN). Disk management- formatting boot block. Bad block, swap space management.

Security-The problem, authentication and program—threats, encryption.

### **Text Books:**

1. Silverschwatz, “Operating System Concepts”, Willey

### **Reference Books**

1. Dietel, “An introduction to operating system”, Addison Wesley
2. Tannenbaum, “Operating system design and implementation”, Phi

## BCA 303 SYSTEM ANALYSES AND DESIGN

### **Introduction**

System definition and concepts: Characteristics and types of system, Manual and automated systems. Systems environment and boundaries, Real-time and distributed systems, Basic principles of successful systems

### **Systems Analyst**

Role and need of systems analyst , Qualifications and responsibilities ,Systems Analyst as and agent of change.

### **System Development cycle**

Introduction to systems development life cycle (SDLC) : Various phases of development :Analysis, Design, Development, Implementation, Maintenance. Systems documentation considerations: Principles of systems documentation, Types of documentation and their importance, Enforcing documentation discipline in an organization .

**System Planning** : Data and fact gathering techniques: Interviews, Group communication, Presentations, Site visits. Selection plan and proposal Cost-Benefit and analysis: Tools and techniques

### **Systems Design and modelling**

Process modelling, Logical and physical design, Design representation, Systems flowcharts and structured charts , Data flow diagrams , Common diagramming conventions and guidelines using DFD and ERD diagrams. Data Modelling and systems analysis , Designing the internals: Program and Process design ,Designing Distributed Systems . Modular and structured design Module specifications ,Module coupling and cohesion , Top-down and bottom-up design

### **Object Oriented Analysis and design**

Introduction to Object Oriented Analysis and design life cycle, object modelling: Class Diagrams, Dynamic modelling: state diagram, Dynamic modelling: sequence diagramming.

### **References: -**

1. System Analysis and Design Methods, Whitten, Bentley and Barlow, Galgotia Publication.
2. System Analysis and Design Elias M. Award, Galgotia Publication
3. Modern System Analysis and Design, Jeffrey A. Hofer Joey F. George Joseph S. Valacich Addison Weseley.

## **BCA 304 Object Oriented Programming Using C++**

**Object Oriented Paradigm:** Basic Concept of Object Oriented Programming (OOP), Structure vs. OOP, Benefit of OOP, Object Modeling-Association Aggregation and Generalization.

**Introduction to C++ :** Tokens, Keywords, Identifiers, Variables, Data Types, Operators in C++, Expressions and Implicit Conversions, Control Structures.

**Functions in C++ :** The Main Function, function Prototyping, Passing argument to a function, Inline Functions, Default Arguments, Function Overloading, Friend and Virtual Functions, Storage Classes.

**Classes and objects:** ClassDeclarations, Defining Member Functions, Nesting of Member Function, Private Member Functions, arrays within a Class, Creating objects, Arrays of Objects, Objects as Function Arguments, Pointers to Members, Difference between Structures and Classes.

**Constructors and Destructors:** Constructors, Constructors with arguments, Multiple Constructors, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Destructors.

**Operator Overloading:** Defining Operator Overloading, Overloading of Unary and Binary Operators, Manipulation of Strings Using Operators, Rules for Over loading Operators, Type Conversions.

**Inheritance:** Introduction, Base and Derived Classes, Different forms of Inheritance, Virtual Base Classes, Abstract Classes, Constructors in Inheritance, Overriding Base Class Members.

**Virtual Functions and Polymorphism:** Introduction, Pointers to objects, this Pointer, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions, Friend Functions.

**Files and Streams:** Stream Classes, Opening and Closing of Files, File of Arrays, File of Structures, File Pointers and Their Manipulations, Error Handling During File Operations, Command-Line Arguments.

**Templates and Exception Handling:** Introduction, Class Templates, Function Templates, Member function Templates, Concept of Exception Handling, Different Types of Exception, Throwing Exception from a Function, Multiple Catch Statements.

**Text Books :**

1. Balguruswami, E., 'Object Oriented Programming in C++', Tata McGraw Hill Pub.

**References:**

1. Schildt : "C++ : The Complete Reference", Tata McGraw Hill Publication.
2. Deitel&Deitel : "C++ : How to Program", Pearson Education Pvt. Ltd.

## BCA 305 MANAGEMENT INFORMATION SYSTEMS

**Introduction :** Definition and significance, Evolution, MIS Support for programmed and nonprogrammed decision making Model of decision making.

**Structure of MIS :** Based on management activity and organisational function, Conceptual and physical structure of MIS.

**Information concept :** Definition of information, information presentation Quality of information DSS (decision support system) : Characteristics of DSS, Decision support and structure of decision-making, Decision support repetitiveness of decisions, Classes of DSS, DSS users, GDSS, Characteristics of GDSS.

Organisation and Information systems of information system, data and information Classification of information system, Definition of organisation.

**Introduction to ERP :** Evaluation of ERP, Integrated management, Supply-chain management and Resource management, Benefits of ERP.ERP implementation, Generalised model, Role vendors, Consultants and users.Future of ERP applications, Marketing of ERP.

**REFERENCES:-**

MIS by Jordan Davis, 2nd Edition

MIS by James A.O. Brien, Galgotia Publication, 4th Edition

MIS by Kamna Malik MIS by C S V Murthy (Himalaya Publishing House) ERP by Vinod

Kumar Garg

MIS by D P Goel

## SESSIONAL

### BCA 306 Linux/unix operating system

History, salient features, Unix system architecture, Unix command format, Unix internal and external commands, Directory commands, File related commands, Disk related commands, general utilities.

## BCA 307 C++ Programming language

### SEMESTER –IV

#### THEORY

#### BCA 401 Data Communication & Computer Networks

Introduction to digital communication systems, information and channel capacity, Entropy , Discrete and Continuous channels, Fano and Huffman's coding.

Error control coding, Hamming distance, Linear block codes, Cyclic codes, Convolution codes.

**Introduction:** History & development of computer network, network topologies, ISO reference model.

**Physical layer:** Transmission media, analog transmission, digital transmission, switching multiplexing, FDM, TDM.

**MAC layer:** Aloha Protocols, LAN—Ethernet, token ring, FDDI, and data link layer.

**Network layer:** Routing algorithms, Congestion Control algorithms, multicast and mobile routing.

**Internetworking:** Bridges, Switches, Repeaters and Routers.

**Transport Layer:** Connection Management, Flow control and buffering.

**Application Layer:** DNS, SNMP, MAIL, WWW, and FTP.

#### Text and Reference Books:

1. Forezen
2. Andrew
3. Tanenbaum

## BCA 402 Programming in JAVA

**Introduction to Java:** History of Java, Feature of Java, Types of Java programs.

JDK Toolkits

**Basic Java:** Java keywords, data type in java ,variable naming conventions, looping, construct, Arrays.

**Java oops concept:** Class, objects, Polymorphism, inheritance.

**Packages:** java packages, collection classes, creating a package.

**Java Threads:** Thread, single thread, multithread, Life cycle of a thread; the current thread, the thread class, synchronizations.

**Applet:** Applet class, life cycle of an Applet, Graphical class, Front class, passing parameters to applets.

**Concept of AWT and SWING:** Windows creation, event handling, menu, toolbar, form design etc.

Data base connectivity using JDBC

**Text and Reference Books:**

1. Java Programming by E. Balagurusamy, TMH Publishing Co. Ltd.
2. Java Programming , BLACK BOOK
3. Java 6, Sun Publication

## BCA 403 Software Engineering Principles

**Introduction:** Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

**Software Requirement Specifications (SRS):** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. ▬

**Software Design:** Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.

**Software Testing:** Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products.

**References:**

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
3. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
4. Pankaj Jalote, Software Engineering, Wiley
5. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.
6. Ian Sommerville, Software Engineering, Addison Wesley.
7. KassemSaleh, "Software Engineering", Cengage Learning.
8. Pflieger, Software Engineering, Macmillan Publication.

## BCA 404 Environmental Science

**Environmental awareness:** Definition, principles scope , and objectives of environmental science; concept on environment; World Environment Day and National Earth Day and their relevance; environmental awareness and education. Environmental movements in India (Narmada Dam, Tehri Dam)

**Components of environment:** Lithosphere, hydrosphere, atmosphere and biosphere; physical and biological environments;

**Introduction to ecology:** Definition, principles, and scope of ecology, ecosystem ecology; concepts of Gaia Hypothesis; limiting factors, combined concept on limiting factors

**Principles and concepts of ecosystem:** Concept of ecosystem; homeostasis of the ecosystem structure and functional aspects of ecosystem; ecological energetics; ecological interactions [5]

**Life Processes and characteristics:** Basic ideas with respects to growth,metabolism and developmental processes

**Biomes:** Meaning of biomes, biome type, tropical evergreen rainforest biome, Monsoon deciduous forest biome, Savana biome, Mediterranean biome, Temperate grassland biome, Tundra biome, Marine biome

**Man, society and environment:** Human civilization processes (anthropological perspectives), society, class, gender; human settlements

### Books

- 1.*Environmental Science* — S. C. Santra, New Central Book Agency.
- 2.*Environmental Science; Cunningham & Saigo WCB McGraw Hill*, 1999-5<sup>th</sup> Den.
- 3.*Environmental Science-Enger & Smith. 7<sup>th</sup> Den*, McGraw Hill .

## BCA 405 Elective-II ( Computer Graphics & Multimedia Application)

Computer Graphics Applications; Interactive graphics, Graphics devices; Memory utilization or Data Storage, Point plotting technique.

Line drawing algorithms, Circle generator, Polygon and surface generation (Register, 2-Buffer), Hidden surface removal, Shading, Solid modelling, Two dimensional transformation.

Clipping and Windowing, 3D-graphics; 3D-transformation, Parallel projection, Perspective projection.

Concept of Multimedia: Multimedia and interactivity, Multimedia technology (Sound & audio, image & graphics and animation & special effects, storage and access speed).



**Text Books:**

1. Computer Graphics; D. Hearn & P.M. Baker, Prentice Hall of India, 1995.
2. Advanced animation and Rendering Techniques; Alan Watt, Mark Watt, Addison Wesley 1992.
3. Computer Graphics – A Programming Approach; S. Harington-McGraw Hill International Edition.
4. Computer Graphics & Multimedia, G.S.Baluja, Dhanpat Rai & Co.
5. Multimedia Systems Design, P.K.Andleigh and K. Thakrar, Prentice Hall PTR, 1996.

**Reference Books:**

1. Mathematical Elements for Computer Graphics; Rogers & Adams, McGraw Hill Int. Edition.
2. Fundamentals of Interactive Computer Graphics; Foley, Van Dam, Friner, Hughes, Addison-Wesley, (2nd Edition) 1990.
3. Procedural elements for Computer Graphics; D.F. Rogers, McGraw Hill International Edition, 1985.

**SESSIONAL****BCA 406 Java Programming Lab****BCA 407 Computer Graphics Lab****SEMESTER V****THEORY****BCA 501 Internet & Web Technology****Evolution of Internet:** Introduction to internetworking, internet architecture, cookies, Session Tracking, Client server, Browser, Server, ISP.**Internet applications:** FTP, Telnet, SMTP, Email, POP3,**World wide web:** HTTP Protocol.

**Designing Web pages (static and dynamic):** Html, Html Forms, image maps, DHTML, CSS, Java Scripts, ASP .NET(Introduction, insert, update, select, delete), connectivity with database access.

**Text and Reference Books:**

1. Inline/Online Fundamentals of the Internet and the World Wide Web, GreenlawHepp, Tata McGraw Hill Publication
2. Multimedia and Web Technology, RameshBangia, Firewall Media Publication
3. Internet and Intranet Engineering, Minoli, Tata McGraw Hill Publication.

**BCA 502 Advanced Database Management System**

Transaction and schedules, Concurrent Execution of transaction, Conflict and View Serializability, Testing for Serializability, Concepts in Recoverable and Cascadeless schedules.

Lock based protocols, time stamp based protocols, Multiple Granularity and Multiversion Techniques,

Distributed Transactions Management, Data Distribution, Fragmentation and Replication Techniques, Distributed Commit, Distributed Locking schemes, Long duration transactions,

Issues of Recovery and atomicity in Distributed Databases, Traditional recovery techniques, Log based recovery, Recovery with Concurrent Transactions, Recovery in Message passing systems, Checkpoints, Algorithms for recovery line, Concepts in Orphan and Inconsistent Messages.

Distributed Query Processing, Multiway Joins, Semi joins

**References**

1. Silberschatz, Korth and Sudershan, Database System Concept', Mc Graw Hill
2. Ramakrishna and Gehrke,' Database Management System, Mc Graw Hill
3. Garcia-Molina, Ullman,Widom,' Database System Implementation' Pearson Education

**BCA 503 Fundamentals of Computer Algorithms**

Introduction: Algorithms, Analysis of Algorithms, Design of Algorithms, Complexity of Algorithms, Asymptotic Notations, Growth of function, Recurrences and their solution methods.

Sorting in polynomial Time: Insertion sort, Merge sort, Heap sort, and Quick sort

Sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort, Medians and order statistics

Advanced Data Structure: Red Black Trees, Augmenting Data Structure, Binomial Heap, B-Tree, Fibonacci Heap, and Data Structure for Disjoint Sets, All kinds of Algorithms on these data structures

Advanced Design and Analysis Techniques: Dynamic programming, Greedy Algorithm, Backtracking, Branch-and-Bound, Amortized Analysis

Graph Algorithms: Elementary Graph Algorithms, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path, All pair Shortest Path, Maximum flow and Traveling Salesman Problem

Dynamic Programming: Multistage graph problem, single-source and all pairs shortest paths, Traveling sales person problem, Longest common subsequence problem, matrix chain multiplication; Back Tracking:

8-queens problem, sum-of-subsets, graph colouring, Hamiltonian cycles; Branch-and-Bound: Least cost search.

**References :**

1. Design and Analysis of Computer Algorithms, Aho, Pearson Education Pub.
2. Fundamentals of Computer Algorithms by Horowitz and Sahani, Galgotia
3. Introduction to Algorithms by Thomas H CormenLeiserson et al, PHI
4. Computer Algorithms : Introduction to Design and Analysis by Sara Baase and Allen Van Gelder, Pearson Education
5. Algorithm Design by Jon Kleinberg and Eva Tardos, Pearson Education
6. Fundamental of Algorithms by Brassard Bratley, PHI
7. Algorithms Design by M T Goodrich et al, John Wiley
8. The Design and analysis of Algorithms by A. V. Aho et.al., Pearson Education

## 504 Elective 3 (Mobile computing)

Introduction to Mobile Communications and Computing : Mobile Computing (MC) : Introduction to MC, novel applications, limitations, and architecture. GSM : Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

Wireless Medium Access Control : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

Mobile Network Layer : Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Database Issues : Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

Protocols and Tools : Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

### **Books**

Raj kamal oxford university press 2007  
Rishabh Anand Laxmi Publication  
Devi kamal oxford university press

## 505 Programming in Visual Basic

**Controls :** Introduction to controls textboxes, frames, check boxes, option buttons, images, setting borders and styles, the shape control, the line control, working with

multiple controls and their properties, designing the user interface, keyboard access, tab controls, default & cancel property, coding for controls.

**Operations:** Data types, constants, named & intrinsic, declaring variables, scope of variables, val function, arithmetic operations, formatting data.

**Decision Making :** If statement, comparing strings, compound conditions (and, or, not), nested if statements, case structure, using if statements with option buttons & check boxes, displaying message in message box, testing whether input is valid or not.

**Modular programming:** Menus, sub-procedures and sub-functions defining / creating and modifying a menu, using common dialog box, creating a new sub-procedure, passing variables to procedures, passing argument by value or by reference, writing a function/ procedure.

**Forms Handling :** Multiple forms creating, adding, removing forms in project, hide, show method, load, unload statement, me keyword, referring to objects on a different Forms

**Iteration Handling:** Do/loops, for/next loops, using msgbox function, using string Function

**Arrays and Grouped Data Control:** Arrays - 1-dimension arrays, initializing an array using for each, user-defined data types, accessing information with user-defined data types, using list boxes with array, two dimensional arrays. lists, loops and printing list boxes & combo boxes, filling the list using property window / add item method, clear method, list box properties, removing an item from a list, list box/ combo box operations.

**Database Connectivity:** Database connectivity of forms with back end tool like mysql, populating the data in text boxes, list boxes etc. searching of data in database using forms. Updating/ editing of data based on a criterion.

## **Sessional**

**506 Internet And Web Technology Lab(HTML,DHTML,JAVASCRIPT,.NET)**

**507 Programming In Visual Basic**

## SEMESTER VI

### THEORY

#### BCA 601 Theory of Computation

*Introduction to automata* :Alphabet, Language, Grammar, Concepts of automata theory, Some applications.

*Finite automata*: An informal picture of finite automata, Deterministic and non-deterministic finite automatas, Language recognized by finite automata, Equivalence of deterministic and non-deterministic finite automata, Finite automata with epsilon-transitions.

*Regular expression and languages*: Regular expressions, Language associated with regular expressions, Connection between regular expression and regular languages, Finite automata and regular expressions, Regular grammars, Equivalence between regular languages and regular grammars, Chomsky classification of languages, Proving languages not to be regular, Pumping lemma and its applications, Properties of regular languages, Minimization of automata.

*Context free grammars and languages*: Context free grammars, Context free languages and derivation trees, Ambiguity in grammars and languages, Properties of context free languages, Normal forms of context free grammars, Pumping lemma for context free languages.

*Pushdown automata* : Basic definition, Language recognized by pushdown automaton, Pushdown automata and context free languages, Context free grammars for pushdown automata, Deterministic pushdown automata.

*Turing machines*: Definition, Turing machine model, Representation of Turing machines, Design of Turing machines, Turing thesis, Non-deterministic Turing machines

#### BCA 602 Elective 4 ( Distributed Computing)

Trends towards Parallel Processing, Type of Parallel Processing, Difference between Temporal and Data Parallelism.

*Parallel Processing Mechanism* : Multiplicity ;of functional units, Parallelism and pipelining within CPU, Overlapped CPU & I/O operation, Use of hierarchical memory; system, Balancing of subsystem bandwidths, Multiprogramming and Time sharing.

*Pipelining* : An overlapped parallelism, Instruction and Arithmetic pipelines, Principles of Designing Pipeline Processors, Vector Processing requirements, Architecture of Vector Computers.

Array Processor : SIMD Array ;Processor, SIMD Interconnection Networks, Parallel Algorithms for Array Processors.

Multiprocessor : Functional Structures, Loosely coupled Multiprocessor, Tightly coupled Multiprocessor, Interconnection Networks, Time shared of Common Buses, Crossbar switch & Multiport Memories, Multistage Networks for Multiprocessor.

### **Text Books :**

1. Computer Architecture & Parallel Processing – By K. W. & Briggs.

### **Reference Books:**

1. Quinn M. J. “Parallel Processing: Theory and Practice,” McGraw-Hill , (1994).
2. Hwang, K., “Advanced Computer Architecture : Parallelism, Scalability & Programmability”, McGraw Hill Inc. (1993).

## BCA 603 e-Commerce and e-Business

### Introduction to Electronic commerce

What is E-Commerce (Introduction And Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, Different types of business models ie. B2B, B2C, C2C, C2B and B2G.

### Internet Security:

Secure Transaction, Privacy on Internet, Corporate Email privacy, Threats, Attack on Computer System, Hacking, Computer Virus( How it spreads, Virus problem, virus protection, Authorisation and Authentication, Firewall, Digital Signature.

### Electronic Data Exchange

Introduction, Concepts of EDI , Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System(Electronic Tokens, E-Cash, E-Cheque, Smart Card, Credit Card, Debit Card, Proximity, Biometric), Electronic Fund Transfer, Electronic Cash

### Online business Transaction

Meaning, Purposes, Advantages and disadvantages of transacting online, E-commerce applications in various industries like {banking, insurance, payment of utility bills,online marketing, e-tailing(popularity, benefits, problems and features), onlines hopping(amazon, snapdeal, alibaba etc.).

### **Books**

E-Commerce Concepts, Models, Strategies- :- G.S.V.Murthy Himalaya Publishing House  
E- Commerce :- Kamlesh K Bajaj and Debjani Nag  
Electronic commerce :- Gray P. Schneider  
E-Commerce, Fundamentals & Applications : Chand (Wiley)

# BCA 604 Accounting and Financial Management

*Financial statements and ratio analysis* : Balance sheet, profit and loss accounts, various types of ratios based on balance sheet, income statements and their usefulness.

*Working capital management* : Definition, need for working capital, sources and user of working capital, determination of appropriate level of working capital (Hedging principle), Inventory mode.

*Budget and budgetary control* : Nature, scope and importance, methods of finalization of master budget and functional budgets.

*Cost and management accounting* : Cost terminology, cost elements-labour, material, overhead, methods of distributing overhead, methods of costing-job and process costing.

*Accounting for fixed assets and depreciation* : Methods for calculating depreciation, accounting for depreciation, selecting methods for depreciation, intangible assets, financing engineering enterprises-shares, bonds, debentures etc.

*Marginal costing* : Nature, scope and importance, break-even analysis, its uses and limitations, construction of break-even chart, practical applications of marginal costing.

*Standard costing* : Nature and scope, computation and analysis of variances with reference to material cost, labour cost and overhead cost, interpretation of variances.

*Uncertainty in economic studies* : Risk & return concepts, expected return in a portfolio, portfolio risk, diversifiable and non-diversifiable risk, Markowitz model; the mean variance criterion, selection of optimal portfolio.

## **Text Books:**

- 1) Narayanswami - Financial Accounting: A Managerial Perspective (PHI, 2<sup>nd</sup> Edition).
- 2) Mukherjee - Financial Accounting for Management (TMH, 1<sup>st</sup> Edition).
- 3) Ramchandran&Kakani - Financial Accounting for Management (TMH, 2<sup>nd</sup> Edition).
- 4) Ghosh T P - Accounting and Finance for Managers (Taxman, 1<sup>st</sup> Edition).
- 5) Maheshwari S.N &Maheshwari S K – An Introduction to Accountancy (Vikas, 9<sup>th</sup> Edition)
- 6) Ashish K. Bhattacharya- Essentials of Financial Accounting (PHI, New Delhi)
- 7) Ghosh T.P- Financial Accounting for Managers (Taxman, 3<sup>rd</sup> Edition)
- 8) Maheshwari S.N &Maheshwari S K – A text book of Accounting for Management (Vikas, 1<sup>st</sup> Edition)
- 9) Gupta Ambrish - Financial Accounting for Management (Pearson Education, 2<sup>nd</sup> Edition)

## **SESSIONAL**

### **BCA 606 Industrial Training**

### **BCA 607 Project And Viva Voce**

# Elective Papers

## Artificial Intelligence

*Scope of AI:* Games, theorem Proving, Natural language Processing; Vision & speech processing, Robotics, Expert Systems; AI techniques-Search, Knowledge, Abstraction.

*Problem Solving:* State space search, Control Strategies (Depth first search, Breadth first search, Production systems). Problem Characteristics (Decomposable, ignorable, recoverable, predictable).

*Use of Heuristics:* Hill climbing; Best first search; A\* algorithm

*Game Playing:* Minimax search; Alpha-Beta pruning.

*Knowledge Representation:* Predicate Logic (Well formed formulas, quantifiers, Prenex Normal Form, Skolemization, Unification, modus ponens, Resolution refutation-various strategies).

*Natural Language Processing:* Syntactic analysis, Top down and bottom up parsing, Augmented Transition Networks, Semantic analysis, case grammars,

*Handling uncertainty:* Probabilistic reasoning (Bayes Net, Dempster Shafer Theory). Use of Certainty Factors, Fuzzy Logic Nonmonotonic reasoning (Dependency directed backtracking, Truth maintenance systems).

*Learning:* Concept of learning, Learning automation; The Genetic algorithm; Learning by induction; Neural Networks (Hopfield Networks; Perceptrons – Learning algorithm, Backpropagation Network, Boltzman Machine, Recurrent Networks)

## Books

- 1) DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
- 2) Russell & Norvig, Artificial Intelligence-A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.
- 3) Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition, 1991.

## Linear Programming

**Linear Programming:** Structure of linear programming model, advantages and limitations of linear programming, application areas of linear programming,

**Mathematical Model of Linear Programming Problem:** Examples on production, marketing, finance, agriculture and transportation

**Graphical Solution Methods of Linear Programming problem:** Examples on minimization and maximization linear programming problem, examples on mixed constraints linear programming



**Special cases in Linear Programming:** Alternative (or multiple) optimal solutions, unbound solution, infeasible solution

**Simplex Method:** Standard form of linear programming, simplex algorithm (maximization case), simplex algorithms (minimization case): Two phase method, big-M method.

Unbound solution, infeasible solution

**Duality in Linear Programming:** Formulation of dual linear programming problem, advantages of duality, dual simplex algorithm

**Sensitivity Analysis:** Changes in objective function coefficient, changes in the availability of resources, changes in input-output coefficients.

**Transportation Problem:** Methods for finding initial solution: North-West corner method, least cost method, Vogel's approximation method.

**Test for Optimality:** MODI method

**Assignment Problem:** Solution optimal solution, maximization case in assignment problem, travelling salesman problem.

#### **Text Books:**

1. J. K. Sharma, "Operations Research : Theory and Applications", 3/e Macmillan Publishers India
2. Ravindran, Phillips & Solberg, "Operations Research: Principles and Practice", 2nd Ed, Wiley India publisher

#### **References:**

1. Hadley, G., "Linear Programming, and Massachusetts", Addison-Wesley
2. Taha, H.A, "Operations Research – An Introduction", Macmillian
3. Hiller, F.S., G.J. Lieberman, " Introduction to Operations Research", Holden-Day
4. Harvey M. Wagner, "Principles of Operations Rsearch with Applications to Managerial Decisions", Prentice Hall of India Pvt. Ltd.
5. Swarup K etal, "Operation Research", S. Chand