SCHEME OF EXAMINATION

&

SYLLABI

for

MASTER OF COMPUTER APPLICATIONS
(Software Systems)

for

Lao PDR students

**GURU GOBIND SINGH
INDRAPRASTHA
UNIVERSITY**

Offered by

University School of Information Technology

Guru Gobind Singh Indraprastha University
Kashmere Gate, Delhi – 110 403 [INDIA]
www.ipu.ac.in

MCA (Software Systems) for Lao PDR students approved in the BOS on 12th Jan, 09 and 26th AC Meeting on 19th Jan, 09 w.e.f. for batch 2007

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SCHEME/SYLLABUS
MASTER OF COMPUTER APPLICATIONS (SOFTWARE SYSTEMS) for LAOS Students
University School of Information Technology

First Semester				
Code No.	Paper	L	T/P	Credits
ITS-601	Introduction to Information Technology	3	1	4
ITS-603	Programming in C	3	1	4
ITS-605	Web Technology	3	1	4
HS-607	Basic English Skills-I	3	1	4
Practicals				
ITS-651	Lab – I	0	4	2
ITS-653	Lab – II	0	4	2
	TOTAL	12	12	20

Lab-I Practical on Introduction to Information Technology & Web Technology
Lab-II Practical on Programming in C

Second Semester				
Code No.	Paper	L	T/P	Credits
ITS-602	Programming in VB	3	1	4
ITS-604	Data Base Management System	3	1	4
ITS-606	Fundamentals of Digital Electronics	3	1	4
HS-608	Basic English Skills-II	3	1	4
Practicals				
ITS-652	Lab – I	0	4	2
ITS-654	Lab – II	0	4	2
ITS-656	Lab – III	0	4	2
	TOTAL	12	16	22

Lab-I Practical on DBMS

Lab-II Practical on Fundamentals of Digital Electronics
Lab-III Practical on Programming in VB

Third Semester				
Code No.	**Paper**	**L**	**T/P**	**Credits**
ITS-701	Foundations of Computer Science	3	1	4
ITS-703	Programming in C++	3	1	4
ITS-705	Operating System Concepts	3	1	4
ITS-707	Software Engineering	3	1	4
ITS-709	Minor Project	-	4	10
Practicals				
ITS-751	Lab – I	0	4	2
ITS-753	Lab – II	0	4	2
	TOTAL	**12**	**12**	**30**

Lab-I Practical on Programming in C++
Lab-II Practical on Software Engineering

Fourth Semester				
Code No.	**Paper**	**L**	**T/P**	**Credits**
ITS-702	Computer Architecture	3	1	4
ITS-704	Data Structures	3	1	4
ITS-706	Computer Networks	3	1	4
ITS-708	Software Project Management	3	1	4
ITS-710	Major Project	-	8	12
Practicals				
ITS-752	Lab – I	0	4	2
ITS-754	Lab – II	0	4	2
	TOTAL	**14**	**20**	**32**

Lab-I Practical on Data Structure
Lab-II Practical on Computer Networks

Fifth Semester				
Code No.	Paper	L	T/P	Credits
ITS-801	Java Programming	3	1	4
ITS-803	Linux & X-Windows Programming	3	1	4
MS-805	Organizational Behavior	3	1	4
Electives (Select any two)				
ITS-807	Artificial Intelligence	3	1	4
ITS-809	Software Testing	3	1	4
ITS-811	.NET Framework using C#	3	1	4
ITS-813	.NET Framework using VB.NET	3	1	4
ITS-815	Web App. Developed in ASP.NET	3	1	4
ITS-817	Advanced Web Technology	3	1	4
ITS-819	Software Engineering with UML	3	1	4
ITS-821	Network Management & Information Security	3	1	4
ITS-823	Management Information Systems	3	1	4
ITS-825	Distributed Systems	3	1	4
ITS-827	Computer Graphics	3	1	4
ITS-829	Operation Research	3	1	4
ITS-851	Lab – I	0	4	2
ITS-853	Lab – II	0	4	2
ITS-855	Lab - III	0	4	2
	TOTAL	15	17	26

Lab-I Practical on Linux & X-Windows Programming
Lab-II Practical on Java Programming
Lab-III Practical based on Electives

Sixth Semester				
Code No.	Paper	L	T/P	Credits
ITS – 852	Dissertation	-	-	25
ITS – 854*	Seminar and Progress Reports	-	-	5
	TOTAL	-	-	30

*NUES

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports.

Note:

The students would qualify for:

1. A degree in M.Sc. (IT) if he has undergone the courses of studies, completed project reports/dissertation specified in the first 4 semesters of the MCA (SS) curriculum within two years and secured minimum 96 credits out of 104.
2. A degree in MCA (SS) if he has undergone the courses of studies, completed project reports/dissertation specified in the 6 semesters of the course curriculum and secured minimum 148 credits out of 160 credits prescribed for the award of MCA (SS) degree.

(Note 1 and 2 was Approved by 18th Meeting of Board of Studies of USIT dated 24th January, 2008 and 24th Meeting of Academic Council dated 1st May, 2008)

ITS 601   **Information Technology**   **L-3, T-1, Cr -4**

Unit I:

Introducing Computer Systems, Exploring Computers and Their Uses Looking Inside the Computer System, Input and Output Media: Input and output devices, memory devices.

Unit II:

Processing Data, Word processor, Preparing presentation, Transforming Data Into Information, Modern CPUs, Storing Data, Types of Storage Devices, Measuring and Improving Drive Performance, data representation in computer

Unit III:

Operating Systems basics, Types of operating system, Functions of operating system, Networking basics, Introduction to data communication

Unit IV:

The Internet: Internet and the World, E-Mail and Other Internet Services, Internet applications, Data over internet, Internet tools. Database Fundamentals, Computer security, Need for Security Measures, Emerging trends in IT

Text books:

1. Peter Norton, "Introduction to Computers", TMH, 2006

2. ITL Education Solutions Ltd., "Introduction to Information Technology", Pearson Education, 2006

References Books:

1. Leon and M. Leon, "Fundamentals of Information Technology", Vikas Publishing House, 2003
2. Rajaraman V., "Fundamentals of Computers", PHI, 2004
3. Sanders D. H., "Computers Today", McGraw Hill, 2005

ITS-603   **Programming in C**   **L**   **T**   **C**
                                                                          3   **1**   **4**

Unit I:
Review of Flow chart, History of C , Basic structure of C Programs , Execution of C Program ,Constants , Variables , Data types , Operators and Expressions : arithmetic , relational, Logical , assignment , increment and decrement , conditional operators, precedence and associativity of Operators , type conversion , Decision making constructs including simple if , if else, and else-if ladder

Unit II:

Switch construct, ? Operator, goto statement, while, do..while , For Looping constructs , jumps in loops , Introduction to arrays , One dimensional arrays and their declaration and initialization . Two dimensional arrays and their implementation. Character array and string, declaration and initialization of strings, comparison and concatenation of two strings, string handling functions

Unit III:

User Defined functions and it's need, Definition and Elements of a user defined function, function calls, call by value and call by reference mechanism. Structure, definition, declaration and implementation, accessing structure members, nesting of structures, Union and difference with structures, array of structures.

Unit IV:
Pointers : Introduction , declaration and initialization , Pointer arithmetic and concept of scale factor , Pointer and arrays , Pointer and character strings , Pointer as function arguments , function returning Pointers , Pointers to function , dynamic Memory allocation , calloc () and Malloc () and Free () functions

Unit V:

Definition , Opening and closing File Operations , input –Output Operation on files , error handling during I/O Operation, copying the contents of one file into another.

Text Books

1. Balagurusamy .E , " Programming in Ansi C : Third Edition " , Tata McGraw Hill, 2003
2. Gottfried , " Programming with C : Second Edition " , Tata McGraw Hill, 2005

Reference Books:

1.Salaria R.S." Application Programming in C" , Khanna Publication, 2001
2. Kernighan and Ritche ," The C Programming Language " , PHI, 1990
3. Johnsonbaugh R and Kalin M , " Application Programming in C " , PHI, 2000
4. Kanetkar. Y " Let Us C " , BPB Publication, 2000

ITS-605   **Web Technology**   **L-3, T-1, Cr -4**

Unit I

Internet & Web: History and growth of Internet and Web , Introduction to WWW, Web Browsers and Search Engines, Internet protocols and applications , overview of various internet & web technologies, cyber laws.

Web Design: Key issues and challenges .

Unit II

HTML : Introduction to HTML, Elements of HTML syntax, Head and Body sections, Building HTML documents, Inserting text, images, hyperlinks, Backgrounds and Color Control, ordered and unordered lists, content layout & presentation.

Tables: use of table tags and various other HTML tags .

Unit III

HTML Editors & Tools: Use of different HTML editors and tools like Microsoft Front Page etc.

Graphical and Animation Tools: Use of Different graphical and animation tools like Abode Photoshop and Gif Animator .

Unit IV

Frames: Developing Web pages using frames.

Security: Considering various security issues like firewalls etc.

Unit V

Interactivity: Creating interactive & dynamic web pages, DHTML,Creating forms, CGI, ASP.

Web Technologies: Current web technologies and their applications. Use of java script and java applets , web engineering and semantic web technology .

Text:

1. Achyut S Godbole and Atul Kahate, "Web Technologies", Tata McGraw Hill
2. C. Xavier, "Web Technology & Design ", Tata McGraw Hill.
3. Ann Navarro, " Effective Web Design", BPB publications.
4. Raj Kamal, "Internet & Web Design", Tata McGraw Hill
5. E Stephen,Will Train, "HTML 4.0", BPB publication

References:

1. VK Jain, "Advanced programming in web design",Cyber tech publications
2. Rick Dranell, "HTML4 unleashed", Techmedia Publication.
3. TM Ramachandran , "Internet & Web development", Dhruv publications
4. James L Mohler and Jon Duff, "Designing interactive web sites",Delmar Thomson learning .
5. Ivan Bay Ross, "HTML,DHTML,Java script,Perl CGI" , BPB

Objective

Initial work (written & oral) with the students indicates that though they have some idea of English language, but none of them has systematic exposure to written language. As a result they falter in making even rudimentary expressions.

The aim of the present activity with them will be to streamline their syntactic understanding of language, enabling them to express themselves through the written medium. This will make them capable of putting their thoughts, ideas and concepts in black and white. Moreover, this will give their expression intelligibility, sustainability and consistency. Besides enhancing their reading and comprehension skills, it will make them better listeners too.

Syllabus

1. Tenses   :   Simple Present & Present Perfect, Continuous, Past, Perfect Continuous, the Future .
2. Sequence of Tenses
3. Helping Verbs: Be, have,do,linking verbs.
4. Modals
5. Forming Questions
6. Verbs: Finite and non-finite, Transitive and intransitive
7. Subject- Verb Agreement
8. Reporting
9. Conditional Sentences
10. Types of Clauses
11. Word Formation
12. Prepositions
13. Articles
14. Determiners & Quantifiers
15. Adjectives
16. Adverbs
17. Linking Words
18. Common errors

ITS- 602   **Programming in VB**   **L-3,T-1,Cr-4**

Unit 1

Variable Names, Data Types, Assignment, If-then, if-then-else, if then-elseif-else, expression, print statement, arrays, variable declaration, built-in & User Defined types

Unit 2

Subroutine and functions, Boolean Operators, Arithmetic Operator, For-.next, do loop, while-wend, procedures/Public, Private, and Static & Dim Statement.

Unit 3

Structure of VB program, Forms & built in controls, Properties and events, Code Module, Scale Modes, Printer Object (Printing text, setting Fonts, graphics) Common dialog Boxes, picture controls, image-controls, send keys, MS-Common controls, Error Handling, Classes, Control Arrays, MDI, SDI.

Unit 4

Review of ANSI SQL, ODBC, Pass through ODBC, DAO, MS-Jet Engine, DB-Engine, Workspaces, Databases, recordsets, Data bound controls, ActiveX controls, ADO, Active X Data controls, RDO

Text:

1. B. Reselman et al, "Using Visual Basic 6", PHI
2. B. Siler & J. Spotts, "Using Visual Basic 6", PHI

Reference:

1. E. Petroutsos, "Mastering Visual Basic 6.0", BPB.
2. Mohd. Azam, "Programming with Visual Basic 6.0", Vikas Publication

Unit I:
Basic concepts: database & database users, characteristics of the database, database systems, concepts and architecture, date models, schemas & instances, DBMS architecture & data independence, database languages & interfaces

Unit II:
Data modelling using the entity-relationship approach. Overview of hierarchical, Network & Relational Data Base Management Systems, MS-Access.

Unit III:
Relational model, languages & systems: relational data model & relational algebra: relational model concepts, relational model constraints, relational algebra, SQL- a relational database language: data definition in SQL, queries in SQL

Unit IV:
Relational data base design: function dependencies & normalization for relational dataases: functional dependencies, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition.

Unit V:
Concepts of object oriented database management systems, Distributed Data Base Management Systems.

Text:

1. Avi Silberschatz, Henry F. Korth, S. Sudarshan ," Database System Concepts Fifth Edition, McGraw-Hill, 2005.
2. ISRD Group,"Introduction to Database Management Systems", TMH, 2005

Reference:

1. Desai, B., "An introduction to database concepts", Galgotia publications, 2002
2. Elmsari and Navathe, "Fundamentals of database systems", Addison Wesley, 1994
3. Ullman, J. D., "Principals of database systems", Galgotia publications, 1996
4. Date, C. J., "An introduction to database systems", 7rd Edition, Addison Wesley, 2001

ITS-606   **Fundamentals of Digital Electronics**   **L-3,T-1,Cr-4**

Unit I:
Analog & Digital signals, AND, OR, NOT, NAND, NOR & XOR gates, Boolean algebra, Standard representation of Logical functions, K-map representation and simplification of logical functions, Don't care conditions, X-OR & X-NOR simplification of K-maps.

Unit II:
Combinational circuits: Multiplexers, demultiplexers, Decoders & Encoders, Adders & Subtractors, Code Converters, comparators

Unit III:
Flip Flops: S-R, J-K, D & T Flip-flops, excitation table of a flip-flop, race around condition, Sequential circuits: Shift registers, Ripple counter, Design of Synchronous counters and sequence detectors.

Unit IV:
A/D and D/A converters, Bipolar-Transistor Characteristics, RTL and DTL circuits, TTL, ECL and C-MOS Logic families.

Unit V:
Logic Implementations using ROM, PAL & PLA., Semiconductor Memories: Memory organization & operation, classification and characteristics of memories, RAM, ROM and content addressable memory.

Text:

1. R.P. Jain, "Modern Digital Electronics", TMH, 2nd Ed, 2005
2   Morris Mano, "Digital Design", PHI, 2nd Ed., 2004

Reference :

1. Malvino and Leach, "Digital principles and applications", TMH, 1985
2. R. J. Tocci, "Digital Systems", PHI, 2000
3. I.J Nagrath, "Electronics, Analog & Digital", PHI, 1999.
3. J. M. Yarbrough, "Digital Logic-Application and Design", PWS Publishing, 2001
4. B. S. Nai, " Digital Electronics and Logic Design", PHI, 2002
5. Balabanian and Carlson, "Digital Logic Design Principles", Wiley Pub., 2003

HS – 608   **Basic English Skills – II**   **L-3   T-1   C-4**

Unit 1: Remedial Exercises, Vocabulary Exercises, Phrasal Verbs, Idiomatic Expressions.

Unit 2: Phrases, Clauses and Sentences; Infinitive Patterns and Gerunds.

Unit 3: Comprehension of Written and Spoken Texts; Developing Writing Efficiency

Unit 4: Composition: a) Note Making
                     b)Paragraph Writing
                     c) Correspondence- Personal & Official
                     d) Writing Longer Pieces

Text:

1. Advanced English Grammar By Martin Hewings (CUP).
2. Written and Spoken Communication in English, (Universities Press).

ITS- 701   Foundations of Computer Science   L-3, T-1,Cr-4

Unit - 1
Sets, Subsets, powersets, binary and unary operations on a set, set operations/set identities, Fundamental counting principles, principle of inclusion and exclusion, pigeonhole principle, Permutation and combination, pascal's triangles, binominal theorem.

Unit - 2
Relation, properties of binary relation, closures, partial ordering, equivalence relation, properties of function, composition of function, inverse of a function

Unit – 3
Matrices and determinants, Linear transformations, Systems of linear equations- consistency and inconsistency, Gauss elimination, rank of a matrix, inverse of a matrix, Bilinear, Quadratic, Unitary, Orthogonal and Hermitian matrices; Skew-Hermitian Forms.

Unit – 4

Mathematical Logic: Logic operators, Truth tables, Theory of inference and deduction, mathematical calculus, predicate calculus, predicates and quantifiers. Boolean Algebra, K-maps, Simplification of Boolean Expressions.

Text:

1. Kolman, Busby & Ross "Discrete Mathematical Structures", 5th Edition, PHI .2004.
2. E. Kreyszig, "Advanced Engineering Mathematics", 9th Edition, Wiley Eastern, May 2006.

Reference:

1. Trembly. J. P & Manohar. P "Discrete Mathematical Structures with Applications to Computer Science", Mc Graw Hill,1987.
2. M.Lipson & Lipshutz, "Discrete Mathematics", Schaum's Outline series ed. McGraw-. Hill (1995).
3. Grewal B.S., "Higher Engineering Mathematics", (35th Edition), Khanna Publishers, Delhi, 2000.

ITS- 703 **Programming in C++** **L-3,T-1,Cr-4**

Unit 1

Objects, relating to other paradigms (functional, data decomposition),basic terms and ideas (abstraction, encapsulation, inheritance, polymorphism).

Unit 2

Overview of C, Encapsulation, information hiding, abstract data types, object & classes: attributes, methods. C++ class declaration, state identity and behavior of an object, constructors and destructors, instantiation of objects, default parameter value, object types, C++ garbage collection, dynamic memory allocation, metaclass.

Unit 3

Inheritance, Class hierarchy, derivation – public, private & protected, aggregation, omposition vs classification hierarchies, polymorphism, operator overloading, parametric polymorphism, generic function – template function, function name overloading, overriding inheritance methods, run time polymorphism.

Unit 4

Standard C++ classes, using multiple inheritance, persistent objects, streams and files,

Text:

1. A. R. Venugopal , Rajkumar, T. Ravishankar, "Mastering C++", First edition, 1998, TMH.
2. E. Balaguruswamy, "Objected Oriented Programming with C++", TMH 2nd ed.

References:

1. R. Lafore, "Object Oriented Programming using C++" Galgotia, New Delhi, 1993.

ITS-705   **Operating System Concepts**   **L 3 T 1 C4**

Unit I.

Introduction to the Operating System, Types of OS: Batch System, Time Sharing System, Real Time System, Multiuser/Single User System.

Functions of Operating System: Process Management, Memory Management, File Management, I/O Devices Management, Information Management.

Unit II

Process Management: Process Concept, Process State, Process Control Block, Process Scheduling, Context Switch, CPU Scheduling, Scheduling Criteria, Scheduling Algorithms, Pre Emptive/ Non Preemptive Scheduling, Threads, Thread Structure Introduction to Deadlock.

Unit III

Memory Management: Contiguous Allocation, External Internal Fragmentation, Paging, Segmentation, Segmentation with Paging.

Virtual Memory: Virtual Memory Concept, Demand Paging, Page Replacement, PR Algorithms, Allocation of Frames, Thrashing.

Unit IV

Information Management: File Concept, Access Methods, Directory Structure.

Device Management: Disk Structure, Disk Scheduling Algorithms, Disk Management, Case study on DOS, Windows 2000, Windows XP, Linux

Text:

1. Silbershatz and Galvin," Operating System Concept", Addition We seley, 2002.

References:

1. A.S. Tannenbaum,"Operating System Concept", Addition Weseley, 2002
2. Flynn, Mchoes, "Understanding Operating System", Thomson Press, Third Edition, 2003
3. Godbole Ahyut, "Operating System",PHI, 2003.

ITS 707   **Software Engineering**   **L-3, T-1, Cr-4**

Unit 1

Software Crisis, Software Myths, Importance of Software Engineering, Difficulties in improving Software Process, Software Characteristics, Software life cycle models: Build & Fix Model, Waterfall, Prototype, Iterative Enhancement, Evolutionary and Spiral models, Rapid Application Development

Unit 2

Steps of Requirement Engineering, Types of Requirements, Requirement Elicitation Techniques, DFD's , Software Requirement specifications

Unit 3

Effort Estimation Techniques, Function Point, COCOMO.

Unit 4

Cohesion & Coupling, Classification of Cohesiveness & Coupling, Strategies of Design.

Unit 5

Functional testing: Boundary value analysis, Equivalence class testing, Introduction to Structural testing, Cyclomatic Complexity. Software maintenance, Categories of software maintenance

Text:

1. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International, 2007.
2. R. S. Pressman, "Software Engineering – A practitioner's approach", 3rd ed., McGraw Hill Int. Ed., 1992.

Reference:

1. R. Fairley, "Software Engineering Concepts", Tata McGraw Hill, 1997.
2. P. Jalote, "An Integrated approach to Software Engineering", Narosa, 1991.

ITS 702   **Computer Architecture**   **L-3,T-1,Cr-4**

Unit-I

Data Representation: Binary numbers, binary codes, fixed point representation, floating point representation, error detection codes. Memory units

Unit-II

Register Transfer and Microoperation: Register transfer language, register transfer, bus and memory transfer, arithmatic microoperations, logic microoperations, shift microoperations., Arithmetic Logic shift Unit

Unit-III

Basic Computer Organization and Design: Instruction codes, computer registers, computer instructions, timing & control, instruction cycle, memory reference instructions, input- output and interrupts ,.

Microprogrammed Control Unit: Control memory, address sequencing. Design of Control Unit

Unit-IV

Central Processing Unit: Introduction, general registers organization, stack organization, instruction formats, and addressing modes.

Input – Output Organization: Peripheral devices, input – Output interface, asynchronous data transfer, modes of data transfer, priority interrupt, direct memory access, input – output processor.

Text:

1. Mano, M "Computer System and Architecture", (3rd edition) Prentice Hall of India, New Delhi, 1994.

References:

1. Malvino "Digital Principals and Applications, 4/e", Mc Graw Hill.
2. Stallings,W "Computer Organization & Architecture", fifth edition, 2000 PHI.

ITS-704   **Data Structures**   **L-3, T-1, Cr-4**

Unit – 1: Introduction to data structures

Introduction to programming methodologies, design of algorithms. Abstract data type, array, array organization, introduction to pointers

Structured data types: Array of records and records of array Differentiation between structured data and data structure

Unit 2: Data Structures: List, Stack

Link Lists: List manipulations, Single link list, double link list and circular link lists, various operations like insertion, deletion and searching in all three lists and their comparison

Stacks: Stack Manipulation, Prefix, infix and postfix expressions, their inter conversion and expression evaluation.

Unit 3: Queues and Trees

Queues: Queue manipulation, Priority queues

Trees, Properties of Trees, Binary trees, Binary Tree traversal, binary search trees,

Unit – 4: Searching and Sorting

Searching – List search, sequential search, and binary search

Sorting concept, order, stability, selection sorts, insertion sort, bubble Sort, merge sort

Hashing: hashing concepts, hashing methods (Direct, modulo division) and collision resolution (by open addressing: linear probe, quadratic probe), Bucket hashing.

Text:

1. T .H . Cormen, C . E . Leiserson, R .L. Rivest "Introduction to Algorithms", Second Edition, 2001 ,Tata McGraw-Hill.
2. A .V. Aho, J . E . Hopcroft, J . D . Ulman "Data Structures and Algorithm", 2nd ed, Addison-Wesley 2001.

Reference

1. S. Sahni and E. Horowitz, "Data Structures", Galgotia Publications,2003.
2. Tanenbaum: "Data Structures using C", Second Edition, 2000, Prentice Hall of India.

ITS-706   **Computer Networks**   **L-3, T-1, Cr-4**

UNIT – I
Networks, Categories and Uses of Computer Networks, Network Hardware, Network Software, Topology, Types of Networks , Theoretical Basis for Data Communication, Reference Model (OSI, TCP/IP Overview), Guided Transmission Media, Unguided Transmission Media : Wireless Transmission, Communication Satellites. Introduction to the Physical Layer

UNIT – II
The Data Link Layer: Ethernet Frame Format, Flow Control Protocols, Stop-and-wait Flow Control, Sliding – Window Flow Control, Error Control, Stop-and-wait ARQ, Go-back-N, Selective-repeat. Introduction to Switches, hubs and repeaters.

UNIT – III
The Network Layer: Circuit Switching & Packet Switching, Packet format IPv4 Addressing Mechanism, Routers, and Routing Techniques.

UNIT – IV
The Transport Layer: Connection Oriented and Connection less Service Protocols: UDP, TCP.
Application Layer: DNS, SMTP, MIME.

Text:
1. Behrouz A. Forouzan, "Data Communications and Networking", 3rd Ed., TMH, 2004
2. A. S. Tanenbaum, "Computer Networks", 4th Ed., Pearson, 2003

References:
1. Comer E. Doughlas, "Computer Networks and Internets", 2nd Ed., Pearson, 2000
2. W. Stallings, "Data and Computer Communications", 7th Ed., Pearson, 2002.

ITS-708   **Software Project Management**   **L-3, T-1, Cr-4**

UNIT – I

Introduction to Software Project Management: Introduction, Why is software project management important? What is a project? Software projects versus other types of project, Activities covered by software project management, Some ways of categorizing software projects, Problems with software projects,

Introduction to Step-Wise project planning, Initiating, Planning Executing and Closing Software Projects

UNIT II
Cost-benefit evaluation techniques: Net Profit, Payback Period, Return on Investment, Net Present Value

UNIT III

Activity planning: Introduction, The objectives of activity planning, Sequencing and scheduling activities, Network planning models, Formulating a network model (CPM), Adding the time dimension, The forward pass, The backward pass, Identifying the critical path

Risk management: Introduction Risk, Categories of risk, A framework for dealing with risk, Risk identification, Risk assessment, Risk planning, Risk management, Applying the PERT techniques

UNIT IV

Resource allocation: Introduction, The nature of resources, identifying resource requirements
Monitoring and control: Introduction, Collecting the data, Visualizing progress The Gantt-Chart, Slip Chart, The Ball Chart, The Timeline
Introduction to Types of Contracts

Text:

1. Bob Hughes & Mike Cotterell "Software project Management" TMH Publication, 4th Edition, 2006.

References:

1. Kathy Schwalbe, "Information Technology Project Management", Thomson, 4th ed. 2005.

ITS 801   **Java Programming**   **L-3, T-1, Cr -4**

Unit I

Introduction to Java: Importance and features of java, keywords, constants, variables and data types, Operators and expressions, Decision making, branching and looping: if..else, switch, ?: operator, while, do, for statements, labeled loops, jump statements: break, continue, return.

Unit II

Introducing classes, objects and methods: defining a class, adding variables and methods, creating objects, constructors, class inheritance.Arrays and strings: creating an array, one and two dimensional arrays, string array and methods, String and StringBuffer classes, Wrapper classes. Inheritance: Basics types, using super, Multilevel hierarchy abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages.

Unit III

Exception Handling: Fundamentals exception types, uncaught exceptions, throw, throw, final, built in exception, creating your own exceptions. Multithreaded Programming: Fundamentals, Java thread model: priorities, synchronization, messaging, thread class, Runnable interface, interthread Communication, suspending, resuming, and stopping threads.

Input/Output: Basics, Streams, Byte and Character stream, predefined streams, Reading and writing from console and files. Using Standard Java Packages (lang, util, io, net).

Unit IV

Networking: Basics, networking classes and interfaces, doing TCP/IP and Datagram Programming. Event Handling: Different mechanism, the Delegation Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes, Working with windows, graphics and text, using AWT controls, Layout managers and menus, sound and video, Java Applet.

Text Books:

1. Java-2 The complete Reference by Herbert Schildt, Osborne.

Reference Books:

1. "Computing Concepts with Java 2 Essentials", by Horstmann, John Wiley.
2. "Programming.Java", Decker & Hirshfield, Vikas Publication
3. "HTML 4 unleashed", by Rick Dranell, second edition, Techmedia publication.
4. "Dynamic web publishing unleashed" by Shelley Powers, 2ndedition, Techmedia.

Unit I

Installation of Linux , Linux Operating System Concepts and Architecture , User Space, Kernel Space, Processes and Daemons, Process Control , , Linux File system, User, Group and Resource Management , Configuration Files, File system Permissions, Access Permissions and Security, ,

Unit II

Linux file system in detail , /proc file system , Common File system Commands, Partitioning and Disk Management, Installing and Selecting Software, Selecting Services for Startup, Configuration , Utilities, Updating Software and Package Management , System Startup, Shutdown and Reboot , System Boot Process Run levels, Rc.d and init.d

Unit III

Linux distribution Apache Installation, Configuration files , Networking in Linux overview , network configuration , configuring Linux firewall , DNS , FTP , network file system , network Information service (NIS) , Samba , LDAP , Data Backup, Restore and Disaster Recovery

Unit IV

Introduction to shell and Kernel programming : Why shell programming?, Creating a script, Variables, Shell commands and control structures, Kernel Basics, General kernel responsibilities, Kernel organization, Kernel modules

Text Books:

1: "Linux system administration: A Beginners guide ", Steve shah, Wale soyinka, TMH

Reference Books:

1. "The Complete reference Linux ", Peterson, Tata McGraw Hill.
2. "Ubuntu complete Reference", Peterson, Tata McGraw Hill.
3. "Understanding the Linux Kernel", Daniel P. Bovet & Marco Cesati , O'Reilly

MS 805 **Organisational Behaviour** **L-3, T-1, Cr -4**

Unit I

The Foundations of Organizational Behaviour
Introduction to Organizational Behaviour. Today's Organization: Information Technology, Learning Organization. Contemporary Challenges: Diversity, Contingent Workforce, Work/Life Balance

Unit II

Organizational Structure
Organizational Structure and Design. Fundamentals of Organizing

Organizational Process
Organizational Culture and Climate. Managerial Communication. Managerial Ethics

Unit III

Planning
Need for Planning. Types and Processes of Planning. Management by Objectives

Managerial Decision Making and Controlling
Types/Models of Decision Making. Problem solving techniques. Group Decision Making. Controlling: Process and Techniques

Unit IV

Micro Perspectives Of Organizational Behaviour
Individual Determinants of Organizational Behaviour: Perception, Learning, Personality,
Attitudes and Values, Motivation, Job Anxiety and Stress.

Macro Perspectives of Organizational Behaviour
Group Dynamics and Interpersonal Relations, Management of Organizational Conflicts, Management of Change, Leadership: Theories and Styles.

Text Books:

1. Robbins, S. Organizational Behaviour. Pearson Education.
2. Luthans, F (2004). Organisational Behaviour. McGraw Hill, International Edition.

ITS 807   **Artificial Intelligence**   **L-3, T-1, Cr -4**

Unit I

Scope of AI
Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction.

Problem solving
State space search; Production systems, search space control: depth-first, breadth-first search, heuristic search - Hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End, Means-End Analysis

Unit-II

Knowledge Representation
Predicate Logic: Unification, modus pones, resolution, dependency directed backtracking.

Structured Knowledge Representation: Semantic Nets: slots, exceptions and default frames, conceptual dependency, scripts.

Unit-III

Handling uncertainty
Non-Monotonic Reasoning, Probabilistic reasoning, use of certainty factors, fuzzy logic.

Learning
Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.

Unit-IV

Expert Systems
Need and justification for expert systems, knowledge acquisition, Case studies: MYCIN, RI.

Text Books:

1. Rich, Knight, Nair, " Artificial Intelligence", TMH, 3rd Ed.,
2. Dan W. Patterson "Introduction to Artificial Intelligence and Expert Systems",
3. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 1990.

Reference Books:

1. Peter Jackson, "Introduction to Expert Systems", AWP, M.A., 1992.
2. R.J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int Ed., Singapore, 1992.
3. M. Sasikumar, S. Ramani, "Rule Based Expert Systems", Narosa Publishing House, 1994.

ITS-809   **Software Testing**   **L-3, T-1, Cr -4**

Unit I

Introduction**:** What is software testing and why it is so hard?, Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitations of Testing

Unit II

Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

Unit III

Structural Testing: Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

Unit IV

Reducing the number of test cases: Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, Slice based testing

Unit V

Testing Tools: Static Testing Tools, Dynamic Testing Tools, Characteristics of Modern Tools.

Text Books:

1. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York, 1995.
2. Cem Kaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 1993.
3. Boris Beizer, "Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
4. Louise Tamres, "Software Testing", Pearson Education Asia, 2002

Reference Books:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
2. Boris Beizer, "Black-Box Testing – Techniques for Functional Testing of Software and Systems", John Wiley & Sons Inc., New York, 1995.
3. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003.
4. Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.
5. Gordon Schulmeyer, "Zero Defect Software", McGraw-Hill, New York, 1990.
6. Watts Humphrey, "Managing the Software Process", Addison Wesley Pub. Co. Inc., Massachusetts, 1989.
7. Boris Beizer, "Software System Testing and Quality Assurance", Van Nostrand Reinhold, New York, 1984.

ITS-811   **.NET Framework using C#**   **L-3, T-1, Cr -4**

Unit 1

Introduction to Three-Tier Architecture, overview of .NET Framework , Common Language Runtime (CLR) , The .NET Framework Class Library , familiarization with visual studio .NET IDE , Design Window, Code Window, Server , Explorer, Toolbox, Docking Windows, Properties Explorer, Solution Explorer, Object Browser, Dynamic Help, Task List Explorer, Features of VS.NET, XML Editor, Creating a Project, Add Reference, Build the Project, Debugging a Project

Unit II

Introduction, Data Types, Identifiers, variables & constants, C# statements, Object Oriented Concept, Object and Classes, Arrays and Strings, System Collections, Delegates and Events, indexes Attributes, versioning.

Unit III

Namespace-System, Input Output, Multi-Threading, Networking and Sockets, Data Handling, Windows Forms, C# in Web application, Error Handling.

Unit IV

Web Services, Windows services, messaging, Reflection, COM and C#, localization. Distributed Application in C#, XML and C#, Unsafe Mode, Graphical Device Interface with C#,

Text Book:

   1. Balagurusamy, "Programming with C#", TMH

Reference Books:

   1. "C# for Programmers", Deitel and Deitel, Pearson
   2. "Programming C#, 3rd Edition " Jesse Liberty , O'really
   3. "Understanding .NET", Chappell, David, , Addison Wesley, 2006

ITS-813   .NET Framework using VB.NET   L-3, T-1, Cr -4

Unit 1

Introduction , Basic Concepts and a Simple Application , Using Variables, Constants, Functions , Processing Decisions , Looping Structures and Lists , Sub Procedures, Function Procedures, Modules , Arrays, Structures, Collections

Unit II

Windows Forms, Adding Controls, Adding an Event Handler, Adding Controls at Runtime
Attaching an Event Handler at Runtime, Menu , Multiple Document Interface, Dialog Form ,Form Inheritance, Tab-Control, Anchoring Controls, Changing the Startup Form, ListView , TreeView imageList Context Menu, TreeView, Creating Controls at run time, Creating a User Control, adding Functionality, Writing a Custom Control, Testing the Control.

Unit III

ADO.NET Architecture, ConnectionObject, Connection String, CommandObject, DataReaders, DataSets and DataAdapters, DataTable, DataColumn, DataRow, Differences between DataReader Model and DataSet Model, DataViewObject, Working with System.Data.OleDb, Working with SQL.NET, Using Stored Procedures, Working with Odbc.NET, Using DSN Connection

Unit IV

Creating Distributed Web Applications, XML and ADO.NET, Graphics, Printing, Reporting

Text Book:

1. Visual Basic.net- A Beginner's Guide: Kent, Jeffrey TMH

Reference Books:

1. "Database Programming in VB.NET", Chittibabu Govindarajulu, Pearson

2. "Understanding .NET", Chappell, David, Addison Wesley, 2006

Unit I

Building ASP.NET Pages: Overview of the ASP.NET Framework ,   Using the Standard Controls,   Using the Validation Controls,   Using the Rich Controls, Designing Websites with Master Pages, Creating Custom Controls with User Controls

Unit II

Performing Data Access: Overview of Data Access, Using SqlDataSource, List, GridView, DetailsView and FormView, Repeater and DataList, ListView and DataPager, Building Components, Using the ObjectDataSource Control, Building Data Access Components with ADO.NET, Data Access with LINQ to SQL, Using the Navigation Controls, Using Site Maps

Unit III

Security: Using the Login control,   ASP.NET Membership,   Maintaining Application State, Caching Application Pages and Data, Localizing Applications for Multiple Languages, Working with the HTTP Runtime, Configuring Applications, Building Custom Controls, Building Templated Data bound Controls

Unit IV

Using Server-Side ASP.NET AJAX, ASP.NET AJAX Control Client-Side ASP.NET AJAX, Building a Code Sample Website

Text Book

1 "ASP.NET 3.5 Unleashed", Stephen Walther , Pearson

Reference Book:

1. **"**Asp.Net : A Beginners Guide", Mercer , TMH
2. "Understanding .NET", Chappell, David, Addison Wesley, 2006

ITS-817   **Advanced Web Technology**   **L-3, T-1, Cr -4**

Unit I

Overview of Web concepts and Website Development, IT Act.

Using latest development tools like Dreamweaver, Flash etc.

Introduction to various advanced web technologies.

Unit II

Creating interactive & dynamic secure websites.

Interactivity with database using ASP, ASP request & response objects, ASP Server Objects.Comparison of ASP, PHP and JSP technologies.

Unit III

Overview and usage of Java beans, Java Servlets, Java applets, Java Script, ASP.NET, VBScript, VB.NET.E-Commerce & M-Commerce concepts.

Unit IV

Semantic web, Semantic Web Services.   XML, RDF, Ontology.   TCP/IP Protocol.

Text Books:

1. Internet and Web Technologies by Raj Kamal , TMH
2. Database Driven Web Sites by Mike Morrison , Vikas Publishing House
3. Active Server Pages by Heith Morneau, Vikas Publishing House
4. E. Petroutsos, "Mastering Visual Basic 6.0", BPB
5. Grigoris Antoniou and Frank van Harmelen, "Semantic Web Primer", MIT Press
6. Tim Berner's Lee, "Weaving the web: The original design and ultimate destiny of www" ,Harper Business(imprint of Harper Collins)
7. Java-2: The complete Reference by Patrick Naughton and Herbertz Schildt, TMH

Reference Books:

1. VK Jain**,** "Advanced programming in web design",Cyber tech publications
2. Achyut S Godbole and Atul Kahate, "Web Technologies", Tata McGraw Hill
3. ASP 3 Programming , Eric A. Smith , IDG Books India
4. TM Ramachandran , "Internet & Web development", Dhruv publications
5. James L Mohler and Jon Duff, "Designing interactive web sites",Delmar Thomson learning
6. Ivan Bay Ross, "HTML,DHTML,Java script,Perl CGI" , BPB
7. B Reselman et al, "Using Visual Basic 6", PHI
8. Vladimir Geroimenko, Chaommei Chin, "Visualizing the Semantic Web", Springer

Unit I

Introduction to Software Engineering: What is Software Engineering?, Software engineering Concepts, Software Engineering Development activities, Managing software Development

Unit II

Modeling with UML: Overview, Modeling Concepts: Use Case Diagrams, Class Diagrams, Interaction Diagrams, State chart Diagrams, Activity Diagrams

Unit III

Requirement Elicitation: Requirement Elicitation Concepts, Requirement Elicitation Activities, Requirement Elicitation Managing

Analysis: Concepts, activities System Design: Overview, Activities

Unit IV

Testing Object Oriented Systems: Introduction, Testing Concepts, Activities & Techniques, Managing Testing, Case Studies

Text Books:

1. "Classical & Object Oriented Software Engineering with UML and Java", Stephen R. Scach, McGraw Hill, 1999.
2. "Object-Oriented Software Engineering", Bernd Bruegge, Pearson.2006.
3. "Visual Modeling with Rational Rose and UML", Terry Quatrani, Addison-Wesly, 1998.
4. "UML Toolkit", Hans-Erik Eriksson and Magnus Penker, John Wiley & Sons, 1998.

Reference Books:

1. "Software Engineering: A Practioner's Approach," Fourth Edition, Roger S. Pressman, McGraw-Hill, 1997.
2. "Design Patterns: Elements of Reusable Object-Oreinted Software," E. Gamma, R. Helm, R. Johnson and J. Vlissides, Addison-Wesley, 1995.
3. "Core JAVA 1.1: Volume II - Advanced Features," Cay S. Horstmann and Gary Cornell, Sun Microsystems Press (Prentice Hall), 1998.
4. "ISO 9001 and Software Quality Assurance," Darrel Ince, McGraw-Hill, 1994.

ITS-821   Network Management and Information Security L-3, T-1, Cr -4

Unit I
Basic concepts: The OSI security Model, Network security model, Network security threats: The Attack process, Attacker types, Attack taxonomy (Read, Manipulate, IP Spoofing, MAC Spoofing, MAC Flooding), various malicious softwares (viruses, Trojan horses, worms, logic bomb, trap doors etc.), Man in the middle attack.

Unit II
Network security technologies: Biometrics, Host and application security, Network firewalls, Content filtering, NIDS, Cryptography.
Classical encryption techniques: Substitution techniques, Transposition techniques.
Block ciphers: Block cipher principles, Confusion and diffusion, Data encryption standard.

Unit III
Public key encryption and Hash functions: Principles of public key cryptosystems, RSA algorithm, Key management, Diffie hellman key exchange, Authentication requirements, Authentication functions, Massage authentication codes , Hash functions, MD5 Algorithm.
Digital signatures: DSS algorithm.

Unit IV
Email security: PGP, S/MIME.
IP security : IP security Architecture, (IKE,AH, ESP).

Text Books:

1. Sean Convery, " Network Security Architectures", Published by Cisco Press, First Ed.2004
2. William Stalling "Cryptography and Network Security" Fourth Ed., Prentice Hall, 2006

Reference Books:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing" 3rd Edition, Prentice Hall, 2003
2. Jeff Crume "Inside Internet Security" Addison Wesley, 2003 .

ITS 823 **Management Information Systems** **L-3, T-1, Cr -4**

Unit I

Foundations of Information Systems in Business, Competing With Information Technology, INFORMATION TECHNOLOGIES: Computer Hardware, Computer Software, Data Resource Management, Telecommunications and Networks

Unit II

Business Applications: Electronic Business Systems, Enterprise Business Systems, Electronic Commerce Systems, Decision Support Systems

Unit III

Development Processes: Developing Business/It Strategies, Developing Business/It Solutions

Unit IV

Management Challenges: Security and Ethical Challenges, Enterprise and Global Management of Information Technology
Case Studies.

Text Books:

1. " Management Information System 7/e", Obrien, TMH
2. Kenneth, Laudon and Jane Laudon (2005). MIS: Managing the Digital Firm. Pearson Education.
3. James, A. O'Brien (2005). Introduction to Information Systems. Tata McGraw Hill.

References Books:

1. Turban, E., McLean, E. and Wetherbe, J. (2001). Information Technology for Management:
Making Connections for Strategic Advantage. John Wiley and Sons.
2. Jawadekar, W. S. (2004). Management Information Systems. Tata McGraw Hill.

ITS 825   **Distributed Systems**   **L-3, T-1, Cr -4**

Unit I

Fundamentals of Distributed Computing: Architectural models for distributed and mobile computing systems. Distributed Operating Systems and network operating systems, Middleware, client/server model for computing.

Unit II

Communication: Layered protocols, RPC, RMI, Remote objects. Basic Algorithms in Message Passing Systems, Leader Election in Rings, and Mutual Exclusion in Shared Memory, Message Passing, PVM and MPI.
Process Concepts: Threads, Clients and Servers, Code migration, Agent based systems.

Unit III

Synchronization: Clock synchronization, Logical clocks, Election algorithms, Mutual exclusion, Distributed transactions, Naming concepts, Security in distributed systems

Unit IV

Distributed object based systems: CORBA, Distributed COM, Introduction to distributed file systems and document based systems

Text Books:

1. Tannenbaum, A, Maarten Van Steen. Distributed Systems, Principles and Paradigm, Prentice Hall India, 2002

Reference Books:

1. Tanenbaum, A, "Modern Operating Systems", 2nd Edition, Prentice Hall India, 2001.
2. Singhal and Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill, 1994

ITS 827 **Computer Graphics** **L-3, T-1, Cr -4**

Unit I

A survey of computer graphics: Various applications and uses of computer graphics Video display devices, Raster scan systems, Random scan systems, Input devices, Hard copy devices, Graphics software

Unit II

Basic raster graphics algorithms for drawing 2 D Primitives lines, circles, ellipses, arcs clipping, clipping circles, ellipses & polygon, filled area primitives. Geometric Transformation: 2D, 3D transformations, window to viewport transformations

Unit III

Two dimensional viewing: Clipping operations, point and line clipping and their algorithms, polygon clipping. 3D Concepts : 3d display methods, projections, visible line and surface identification

3D Object Representation: Polygon Surfaces, Curved Lines and Surfaces, Blobby objects, Bezier curves, B-Spline Curves Visible Surface Detection Methods:. Classification of Visible surface detection Algorithms, Z-buffer algorithm, scanline algorithm, ray-Casting method, wireframe methods.

Unit IV

Illumination Models and surface rendering methods: Light sources, basic illumination methods, constant intensity shading, Gouraud & Phong shading techniques, Basic ray tracing algorithm, basic radiosity model, texture mapping, bump mapping.

Color Models and color applications: Various color models,Conversion between color models, Fractals, Shape Grammars and other Procedural methods, Particle systems, Visualization of Data sets

Text Book:

1. "Computer Graphics", Donald Hearn, M. Pauline Baker, PHI,

Reference Books:

1. "Computer Graphics Principles & practice ", Foley et. al., AWL.

2. "Procedural elements of Computer Graphics", Rogers, Mc-Graw Hill.

3. "Mathematical elements of Computer Graphics", Rogers, Mc-Graw Hill.

ITS 829   **Operation Research**   **L-3, T-1, Cr -4**

Unit-I

Decision –Making and Quantitative Techniques, Linear Programming I: Formulation and Graphic Solution, Linear Programming II: Simplex Method, statements of basic theorems and properties, phase i and phase ii of the simplex method

Unit-II

Linear Programming III: Duality and Sensitivity Analysis, Specially Structured Linear Programmes I: Transportation and Transhipment Problems

Unit III

Specially Structured Linear Programmes II: Assignment Problem, Goal Programming, Sequencing, Inventory Management, Queuing Theory, Replacement Theory

Unit IV

PERT and CPM, arrow network, time estimate, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and slack, critical path, probability of meeting scheduled date of completion of project, calculation of CPM network, various floats for activities, critical path, updating project, operation time cost trade off curve

Text Books:

1. Vohra: Quantitative Techniques, 3/e, TMH
2. Gillet, B.E.., "Introduction to Operation Research : a computer oriented algorithmic approach " Tata McGraw Hill, NY.
3. Gross D., and Harris, C. M., "Fundamentals of queueing theory ", John Willey and Sons, NY.

Reference Books:

1. Hillier F., and Lieberman, G. J. , "Introduction to Operation Research", Holden Day , NY.
2. Kambo, N.S., "Mathematical Programming Techniques", McGraw Hill.
3. Kanti Swaroop, Gupta P. K., Man Mohan, "Operations Research", Sultan Chand and Sons.
4. Taha, H. A., "Operations Research – An Introduction", McMillan Publishing Company, NY.