

# Harcourt Butler Technological Institute Kanpur

## Study and Evaluation Scheme

**B.Tech. Computer Science & Engineering & B.Tech. Information Technology**

[Effective from the session 2009-10]

**YEAR - II, SEMESTER - III**

S.No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme					
						SESSIONAL EXAM.			ESE	SUBJECT TOTAL	
						CT	TA	Total			
1	HET-302	Digital Logic Design	3	1	0	30	20	50	100	150	
2	HMA-302	Computer Oriented Numerical & Statistical Technique	3	1	0	30	20	50	100	150	
3	HCS-301	Data Structures Using C	3	1	0	30	20	50	100	150	
4	HMA-303	Discrete Mathematical Structures	3	1	0	30	20	50	100	150	
5	HCS-302	Object Oriented Systems	3	1	0	30	20	50	100	150	
<b>PRACTICALS</b>											
6	HET-352	Digital Logic Design Lab	0	0	2	10	10	20	30	50	
7	HCS-351	Data Structures Lab	0	0	3	10	15	25	50	75	
8	HCS-352	Object Oriented Systems Lab	0	0	3	10	15	25	50	75	
9	HGP-301	General Proficiency						50		50	
		<b>Total</b>	15	5	8	-	-	-	-	1000	
<b>YEAR - II, SEMESTER - IV</b>											
S.No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme					
						SESSIONAL EXAM.			ESE	SUBJECT TOTAL	
						CT	TA	Total			
1	HEE-402	Network Analysis & Synthesis	3	1	0	30	20	50	100	150	
2	HCS-403	Computer Organisation	3	1	0	30	20	50	100	150	
3	HCS-401	Data Base Management Systems	3	1	0	30	20	50	100	150	
4	HCS-404	Priciples of Programming Languages	3	1	0	30	20	50	100	150	
5	HCS-402	Software Engineering	3	1	0	30	20	50	100	150	
<b>PRACTICALS</b>											
6	HEE-452	Network Analysis & Synthesis Lab	0	0	2	10	10	20	30	50	
7	HCS-451	Data Base Management Systems Lab	0	0	3	10	15	25	50	75	

8	HCS-452	Software Engineering Lab	0	0	3	10	15	25	50	75
9	HGP-401	General Proficiency						50		50
		<b>Total</b>	15	5	8	-	-	-	-	1000

## Study and Evaluation Scheme

### B.Tech. Information Technology

(Effective from the session 2010-11)

#### YEAR - III, SEMESTER - V

S.No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				
						SESSIONAL EXAM.			ESE	SUBJECT TOTAL
L	T	P	CT	TA	Total					
1	HHU-501	Engineering Economics and Management	3	1	0	30	20	50	100	150
2	HIT-501	E-Commerce	3	1	0	30	20	50	100	150
3	HCS-502	Operating Systems	3	1	0	30	20	50	100	150
4	HIT-502	Web Technology	3	1	0	30	20	50	100	150
5	HCS-503	Design & Analysis of Algorithm	3	1	0	30	20	50	100	150
<b>PRACTICALS</b>										
6	HCS-552	Operating Systems Lab	0	0	2	10	10	20	30	50
7	HIT-512	Web Technology Lab	0	0	3	10	15	25	50	75
8	HCS-553	Design & Analysis of Algorithm Lab	0	0	3	10	15	25	50	75
9	HGP-501	General Proficiency						50		50
		<b>Total</b>	15	5	6	-	-	-	-	1000

#### YEAR - III, SEMESTER - VI

S.No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				
						SESSIONAL EXAM.			ESE	SUBJECT TOTAL
L	T	P	CT	TA	Total					
1	HMA-602	Operational Research	3	1	0	30	20	50	100	150
2	HHU-601	Organizational Behavior	3	1	0	30	20	50	100	150
3	HIT-601	Information Systems	3	1	0	30	20	50	100	150
4	HCS-604	Computer Networks	3	1	0	30	20	50	100	150
5	HIT-602	Software Project Management	3	1	0	30	20	50	100	150
<b>PRACTICALS</b>										

6	HIT-651	Information Systems Lab	0	0	3	10	15	25	50	75
7	HCS-654	Computer Networks Lab	0	0	3	10	15	25	50	75
8	HIT-652	Software Project Management Lab	0	0	2	10	10	20	30	50
9	HGP-601	General Proficiency						50		50
		<b>Total</b>	15	5	8	-	-	-	-	1000

**Study and Evaluation Scheme**  
**B.Tech. Information Technology**  
**(Effective from the session 2011-12)**  
**YEAR - IV, SEMESTER - VII**

S.No	Course Code	SUBJECT	PERIODS			Evaluation Scheme				
						SESSIONAL EXAM.			ESE	SUBJECT TOTAL
L	T	P	CT	TA	Total					
1	HOE-	Open Elective	3	1	0	30	20	50	100	150
2	HIT-701	Cryptography & Network Security	3	1	0	30	20	50	100	150
3	HCS-702	Artificial Intelligence	3	1	0	30	20	50	100	150
4	HCS-703	Elective - I	3	1	0	30	20	50	100	150
5	HIT-702	Elective - II	3	1	0	30	20	50	100	150
<b>PRACTICALS</b>										
6	HIT-752	Industrial / Practical / Training and Report Presentation	0	0	2	10	10	20	30	50
7	HIT-751	Cryptography & Network Security Lab	0	0	3	10	10	20	30	50
8	HIT-753	Project	0	0	3	30	20	50	50	100
9	HGP-701	General Proficiency						50		50
		<b>Total</b>	15	5	8	-	-	-	-	1000

**YEAR - IV, SEMESTER - VIII**

S.No	Course Code	SUBJECT	PERIODS			Evaluation Scheme				
						SESSIONAL EXAM.			ESE	SUBJECT TOTAL
L	T	P	CT	TA	Total					
1	HCS-801	Distributed Systems	3	1	0	30	20	50	100	150

2	HIT-801	Mobile Computing	3	1	0	30	20	50	100	150
3	HCS-803	Elective - III	3	1	0	30	20	50	100	150
4	HIT-802	Elective - IV	3	1	0	30	20	50	100	150
<b>PRACTICALS</b>										
6	HIT-851	Mobile Computing Lab	0	0	3	10	10	20	30	50
7	HCS-851	Distributed Systems Lab	0	0	3	10	10	20	30	50
8	HIT-853	Project	0	0	6	-	100	100	150	250
9	HGP-801	General Proficiency						50		50
		<b>Total</b>	12	4	12	-	-	-	-	1000

**B. Tech. II Year**  
**Computer Science and Engineering**  
**&**  
**Information Technology**  
**(Effective from the session 2009-10)**

**HCS-301**  
**DATA STRUCTURES USING C**

**L T P**

**3 1 0**

**Unit - I**

**Introduction:** Basic Terminology, Elementary Data Organization, Structure operations, Algorithm Complexity and Time-Space trade-off.

**Arrays:** Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered List, Sparse Matrices and Vectors.

**Stacks:** Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack., Applications of recursion in problems like 'Tower of Hanoi'.

## UNIT - II

**Queues:** Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues.

**Linked list:** Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.

## UNIT – III

**Trees:** Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.

**Searching and Hashing:** Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.

## UNIT – IV

**Sorting:** Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting.

**Binary Search Trees:** Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees.

## UNIT - V

**Graphs:** Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.

**File Structures:** Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons.

**Text Books:**

1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia Publication Pvt. Ltd., New Delhi.
2. R. Kruse et al, "Data Structures and Program Design in C", Pearson Education Asia, Delhi-2002
3. A. M. Tenenbaum, "Data Structures using C & C++", Prentice-Hall of India Pvt. Ltd., New Delhi.
4. K Loudon, "Mastering Algorithms with C", Shroff Publisher & Distributors Pvt. Ltd.
5. Bruno R Preiss, "Data Structures and Algorithms with Object Oriented Design Pattern in C++", Jhon Wiley & Sons, Inc.
6. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Asia Pvt. Ltd.(Singapore)

**HCS-302****OBJECT ORIENTED SYSTEMS****L T P****3 1 0****UNIT – I**

Object Oriented Design and Modeling: Object oriented fundamentals, Objects and Classes, Links and Associations, Generalization and Inheritance, Aggregation, Abstract Classes, Object-Oriented Design Process, importance of modeling, principles of modeling, OOAD Methods.

Introduction to UML: UML Terminology, conceptual model of the UML, Architecture, Software Development Life Cycle.

**UNIT - II**

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages.

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams.

### **UNIT- III**

Behavioral Modeling: Interactions and Interaction diagrams, Use Cases and Use Case Diagrams, Activity Diagrams. Events and Signals, State Machines, Nested State Diagrams, Processes and Threads, Time and Space, State Chart Diagrams. Advanced Dynamic Modeling Concepts.

### **UNIT-IV**

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. Elementary Design Patterns, The MVC Architecture Pattern.

### **UNIT – V**

Object-Oriented Programming Languages, Dominant features of C++, Java and C#. Object Oriented Database design, Modern Object technologies and web services.

Case Study: The Unified Library Application.

### **Text and Reference Books:**

1. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.
2. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
3. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
4. Pascal Roques: Modeling Software Systems Using UML2, WILEY-Dreamtech India Pvt. Ltd.
5. Mark Priestley: Practical Object-Oriented Design with UML, TATA Mc-GrawHill
6. Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

**HCS-351**

**DATA STRUCTURES LAB**

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**0 0 3**

**Write Program in C or C++ for following.**

1. Array implementation of Stack, Queue, Circular Queue, List.
2. Implementation of Stack, Queue, Circular Queue, List using Dynamic memory Allocation.
3. Implementation of Tree Structures, Binary Tree, Tree Traversal, Binary Search Tree, Insertion and Deletion in BST.
4. Implementation of Searching and Sorting Algorithms.
5. Graph Implementation, BFS, DFS, Min. cost spanning tree, shortest path algorithm.

**HCS-352**

**OBJECT ORIENTED SYSTEMS LAB**

**L T P**

**0 0 3**



Lab exercises are to be carried out using C++, Java, C# and tools like Visio, ARGOUML etc. Design and Implementation of an Object based application using any one of the above languages/tools is desirable

**HCS-403**

**COMPUTER ORGANIZATION**

**L T P**

**3 1 0**

**Unit-I (Representation of Information and Basic Building Blocks)**

Introduction to Computer, Computer hardware generation, Number System: Binary, Octal, Hexadecimal, Character Codes (BCD, ASCII, EBCDIC), Logic gates, Boolean Algebra, K-map simplification, Half Adder, Full Adder, Subtractor, Decoder, Encoders, Multiplexer, Demultiplexer, Carry lookahead adder, Combinational logic Design, Flip-Flops, Registers, Counters (synchronous & asynchronous), ALU, Micro-Operation. ALU-Chip, Faster Algorithm and Implementation (multiplication & Division)

### **Unit-II (Basic Organization)**

Von Neumann Machine (IAS Computer), Operational flow chart (Fetch, Execute), Instruction Cycle, Organization of Central Processing Unit, Hardwired & micro programmed control unit, Single Organization, General Register Organization, Stack Organization, Addressing modes, Instruction formats, data transfer & Manipulation, I/O Organization, Bus Architecture, Programming Registers

### **Unit-III (Memory Organization)**

Memory Hierarchy, Main memory (RAM/ROM chips), Auxiliary memory, Associative memory, Cache memory, Virtual Memory, Memory Management Hardware, hit/miss ratio, magnetic disk and its performance, magnetic Tape etc.

### **Unit-IV (I/O Organization)**

Peripheral devices, I/O interface, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, and Serial Communication. I/O Controllers, Asynchronous data transfer, Strobe Control, Handshaking.

### **Unit-V (Process Organization)**

Basic Concept of 8-bit micro Processor (8085) and 16-bit Micro Processor (8086), Assembly Instruction Set, Assembly language program of (8085): Addition of two numbers, Subtraction, Block Transfer, find greatest number, Table search, Numeric Manipulation, Introductory Concept of pipeline, Flynn's and Feng's Classification, Parallel Architectural classification. Concept of Pipelining, Multi-Core Architecture.

### **Text and Reference Books:**

1. William Stalling, "Computer Organization & Architecture", Pearson education Asia
2. Mano Morris, "Computer System Architecture", PHI
3. Zaky & Hamacher, "Computer Organization", McGraw Hill
4. B. Ram, "Computer Fundamental Architecture & Organization", New Age
5. Tannenbaum, "Structured Computer Organization", PHI.

**HCS-401**

**DATABASE MANAGEMENT SYSTEM**

**L T P**

**3 1 0**

**Unit- I**

**Introduction:** An overview of database management system, database system Vs file system, Database system concepts and architecture, data models schema and instances, data independence and database language and interfaces, Data definitions language, DML, Overall Database Structure.

**Data Modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.

**Unit- II**

**Relational data Model and Language:** Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus,

**Introduction to SQL:** Characteristics of SQL. Advantage of SQL. SQL data types and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations. Joins, Unions, Intersection, Minus, Cursors in SQL.

**Unit- III**

**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependences, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

#### **Unit- IV**

**Transaction Processing Concepts:** Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.

#### **Unit- V**

**Concurrency Control Techniques:** Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction.

#### **Text Books**

1. Date C J, "An Introduction To Database System", Addison Wesley
2. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
3. Elmasri, Navathe, "Fundamentals Of Database Systems", Addison Wesley
4. Leon & Leon, "Database Management System", Vikas Publishing House.
5. Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication
6. Majumdar & Bhattacharya, "Database Management System", TMH
7. Ramakrishnan, Gehrke, "Database Management System", McGraw Hill
8. Kroenke, "Database Processing: Fundamentals, Design and Implementation", Pearson Education.
9. Maheshwari Jain, "DBMS: Complete Practical Approach", Firewall Media, New Delhi.

**HCS-404**

**PRINCIPLES OF PROGRAMMING LANGUAGES**

**L T P**

**3 1 0**

**Unit -I**

**Introduction:** Characteristics of programming Languages, Factors influencing the evolution of programming language, developments in programming methodologies, desirable features and design issues. Programming language processors: Structure and operations of translators, software simulated computer, syntax, semantics, structure, virtual computers, binding and binding time.

**Unit -II**

Elementary and Structured Data Types: Data object variables, constants, data types, elementary data types, declaration, assignment and initialization, enumeration, characters, strings. Structured data type and objects: Specification of data structured types, vectors and arrays, records, variable size data structure, pointers and programmer constructed data structure, Sets files. Sub Program and programmer defined data types: Evolution of data types, abstractions, encapsulations, information hiding, sub programmes, abstract data types.

**Unit -III**

Sequence Control; Implicit and Explicit sequence control, sequence control with within expression and statements, recursive sub programmes, exception handling, co routines, Scheduled sub programmes, concurrent execution. Data control referencing environments, static and dynamic scope, local data local data referencing environment, shared data: Explicit common environment dynamic scope parameter passing mechanism.

**Unit -IV**

Storage Management: Major run time requirements, storage management phases, static storage management, stack based, heap based storage management. Syntax and translation: General syntactic criteria, syntactic element of a language, stages in translation, formal syntax and semantics.

**Unit -V**

Operating and Programming Environment: Batch Processing Environments, Embedded system requirements, Theoretical models, Introduction to Functional Programming, Lambda calculus, Data flow language and Object Oriented language, Comparison in various general and special purpose programming languages e.g. Fortran, C, Pascal, Lisp, etc.

**Text and Reference Books:**

1. Terrance W Pratt, "Programming Languages: Design and Implementation" PHI
2. Sebesta, "Concept of Programming Language", Addison Wesley
3. E Horowitz, "Programming Languages", 2nd Edition, Addison Wesley
4. "Fundamentals of Programming Languages", Galgotia.

## SOFTWARE ENGINEERING

L T P

3 1 0

### **Unit-I: 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.

### **Unit-II: 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 Quality Assurance (SQA):** Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.

### **Unit-III: 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: Halstead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.

### **Unit-IV: 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.

Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.

### **Unit-V: Software Maintenance and Software Project Management**

Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse

Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

#### **Text and Reference Books:**

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. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.
5. Ian Sommerville, Software Engineering, Addison Wesley.
6. Pankaj Jalote, Software Engineering, Narosa Publication
7. Pfleeger, Software Engineering, Macmillan Publication.
8. A. Leon and M. Leon, Fundamentals of Software Engineering, Vikas Publication.

### **HCS-451**

#### **Database Management System LAB**

**L T P**

**0 0 3**

#### **The Queries to be implemented on DBMS using SQL.**

1. Write the queries for Data Definition and Data Manipulation language.
2. Write SQL queries using Logical operators (=,<,>,etc.).
3. Write SQL queries using SQL operators (Between.... AND, IN(List), Like, ISNULL and also with negating expressions ).
4. Write SQL query using character, number, date and group functions.
5. Write SQL queries for Relational Algebra (UNION, INTERSECT, and MINUS, etc.).
6. Write SQL queries for extracting data from more than one table (Equi-Join, Non-Equi-Join , Outer Join)
7. Write SQL queries for sub queries, nested queries.
8. Write programs by the use of PL/SQL.



9. Concepts for ROLL BACK, COMMIT & CHECK POINTS.
10. Create VIEWS, CURSORS, and TRIGGRS & write ASSERTIONS.
11. Create FORMS and REPORTS.

\*Students are advised to use **Developer 2000/Oracle-9i** version or other latest version for above listed experiments. However depending upon the availability of software's, students may use **Power Builder /SQL SERVER**. Mini Project may also be planned & carried out through out the semester to understand the important various concepts of Database.

**HCS- 452**

**SOFTWARE ENGINEERING LAB**

**L T P**

**0 0 3**

1. Using any development tool like Rational Rose Perform SA/SD for the following types of problems.
  - Hotel Automation System
  - Book Shop Automation Software
  - Word processing Software
  - Software Component Cataloguing Software.
  - Payroll System
  - Banking System
  - Purchase Order System
  - Library Management System
  - Railway Reservation System
  - Bill Tracking System
  - College Admission System
2. Illustration of various activities of Software Project Management using MS Project 2000.

**B. Tech. III Year**

# **Information Technology**

**(Effective from the session 2010-11)**

## **E-COMMERCE (HIT-501)**

**L T P**

**3 1 0**

### **UNIT-I: Introduction**

What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of ECommerce, Inter Organizational E-Commerce Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework Network Infrastructure for E-Commerce Network Infrastructure for E-Commerce, Market forces behind I Way, Component of I way Access Equipment, Global Information Distribution Network, Broad band Telecommunication.

### **UNIT-II: Mobile Commerce**

Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices, Web Security Introduction to Web security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, firewalls & Network Security.

### **UNIT-III: Encryption**

World Wide Web & Security, Encryption, Transaction security, Secret Key Encryption, Public Key Encryption, Virtual Private Network (VPM), Implementation Management Issues.

#### **UNIT-IV: Electronic Payments**

Overview of Electronics payments, Digital Token based Electronics payment System, Smart Cards, Credit Card / Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

#### **UNIT-V: Net Commerce**

EDA, EDI Application in Business, Legal requirement in E –Commerce.

#### **Text and Reference Books:**

1. Greenstein and Feinman, "E-Commerce", TMH
2. Ravi Kalakota, Andrew Whinston, "Frontiers of Electronic Commerce", Addison Wesley.
3. Denieal Amor, "The E-Business Revolution", Addison Wesley.
4. Diwan, Sharma, "E-Commerce" Excel.
5. Bajaj & Nag, "E-Commerce: The Cutting Edge of Business", TMH.

### **OPERATING SYSTEMS (HCS-502)**

**L T P**

**3 1 0**

#### **Unit -I**

Introduction: Operating System and its functions, Evolution of Operating System, Batch, Interactive, Time Sharing and Real Time Operating System, System Protection. Operating System Structure: System Components, System Structure, Operating System Services.

#### **Unit - II**

Concurrent Processes: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Critical Section, Problem, Semaphores, Classical Problems in Concurrency, Inter Processes Communication, Process Generation, Process Scheduling.

#### **Unit - III**

CPU Scheduling: Scheduling Concept, Scheduling Techniques, Performance Criteria for Scheduling Algorithm, Evolution, Multiprocessor Scheduling. Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery From Deadlock Combined Approach.

#### **Unit - IV**

Memory Management: Basic Machine, Resident Monitor, Multiprogramming with Fixed Partition, Multiprogramming With Variable Partition, Multiple Base Register, Paging, Segmentation, Paged Segmentation, Virtual' Memory Concept, Demand Paging, Performance, Paged Replaced Algorithm, Allocation of Frames, Thrashing, Cache Memory Organization, Impact on Performance.

#### **Unit - V**

I/O Management & Disk Scheduling: I/O Devices and The Organization of I/O Function, I/O Buffering, Disk I/O, Operating System Design Issues. File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues.

#### **Text & Reference Books:**

1. Milenekovie, "Operating System Concept", McGraw Hill.
2. Petersons, "Operating Systems", Addison Wesley.
3. Dietal, "An Introduction to Operating System", Addison Wesley.
4. Tannenbaum, "Operating System Design and Implementation", PHI.
5. Gary Nutt, "Operating System, A Modern Perspective", Addison Wesley.
6. Stalling, Williams, "Operating System", Maxwell Macmillan
7. Silveschatz, Peterson J., "Operating System Concepts", Willey.
8. Crowley, "Operating System", TMH.

### **Unit-I**

History of the web, Growth of the Web, Protocols governing the web, Introduction to Cyber Laws in India, Introduction to International Cyber laws, Web project, Web Team, Team dynamics.

### **Unit-II**

Communication Issues, the Client, Multi-departmental & Large scale Websites, Quality Assurance and testing, Technological advances and Impact on Web Teams.

### **Unit-III**

HTML: Formatting Tags, Links, List, Tables, Frames, forms, Comments in HTML, DHTML. JavaScript: Introduction, Documents, Documents, forms, Statements, functions, objects in JavaScript, Events and Event Handling, Arrays, FORMS, Buttons, Checkboxes, Text fields and Text areas.

### **Unit-IV**

XML: Introduction, Displaying an XML Document, Data Interchange with an XML document, Document type definitions, Parsers using XML, Client-side usage, Server Side usage.

### **Unit-V**

Common Gateway Interface (CGI), PERL, RMI, COM/DCOM, VBScript, Active Server Pages (ASP).

### **Text and Reference Books:**

1. Burdman, "Collaborative Web Development", Addison Wesley.
2. Sharma & Sharma, "Developing E-Commerce Sites", Addison Wesley
3. Ivan Bayross, "Web Technologies Part II", BPB Publications.
4. Shishir Gundavarma, "CGI Programming on the World Wide Web", O'Reilly & Associate.
5. DON Box, "Essential COM", Addison Wesley.
6. Greg Buczek, "ASP Developer's Guide", TMH.

## **DESIGN & ANALYSIS OF ALGORITHMS (HCS-503)**

**L T P**

**3 1 0**

### **Unit -I**

Introduction: Algorithms, Analysis of algorithms, Growth of Functions, Master's Theorem, Designing of Algorithms, Divide and Conquer: Merge Sort and Quick Sort, Sorting and order Statistics: Heap sort, Sorting in Linear time, Medians and Order Statistics.

#### **Unit -II**

Advanced Data Structure: Red-Black Trees, Augmenting Data Structure. B-Trees, Binomial Heaps, Fibonacci Heaps, Data Structure for Disjoint Sets, Amortized Analysis.

#### **Unit -III**

Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithms, Back Tracking, Branch and Bound.

#### **Unit -IV**

Graph Algorithms: Elementary Graphs Algorithms, Minimum Spanning Trees, Single-source Shortest Paths, All-Pairs Shortest Paths, Maximum Flow, and Traveling Salesman Problem.

#### **Unit -V**

Selected Topics: Randomized Algorithms, String Matching, NP Completeness, Non deterministic Algorithms, Approximation Algorithms, PRAM Algorithms.

#### **Text & Reference Books:**

1. Coreman, Rivest, Lisserson: "Algorithm", PHI.
2. Basse, "Computer Algorithms: Introduction to Design & Analysis", Addison Wesley.
3. Horowitz & Sahni, "Fundamental of Computer Algorithm", Universities Press.

**OPERATING SYSTEMS LAB (HCS-552)**

**L T P**

**0 0 2**

Web based Address Book: This application can be used to keep track of your contacts/addresses. N Tier architecture is used to separate data layer, business layer and UI layers.

1. Simulation of the CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority Simulation of MUTEX and SEMAPHORES.
2. Simulation of Bankers Deadlock Avoidance and Prevention algorithms.
3. Implementation of Process Synchronization (Reader-Writer, Sleeping Barber and Dining Philosopher's Problem)
4. Simulation of page Replacement Algorithms a) FIFO b) LRU c) LFU
5. Simulation of paging techniques of memory management.
6. Simulation of file allocation Strategies a) Sequential b) Indexed c) Linked
7. Simulation of file organization techniques a) Single Level Directory b) Two Level c) Hierarchical d) DAG

### **WEB TECHNOLOGY LAB (HIT-552)**

**L T P**

**0 0 3**

1. Design a HTML page to display your CV.
2. Design a HTML form to reserve a railway ticket.
3. Write a Java Script program that finds the greatest common divisor of two numbers.
4. In the form mentioned in problem 2 to reserve a railway ticket add the following validations using java Script.
  - From city and to city are two different cities.
  - Age of passengers should not be greater than 150.
  - Name of the passenger should be a string of a maximum length
5. Write a program for illustrating client/server side scripting with help of ASP.
6. Write a piece of code in XML for creating DTD, which specifies set of rules.
7. Create style sheet in CSS/XSL and display the document in Internet Explorer.

## **DESIGN AND ANALYSIS OF ALGORITHMS LAB (HCS-553)**

**L T P**

**0 0 3**

Programming assignments on each of the following algorithmic strategy:

1. Divide and conquer method (quick sort, merge sort, Strassen's matrix multiplication).
2. Greedy method (knapsack problem, job sequencing, optimal merge patterns, minimal spanning trees).
3. Dynamic programming (multistage graphs, OBST, 0/1 knapsack, traveling salesperson problem).
4. Back tracking (n-queens problem, graph coloring problem, Hamiltonian cycles).
5. Sorting: Insertion sort, Heap sort, Bubble sort.
6. Searching: Sequential and Binary Search.
7. Selection: Minimum/ Maximum,  $K_{th}$  smallest element.

## **INFORMATION SYSTEMS (HIT-601)**

**L T P**

**3 1 0**

### **Unit-I**

Foundation of Information Systems: Introduction to information system in business, fundamentals of information systems, solving business problems with information system, concept of balanced MIS, effectiveness & efficiency criteria.

### **Unit-II**

System Analysis Design function, CASE Tools, Project Feasibility, Information Requirement & Decision Analysis, Preparing System Proposal, Input / Output design, Procedures & control design, System development, Testing & Quality assurance.

### **Unit-III**

Implementation, Operation, Evaluation and Maintenance, Structured System Methodologies, Automated systems development, Hardware/Software selection, Systems function management.



Information system for business operations, information system for managerial decision support, information system for strategic advantage.

#### **Unit-IV**

Managing Information Technology: Enterprise and global management, security & ethical challenges planning & implementing changes.

#### **Unit-V**

Advanced Concepts in Information Systems: Enterprise resource planning, Supply Chain Management, C.R.M., Procurement Management.

#### **Text and Reference Books:**

1. O. Brian, "Introduction to Information System", McGraw Hill.
2. O. Brain, "Management Information System", TMH
3. Ashok Kumar Sharma, "Analysis Design & Implementation of Information Systems: A Transition to Objects".
4. Vikas, Alter, "Information System: A management perspectives Addison Wesley.
5. Arora & Bhatia, "Information System for Managers", Excel
6. Bansal, "Information System Analysis and Design", New Age.

### **COMPUTER NETWORKS (HCS-604)**

**L T P**

**3 1 0**

#### **Unit -I**

Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design - Delay Analysis, Back Bone Design, Local Access Network Design. Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling.

#### **Unit-II**

Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.

### **Unit - III**

Network Layer: Network Layer - Point - to Point Networks, routing, Congestion control Internetworking - TCP / IP - IP packet, IP address, IPv6. '

### **Unit - IV**

Transport Layer: Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, cryptography - TCP - Window Management.

### **Unit-V**

Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application, Example Networks - Internet and Public Networks.

### **Text and Reference Books:**

1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tanenbaum, "Computer Networks", 3rd Edition, Prentice Hall India, 1997.
3. S. Keshav, "An Engineering Approach on Computer Networking", Addison Wesley, 1997
4. W. Stallings, "Data and Computer Communication", Macmillan Press, 1989.

## **SOFTWARE PROJECT MANAGEMENT (HIT-602)**

**L T P**

**3 1 0**

### **UNIT-I: Introduction and Software Project Planning**

Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.

### **UNIT-II: Project Organization and Scheduling**

Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.

### **UNIT-III: Project Monitoring and Control**

Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.

### **UNIT-IV: Software Quality Assurance and Testing**

Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model (CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Cleanroom process.

### **UNIT-V: Project Management and Project Management Tools**

Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

### **Text and Reference Books:**

1. Software Project Management, M. Cotterell, Tata McGraw-Hill Publication.
2. Information Technology Project Management, Kathy Schwalbe, Vikas Pub. House.
3. Software Project Management, S. A. Kelkar, PHI Publication.

List of Projects are as follows (Implement any one)

1. Shopping cart project using ADO.NET: This sample project has all basic features required for a shopping cart web site including Login, Registration, Add to Cart, Checkout etc. A good ASP.NET learning project using C#, ASP.NET, SQL Server.
2. Personal Assistant: This is a small project for managing personal details. Current version of this project support Address Book feature - Add, Edit and Manage contacts and addresses using VB.NET.
3. Address Book: This is a small project for managing contact details. This is a C# version of the 'Personal Assistant' project.
4. School Management System: This is a project for managing education institutes using C#.
5. Library Management System: This is an academic project for students using Java.
6. Spider Alerts & Web services: This project communicates with web services and downloads Alerts from the web server using Java & XML.
7. Patient Information System: This software can be used to keep track of the patients' information and treatment details in a hospital or clinic. Some of the advanced features include patient consulting, lab information, billing etc using JSP, Servlet & JDBC.

### COMPUTER NETWORKS LAB (HCS-654)

L T P

1. Implementation of the Data Link Layer framing method such as character stuffing and bit stuffing in C.
2. Implementation of CRC algorithm in C.
3. Implementation of a Hamming (7, 4) code to limit the noise. We have to code the 4 bit data in to 7 bit data by adding 3 parity bits. Implementation will be in C.
4. Implementation of LZW compression algorithm in C.
5. Write a socket program in C to implement a listener and a talker.
6. Simulation of a network of 3 nodes and measure the performance on the same network.
7. Write a program in C to encrypt 64-bit text using DES algorithm.

## **SOFTWARE PROJECT MANAGEMENT LAB (HIT-652)**

**L T P**

**0 0 2**

Do the exercises based on the following aspects of SPM:

1. Creating Work Breakdown Structure (WBS).
2. Preparing and Comparing Gantt Chart.
3. Drawing Pert Chart and finding critical paths.
4. Resource Management
5. Time Scheduling and Management.

# Exercises can be done on any of the following using MS Project or any other CASE Tool.

- Intranet
- Library Automation
- Academic Management
- Departmental Store Management.
- Hotel management

# **B. Tech. IV Year**

## **Information Technology**

**(Effective from the session 2011-12)**

## CRYPTOGRAPHY AND NETWORK SECURITY (HIT-701)

LTP

3 1 0

### Unit-I

Introduction to security attacks, services and mechanism, introduction to cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers.

Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

### Unit-II

Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, Primality testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms. Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption.

### Unit-III

Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA). Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.

### Unit-IV

Authentication Applications: Kerberos and X.509, directory authentication service, electronic mail security-pretty good privacy (PGP), S/MIME.

### Unit-V

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET). System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.

**Text and Reference Books:**

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersey.
2. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.
3. Bruce Schneier, "Applied Cryptography".

**ARTIFICIAL INTELLIGENCE (HIT-702)**

**L T P**

**3 1 0**

**UNIT-I: Introduction**

Introduction to Artificial Intelligence, Brief history, Various approaches to AI, Areas of application, Simulation of sophisticated & Intelligent Behavior in different area, Problem solving in games, natural language processing, automated reasoning, and visual perception, Knowledge and its role in AI, Heuristic algorithm versus solution guaranteed algorithms, Introduction to soft computing.

**UNIT-II: Searching in State Space**

Representing problems in state space, Informed versus uninformed search, Production System Model, Evaluation of the Production System, Depth First Search and Breadth First Search, Heuristics, Heuristic Search Techniques: Hill Climbing, Best First search, A\* Algorithm, Branch and Bound, Cryptarithmic Problem, Means End Analysis, AO\* Algorithm, Game Playing: MINMAX Search, Alpha-Beta Pruning, Heuristic Estimation.

**UNIT-III: Knowledge Representation and Reasoning**

Propositional Logic, First Order Predicate Logic, Graphs, Associative Network, Semantic Networks, Conceptual Dependencies, Frames, Scripts, Horn Clauses, Introductory Examples from PROLOG, Case Grammar Theory, Production Rules Knowledge Base, The Interface System, Forward & Backward Deduction, Inference System in Propositional and Predicate Logic, Reasoning under Uncertainty.

#### **UNIT-IV: Understanding Natural Languages.**

Various Approaches of NLP, Parsing techniques, Context free and transformational grammars, Transition nets, Augmented transition nets, Fillmore's grammars, Grammar free analyzers, Sentence generation, and translation, Introduction to Pattern Recognition, Structured Description, Symbolic Description, Machine Perception, Object Identification, Speech Recognition.

#### **UNIT-V: Expert Systems**

Architecture of Expert System, Representing and using domain knowledge, Expert System Shell, Explanation System, Knowledge Acquisition System, Case study of Existing Expert Systems like DENDRAL, MYCIN, Development of a small Expert System using programming Languages and tools like LISP, PROLOG, JESS.

#### **Text and Reference Books:**

1. N. J. Nilsson, "Artificial Intelligence: A New Synthesis", Elsevier Publications.
2. Charnick, "Introduction to A.I.", Addison Wesley.
3. Rich & Knight, "Artificial Intelligence", McGraw-Hill Publication.
4. Winston, "LISP", Addison Wesley
5. Marcellous, "Expert System Programming", PHI
6. Elamie, "Artificial Intelligence", Academic Press
7. Liroyed, "Foundation of Logic Processing", Springer Verlag
8. D. W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI.

### **DATA MINING AND DATA WAREHOUSING (HCS-703)**

**L T P**

**3 1 0**

#### **Unit-I**

Overview, Motivation (for Data Mining), Data Mining-Definition & Functionalities, Data Processing, Form of Data Preprocessing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. **Data Reduction**:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.



## **Unit-II**

**Concept Description:-** Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, Mining Association Rules in Large Databases, Association rule mining, mining Single-Dimensional Boolean Association rules from Transactional Databases–Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases

## **Unit-III**

### **Classification and Predictions:**

What is Classification & Prediction, Issues regarding Classification and prediction, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm, Classification methods K-nearest neighbor classifiers, Genetic Algorithm.

### **Cluster Analysis:**

Data types in cluster analysis, Categories of clustering methods, partitioning methods. Hierarchical Clustering- CURE and Chameleon. Density Based Methods-DBSCAN, OPTICS. Grid Based Methods-STING, CLIQUE. Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis

## **Unit-IV**

**Data Warehousing:** Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting.

## **Unit-V**

Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.

### **Text and Reference Books:**

1. M.H.Dunham, "Data Mining:Introductory and Advanced Topics", Pearson Education
2. Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques", Elsevier
3. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World : A Practical Guide for Building Decision Support Systems, 1/e " Pearson Education
4. Mallach, "Data Warehousing System", McGraw –Hill

## DISTRIBUTED DATABASE MANAGEMENT SYSTEM (HCS-704)

L T P

3 1 0

### Unit-I: Introduction

**Architecture of distributed systems:** A detailed review of distributed system architecture (network operating system, distributed operating systems, etc.) will be presented leading to distributed database systems. This will then be categorized into (a) federated database systems, (b) Multi-database systems, and (c) Client/Server systems. **Advanced transaction model:** For managing data processing on distributed platform the conventional transaction model needs some improvements. Discussion of some advanced transaction models suitable for different types of distributed database systems.

### Unit-II: Workflow

It is a unit of business processing. From conventional viewpoint it is a set of tightly linked atomic processing units which requires special concurrency control and commit protocols. Discussion of existing ways of handling workflows.

**Unit-III: Query processing and Optimization:** On distributed systems a query may be fragmented for processing on multiple nodes. This give rise to the problem of query fragmentation and distribution which must be addressed for improving performance.

**Unit-IV: Application distribution:** To support parallel and concurrent processing of transactions processing application have to be distributed. This gives rise to application recovery problem. This course will explore new ways of managing application recovery which is more complex than database recovery.

**Unit-V: Transaction management, commit protocol and database recovery:** These are system related issues. We will discuss commonly used schemes and advanced protocols for managing these activities.

**Buffer management:** Database maintains their own buffer for processing transactions. We will discuss the buffer architecture and buffer management schemes (replacement, allocation, etc.)

### Text and Reference Books:

1. Distributed Systems: Concept and Design. Coulouris, Dollimore, and Kindberg., AW.
2. Distributed Database Principles and Systems. Ceri and Pelagatti. McGraw Hill.
3. Recovery Mechanisms in Database Systems. Kumar and Hsu, Prentice Hall.

4. Concurrency Control and Recovery in Database Systems. Bernstein, Hadzilacos and Goodman, AW.

## **SERVICE ORIENTED ARCHITECTURE (HCS-705)**

**LT P**

**3 1 0**

### **UNIT-I: SOA Fundamentals**

Defining SOA, Business Value of SOA, Evolution of SOA, SOA characteristics, concept of a service in SOA, misperceptions about SOA, Basic SOA architecture, infrastructure services, Enterprise Service Bus (ESB), SOA Enterprise Software models, IBM On Demand operating environment

### **UNIT-II: SOA Planning and Analysis**

Stages of the SOA lifecycle, SOA Delivery Strategies, service-oriented analysis, Capture and assess business and IT issues and drivers, determining non-functional requirements (e.g., technical constraints, business constraints, runtime qualities, non-runtime qualities), business centric SOA and its benefits, Service modeling, Basic modeling building blocks, service models for legacy application integration and enterprise integration, Enterprise solution assets(ESA).

### **UNIT-III: SOA Design**

Service-oriented design process, design activities, determine services and tasks based on business process model, choosing appropriate standards, articulate architecture, mapping business processes to technology, designing service integration environment (e.g., ESB, registry), Tools available for appropriate designing.

### **UNIT-IV: SOA Implementation**

Implementing SOA, security implementation, implementation of integration patterns, services enablement, Quality assurance, A brief overview of tools available for SOA Implementation.

### **UNIT-V: Managing SOA Environment**

Distributing service management and monitoring concepts, operational management challenges, Service-level agreement considerations, SOA governance (SLA, roles and responsibilities, policies, critical success factors, and metrics), QoS compliance in SOA governance, role of ESB in SOA governance, impact

of changes to services in the SOA lifecycle.

**Text and Reference Books:**

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Prentice Hall Publication, 2005.
2. Norbert Bieberstein, Sanjay Bose, Marc Fiammante, Keith Jones, Rawn Shah, "Service-Oriented Architecture Compass: Business Value, Planning, and Enterprise Roadmap", IBM Press Publication, 2005.
3. Sandy Carter, "The New Language of Business: SOA & Web 2.0", IBM Press, 2007.
4. Thomas Erl, "Service-Oriented Architecture: A Field Guide to Integrating XML and Web Services", Prentice Hall Publication, 2004.
5. Dave Chappell, "Enterprise Service Bus", O'Reilly Publications, 2004.
6. Sanjiva Weerawarana, Francisco Curbera, Frank Leymann, Tony Storey, Donald F. Ferguson, "Web Services Platform Architecture: SOAP, WSDL, WS-Policy, WS- Addressing, WS-BPEL, WS-Reliable Messaging, and More", Prentice Hall Publication, 2005.
7. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Addison Wesley Publication, 2004.

**DOT NET & C# (HIT-702)**

**L T P**

**3 1 0**

**Unit-I**

The .NET framework: Introduction, Common Language Runtime, Common Type System, Common Language Specification, The Base Class Library, The .NET class library Intermediate language, Just-in-Time compilation, garbage collection, Application installation & Assemblies, Web Services, Unified classes.

**Unit-II**

C# Basics: 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**

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

#### **Unit-IV**

Advanced Features Using C#: Web Services, Windows services, messaging, Reflection, COM and C#, Localization.

#### **Unit-V**

**Advanced Features Using C#:** Distributed Application in C#, XML and C#, Unsafe Mode,

Graphical Device Interface with C#, Case Study (Messenger Application)

#### ***Text and Reference Books:***

1. Shibi Panikkar and Kumar Sanjeev, "C# with .NET Frame Work", Firewall Media.
2. Schildt, "C#: The Complete Reference", TMH
3. Jeffrey Richter, "Applied Microsoft .Net Framework Programming", (Microsoft)
4. Fergal Grimes, "Microsoft .Net for Programmers", (SPD)
5. TonyBaer, Jan D. Narkiewicz, Kent Tegels, Chandu Thota, Neil Whitlow, "Understanding the .Net Framework", (SPD)
6. Balagurusamy, "Programming with C#", TMH

### **ERP SYSTEMS (HIT-703)**

**L T P**

**3 1 0**

#### **Unit-I**

Enterprise wide information system, Custom built and packaged approaches, Needs and Evolution of ERP Systems, Common myths and evolving realities, ERP and Related Technologies, Business Process Reengineering and Information Technology, Supply Chain Management, Relevance to Data Warehousing, Data Mining and OLAP, ERP Drivers, Decision support system.

#### **Unit-II**

ERP Domain, ERP Benefits classification, Present global and Indian market scenario, milestones and pitfalls, Forecast, Market players and profiles, Evaluation criterion for ERP product, ERP Life Cycle: Adoption decision, Acquisition, Implementation, Use & Maintenance, Evolution and Retirement phases, ERP Modules.

### **Unit- III**

Framework for evaluating ERP acquisition, Analytical Hierarchy Processes (AHP), Applications of AHP in evaluating ERP, Selection of Weights, Role of consultants, vendors and users in ERP implementation; Implementation vendors evaluation criterion, ERP Implementation approaches and methodology, ERP implementation strategies, ERP Customization, ERP-A manufacturing Perspective.

### **Unit- IV**

Critical success and failure factors for implementation, Model for improving ERP effectiveness, ROI of ERP implementation, Hidden costs, ERP success inhibitors and accelerators, Management concern for ERP success, Strategic Grid: Useful guidelines for ERP Implementations.

### **Unit- V**

Technologies in ERP Systems and Extended ERP, Case Studies Development and Analysis of ERP Implementations in focusing the various issues discussed in above units through Soft System approaches or qualitative Analysis tools, Learning and Emerging Issues, ERP and E-Commerce.

### **Text and Reference Books:**

1. Lexis Leon, "Enterprise Resource Planning", TMH
2. Brady, Manu, Wegner, " Enterprise Resource Planning", TMH

## **BIOINFORMATICS (HCS-708)**

**L T P**

**3 1 0**

### **Unit-I: Introduction**

Bioinformatics objectives and overviews, Interdisciplinary nature of Bioinformatics, Data integration, Data analysis, Major Bioinformatics databases and tools, Metadata: Summary & reference systems, finding new type of data online.

**Molecular Biology and Bioinformatics:** Systems approach in biology, Central dogma of molecular biology, problems in molecular approach and the bioinformatics approach, Overview of the bioinformatics applications.

## **Unit-II: The Information Molecules and Information Flow**

Basic chemistry of nucleic acids, Structure of DNA, Structure of RNA, DNA Replication, -Transcription, - Translation, Genes- the functional elements in DNA, Analyzing DNA, DNA sequencing. Proteins: Amino acids, Protein structure, Secondary, Tertiary and Quaternary structure, Protein folding and function, Nucleic acid-Protein interaction.

## **Unit-III: Perl**

Perl Basics, Perl applications for bioinformatics- Bioperl, Linux Operating System, Understanding and Using Biological Databases, Java clients, CORBA, Introduction to biostatistics.

**Unit-IV: Nucleotide** sequence data Genome, Genomic sequencing, expressed sequence tags, gene expression, transcription factor binding sites and single nucleotide polymorphism. Computational representations of molecular biological data storage techniques: databases (flat, relational and object oriented), and controlled vocabularies, general data retrieval techniques: indices, Boolean search, fuzzy search and neighboring, application to biological data warehouses.

**Unit-V: Biological data types and their special requirements:** sequences, macromolecular structures, chemical compounds, generic variability and its connection to clinical data. Representation of patterns and relationships: alignments, regular expressions, hierarchies and graphical models.

## **Text and Reference Books:**

1. O'Reilly, " Developing Bio informatics computer skills", Indian Edition's publication
2. Rastogi, Mendiratta, Rastogi, "Bioinformatics concepts, skills & Applications", CBS Publishers
3. Rashidi, Hooman and Lukas K. Buehler, "Bioinformatics Basic Applications" CRC Press.
4. "Bioinformatics" , Addison Wesley
5. Stephen Misner & Stephen Krawetz, " Bioinformatics- Methods & Protocols"

The following programs should be implemented preferably on 'UNIX' platform using 'C' language (for 1-5) and other standard utilities available with 'UNIX' systems (for 6-8):

1. Implement the encryption and decryption of 8-bit data using 'Simplified DES Algorithm(created by Prof. Edward Schaefer) in 'C'.
2. Implement 'Linear Congruential Algorithm' to generate 5 pseudo-random numbers in 'C'.
3. Implement Rabin-Miller Primality Testing Algorithm in 'C'.
4. Implement the Euclid Algorithm to generate the GCD of an array of 10 integers in 'C'.
5. Implement RSA algorithm for encryption and decryption in 'C'.
6. Configure a mail agent to support Digital Certificates, send a mail and verify the correctness of this system using the configured parameters.
7. Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.
8. Configure a firewall to block the following for 5 minutes and verify the correctness of this system using the configured parameters:
  - a. Two neighborhood IP addresses on your LAN
  - b. All ICMP requests
  - c. TCP SYN Packets

## **DISTRIBUTED SYSTEMS (HCS-801)**

**L T P**

**3 1 0**

### **Unit-I**

**Characterization of Distributed Systems:** Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges.

**System Models:** Architectural models, Fundamental Models

**Theoretical Foundation for Distributed System:** Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks, Causal ordering of messages, global state, termination detection.

**Distributed Mutual Exclusion:** Classification of distributed mutual exclusion, Requirement of mutual exclusion theorem, Token based and non token based algorithms, Performance metric for distributed mutual exclusion algorithms.

### **Unit-II**



**Distributed Deadlock Detection:** System model, Resource vs communication deadlocks, Deadlock prevention, avoidance, detection & resolution, Centralized deadlock detection, Distributed dead lock detection, Path pushing algorithms, Edge chasing algorithms.

**Agreement Protocols:** Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system.

### **Unit–III**

**Distributed Objects and Remote Invocation:** Communication between distributed objects, Remote procedure call, Events and notifications, Java RMI case study.

**Security:** Overview of security techniques, Cryptographic algorithms, Digital signatures Cryptography pragmatics, Case studies: Needham Schroeder, Kerberos, SSL & Millicent.

**Distributed File Systems:** File service architecture, Sun Network File System, The Andrew File System, Recent advances.

### **Unit–IV**

**Transactions and Concurrency Control:** Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control.

**Distributed Transactions:** Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.

### **Unit –V**

**Distributed Algorithms:** Introduction to communication protocols, Balanced sliding window protocol, Routing algorithms, Destination based routing, APP problem, Deadlock free Packet switching, Introduction to Wave & traversal algorithms, Election algorithm.

**CORBA Case Study:** CORBA RMI, CORBA services.

### **Text and Reference Books:**

1. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Ed.
3. Gerald Tel, "Distributed Algorithms", Cambridge University Press

## **MOBILE COMPUTING (HIT-801)**

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### **Unit – I**

Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

### **Unit - II**

Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

### **Unit – III**

Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, file system, disconnected operations.

### **Unit - IV**

Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

### **Unit – V**

Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

### **Text and Reference Books:**

1. J. Schiller, Mobile Communications, Addison Wesley.
2. A. Mehrotra , GSM System Engineering.
3. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.

4. Charles Perkins, Mobile IP, Addison Wesley.
5. Charles Perkins, Ad hoc Networks, Addison Wesley.

## **MULTI CORE ARCHITECTURE (HCS-803)**

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### **Unit-I: Multi-core Architectures**

Introduction to multi-core architectures, issues involved into writing code for multi-core architectures, Virtual Memory, VM addressing, VA to PA translation, Page fault, TLB- Parallel computers, Instruction level parallelism (ILP) vs. thread level parallelism (TLP), Performance issues, OpenMP and other message passing libraries, threads, mutex etc.

### **Unit-II: Multi-threaded Architectures**

Brief introduction to cache hierarchy - Caches: Addressing a Cache, Cache Hierarchy, States of Cache line, Inclusion policy, TLB access, Memory Op latency, MLP, Memory Wall, communication latency, Shared memory multiprocessors, General architectures and the problem of cache coherence, Synchronization primitives: Atomic primitives; locks: TTS, ticket, array; barriers: central and tree; performance implications in shared memory programs; Chip multiprocessors: Why CMP (Moore's law, wire delay); shared L2 vs. tiled CMP; core complexity; power/performance; Snoopy coherence: invalidate vs. update, MSI, MESI, MOESI, MOSI; performance trade-offs; pipelined snoopy bus design; Memory consistency models: SC, PC, TSO, PSO, WO/WC, RC;

Chip multiprocessor case studies: Intel Montecito and dual-core, Pentium4, IBM Power4, Sun Niagara

### **Unit-III: Compiler Optimization Issues**

Code optimizations: Copy Propagation, dead Code elimination , Loop Optimizations-Loop Unrolling, Induction variable Simplification, Loop Jamming, Loop Unswitching, Techniques to improve detection of parallelism: Scalar Processors, Special locality, Temporal locality, Vector machine, Strip mining, Shared memory model, SIMD architecture, Dopar loop, Dosingle loop.

### **Unit-IV: Control Flow analysis**

Control flow analysis, Flow graph, Loops in Flow graphs, Loop Detection, Approaches to Control Flow Analysis, Reducible Flow Graphs, Node Splitting. Dataflow analysis: Analysis of Structured programs, Reaching definition Analysis, Control Tree based.

#### **Unit-V: Data-Flow Analysis**

Data Flow analysis, Interval Analysis, Backward Analysis, Available Expression, Live variable Analysis, Very busy Expression, pointer analysis, alias analysis; Data Dependence Analysis : data Dependence, solving data dependence equations (integer linear programming problem); Data Dependency graph, Basic Block dependence, Data Dependence in loops, iteration space, iteration Vector, Data dependency in parallel loops, Loop optimizations.

#### **Text and Reference Books:**

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques & Tools", 2nd Ed, 2006
2. Shameem Akhter and Jason Roberts, Multi-Core Programming, Intel Press, 2006
3. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann publishers, 2002

### **EMBEDDED SYSTEMS (HCS-804)**

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#### **UNIT-I: Introduction to Embedded Systems**

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

#### **UNIT-II: Devices and Buses for Devices Network**

I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - '12C', 'USB', 'CAN' and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

### **UNIT-III: Programming Concepts and Embedded Programming in C**

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of 'C' Program compilers – Cross compiler – Optimization of memory codes.

### **UNIT-IV: Real Time Operating Systems**

Timing and clocks in embedded system, Task modeling and management: RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics – Co-operative Round Robin Scheduling – Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) – Preemptive Scheduling Model strategy by a Scheduler – Critical Section Service by a Preemptive Scheduler – Fixed (Static) Real time scheduling of tasks

### **UNIT-V: Embedded Control**

Embedded control and control hierarchy, communication strategies for embedded system: encoding and flow chart. Fault tolerance and formal verification.

### **Text and Reference Books:**

1. Steve Heath, Embedded Systems Design, Second Edition-2003, Newnes.
2. David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
3. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001.
4. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware Software Introduction, John Wiley, 2002.
5. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First reprint Oct. 2003.
6. H.Kopetz, "Real-Time Systems", Kluwer, 1997.
7. R.Gupta, "Co-synthesis of Hardware and Software for Embedded Systems", Kluwer 1995.

## REAL TIME SYSTEMS (HCS-805)

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### UNIT-I: Introduction

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

### UNIT-II: Real Time Scheduling

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

### UNIT-III: Resources Access Control

Effect of Resource Contention and Resource Access Control (RAC), Nonpreemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic nPriority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

### UNIT-IV: Multiprocessor System Environment

Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol, Schedulability of Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems, Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks with Temporal Distance Constraints.

### UNIT-V: Real Time Communication

Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real Time Protocols, Communication in Multicomputer System, An Overview of Real Time Operating Systems.

### Text and Reference Books:

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.

2. Real-Time Systems: Scheduling, Analysis, and Verification by Prof. Albert M. K. Cheng, John Wiley and Sons Publications.

## **SOFT COMPUTING (HIT-802)**

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### **Unit-I: Artificial Neural Networks**

Basic concepts - Single layer perception - Multilayer Perception - Supervised and Unsupervised learning – Back propagation networks - Kohnen's self organizing networks - Hopfield network.

### **Unit-II: Fuzzy Systems**

Fuzzy sets and Fuzzy reasoning - Fuzzy matrices - Fuzzy functions - Decomposition - Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.

### **Unit-III: Neuro-Fuzzy Modelling**

Adaptive networks based Fuzzy interface systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation.

### **Unit-IV: Genetic Algorithms**

Survival of the Fittest - Fitness Computations - Crossover - Mutation - Reproduction - Rank method - Rank space method.

### **Unit-V: Soft Computing and Conventional AI**

AI search algorithm - Predicate calculus - Rules of interference – Semantic networks - Frames - Objects - Hybrid models - Applications.

### **Text and Reference Books:**

1. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall 1998.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 1997.
3. Laurene Fauset, "Fundamentals of Neural Networks", Prentice Hall, 1994.

4. George J. Klir and Bo Yuan, "Fuzzy sets and Fuzzy Logic", Prentice Hall, USA 1995.
5. N. J. Nilsson, "Artificial Intelligence - A New Synthesis", Harcourt Asia Ltd., 1998.
6. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y, 1989.

## **SOFTWARE QUALITY ENGINEERING (HCS-807)**

**LT P**

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### **UNIT-I: Introduction**

Defining Software Quality, Software Quality Attributes and Specification, Cost of Quality, Defects, Faults, Failures, Defect Rate and Reliability, Defect Prevention, Reduction, and Containment, Overview of Different Types of Software Review, Introduction to Measurement and Inspection Process, Documents and Metrics.

### **UNIT-II: Software Quality Metrics**

Product Quality Metrics: Defect Density, Customer Problems Metric, Customer Satisfaction Metrics, Function Points, In-Process Quality Metrics: Defect Arrival Pattern, Phase-Based Defect Removal Pattern, Defect Removal Effectiveness, Metrics for Software Maintenance: Backlog Management Index, Fix Response Time, Fix Quality, Software Quality Indicators.

### **UNIT-III: Software Quality Management and Models**

Modeling Process, Software Reliability Models: The Rayleigh Model, Exponential Distribution and Software Reliability Growth Models, Software Reliability Allocation Models, Criteria for Model Evaluation, Software Quality Assessment Models: Hierarchical Model of Software Quality Assessment.

### **UNIT-IV: Software Quality Assurance**

Quality Planning and Control, Quality Improvement Process, Evolution of Software Quality Assurance (SQA), Major SQA Activities, Major SQA Issues, Zero Defect Software, SQA Techniques, Statistical Quality Assurance, Total Quality Management, Quality Standards and Processes.

### **UNIT-V: Software Verification, Validation & Testing:**



Verification and Validation, Evolutionary Nature of Verification and Validation, Impracticality of Testing all Data and Paths, Proof of Correctness, Software Testing, Functional, Structural and Error-Oriented Analysis & Testing, Static and Dynamic Testing Tools, Characteristics of Modern Testing Tools.

**Text and Reference Books:**

1. Jeff Tian, Software Quality Engineering (SQE), Wiley-Interscience, 2005; ISBN 0-471-71345-7.
2. Metrics and Models in Software Quality Engineering, Stephen H. Kan, Addison-Wesley (2002), ISBN: 0201729156

**SOFTWARE TESTING (HCS-808)**

**LT P**

**3 1 0**

**Unit-I: Introduction**

Faults, Errors, and Failures, Basics of software testing, Testing objectives, Principles of testing, Requirements, behavior and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software Quality and Reliability, Software defect tracking.

**Unit-II: White Box and Black Box Testing**

White box testing, static testing, static analysis tools, Structural testing: Unit/Code functional testing, Code coverage testing, Code complexity testing, Black Box testing, Requirements based testing, Boundary value analysis, Equivalence partitioning, state/graph based testing, Model based testing and model checking, Differences between white box and Black box testing.

**Unit-III: Integration, System, and Acceptance Testing**

Top down and Bottom up integration, Bi-directional integration, System integration, Scenario Testing, Defect Bash, Functional versus Non-functional testing, Design/Architecture verification, Deployment testing, Beta testing, Scalability testing, Reliability testing, Stress testing, Acceptance testing: Acceptance criteria, test cases selection and execution,

**Unit-IV: Test Selection & Minimization for Regression Testing**

Regression testing, Regression test process, Initial Smoke or Sanity test, Selection of regression tests, Execution Trace, Dynamic Slicing, Test Minimization, Tools for regression testing, Ad hoc Testing: Pair testing, Exploratory testing, Iterative testing, Defect seeding.

#### **Unit-V: Test Management and Automation**

Test Planning, Management, Execution and Reporting, Software Test Automation: Scope of automation, Design & Architecture for automation, Generic requirements for test tool framework, Test tool selection, Testing in Object Oriented Systems.

#### **Text and Reference Books:**

1. S. Desikan and G. Ramesh, "Software Testing: Principles and Practices", Pearson Education.
2. Aditya P. Mathur, "Fundamentals of Software Testing", Pearson Education.
3. K. K. Aggarwal and Yogesh Singh, "Software Engineering", 3<sup>rd</sup> Edition, New Age International Publication.

### **MOBILE COMPUTING LAB (HIT-851)**

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Experiments/Exercises based on simulation, working and performance analysis of various mobile systems are to be done on tools like NS2, NetSIM, GlomoSIM, and MATLAB.

### **DISTRIBUTED SYSTEMS LAB (HCS-851)**

The following programs should be developed preferably on '**UNIX**' platform:-

1. Simulate the functioning of Lamport's Logical Clock in 'C'.
2. Simulate the Distributed Mutual Exclusion in 'C'.
3. Implement a Distributed Chat Server using TCP Sockets in 'C'.
4. Implement RPC mechanism for a file transfer across a network in 'C'.
5. Implement 'Java RMI' mechanism for accessing methods of remote systems.
6. Simulate Balanced Sliding Window Protocol in 'C'.
7. Implement CORBA mechanism by using 'C++' program at one end and 'Java' program on the other.