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**SEMESTER IV**

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TOTAL NO OF CREDITS TO BE EARNED FOR THE AWARD OF DEGREE: 20+22+15+12= 69
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UNIT I  DISTRIBUTED DATABASES  5
Distributed Databases Vs Conventional Databases – Architecture – Fragmentation – Query

UNIT II  OBJECT ORIENTED DATABASES  10
Introduction to Object Oriented Data Bases - Approaches - Modeling and Design - Persistence –

UNIT III  EMERGING SYSTEMS  10
Enhanced Data Models - Client/Server Model - Data Warehousing and Data Mining - Web
Databases – Mobile Databases.

UNIT IV  DATABASE DESIGN ISSUES  10
ER Model - Normalization - Security - Integrity - Consistency - Database Tuning - Optimization
and Research Issues – Design of Temporal Databases – Spatial Databases.

UNIT V  CURRENT ISSUES  10
Rules - Knowledge Bases - Active And Deductive Databases - Parallel Databases – Multimedia
Databases – Image Databases – Text Database

TOTAL : 45 PERIODS

REFERENCES:
1. Elisa Bertino, Barbara Catania, Gian Piero Zarri, “Intelligent Database Systems”, Addison-
2. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, R.T.Snodgrass, V.S.Subrahmanian,
5. Abdullah Uz Tansel Et Al, “Temporal Databases: Theory, Design And Principles”, Benjamin
UNIT I  INTRODUCTION  

UNIT II  DISTRIBUTED OPERATING SYSTEMS 

UNIT III  DISTRIBUTED RESOURCE MANAGEMENT 

UNIT IV  FAILURE RECOVERY AND FAULT TOLERANCE  
Basic Concepts-Classification of Failures – Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Checkpointing and Recovery; Checkpointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and Non-blocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols;

UNIT V  MULTIPROCESSOR AND DATABASE OPERATING SYSTEMS  

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:
UNIT I 9

UNIT II 10

UNIT III 9

UNIT IV 9

UNIT V 8

TOTAL : 45 PERIODS

TEXT BOOKS:
2. James E Smith and Ravi Nair, “Virtual Machines”, Elsevier, 2005. (Units 4, 5) (Sections 1.0-1.6, 2.0-2.5, 2.8, 3.0-3.6, 4.2, 5.0-5.3, 5.5-5.6, 6.0-6.3, 6.5-6.6, 10.2, 10.3)

REFERENCES:
UNIT I
An Overview of Computer Security, Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

UNIT II
Cryptography- Key management – Session and Interchange keys, Key exchange and generation, Cryptographic Key Infrastructure, Storing and Revoking Keys, Digital Signatures, Cipher Techniques

UNIT III

UNIT IV
Malicious Logic, Vulnerability Analysis, Auditing and Intrusion Detection

UNIT V

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:
UNIT IV

UNIT V

TOTAL : 45 PERIODS

TEXT BOOKS:

CS9227 OPERATING SYSTEM LAB

MULTIPROCESSOR OPERATING SYSTEMS

PROGRAM 1 – Semaphores - Multiprocessor operating systems

Assume there are three processes: Pa, Pb, and Pc. Only Pa can output the letter A, Pb B, and Pc C.
Utilizing only semaphores (and no other variables) the processes are synchronized so that the output satisfies the following conditions:

a) A B must be output before any C's can be output.
b) B's and C's must alternate in the output string, that is, after the first B is output, another B cannot be output until a C is output. Similarly, once a C is output, another C cannot be output until a B is output.
c) The total number of B's and C's which have been output at any given point in the output string cannot exceed the number of A's which have been output up to that point.

Examples

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<td>invalid, violates b)</td>
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<td>AABCABC</td>
<td>invalid, violates c)</td>
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<td>AB</td>
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TOTAL : 45 PERIODS

PROGRAM 2 – Multithreading - Multiprocessor operating systems
The Cigarette Smokers Problem

Consider a simulation with three smoker threads and one agent thread. Each smoker continuously makes a cigarette and smokes it. But to make a cigarette, a smoker needs three ingredients: tobacco, paper, and matches. One of the smoker threads has only paper, another has only tobacco, and the third has only matches. The agent thread has an infinite supply of all three materials. The three smoker threads are initially blocked. The agent places two randomly chosen (different) ingredients on the table and unblocks the one smoker who has the remaining ingredient. The agent then blocks. The unblocked smoker removes the two ingredients from the table, makes a cigarette, and smokes it for a random amount of time, unblocking the agent on completion of smoking the cigarette. The agent then puts out another random two of the three ingredients, and the cycle repeats.

Write a multi-class multithreaded Java program that uses a monitor to synchronize the agent thread and the three smoker threads. Do not mechanically translate semaphore code into monitor code! The agent thread executes in an agent object created from an agent class. Each smoker thread executes in a smoker object. All smoker objects are created from one smoker class whose constructor is used to specify the ingredient possessed by the smoker object. A driver class with a main method constructs the objects and starts the threads.

Use a single monitor object instantiated from a class Control for synchronization. Each of the four threads invokes a synchronized monitor method for its synchronization. No semaphores are allowed. No synchronized blocks are allowed, only synchronized methods. No busy waiting is allowed. No calls to nap inside a synchronized method are allowed (do not nap while holding the monitor object's lock, that is, while inside a synchronized method or while inside a method called by a synchronized method).

PROGRAM 3 – Multiple sleeping barbers - Multiprocessor operating systems

Write a multi-class multithreaded Java program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single Customer class, each barber is instantiated from a single Barber class.

Network operating systems

PROGRAM 4 – Network operating systems

Establish a Lab setup for the following network operating systems based programs based on the skills in networking on your own. E.g. for identifying networking hardware, identifying different kinds of network cabling and network interface cards can be done.

Exercises

1. Identifying Local Area Network Hardware
2. Exploring Local Area Network Configuration Options
3. Verifying TCP/IP Settings
4. Sharing Resources
5. Testing LAN Connections
6.
Real time operating systems

PROGRAM 5 – Real time operating systems

A real-time program implementing an alarm clock shall be developed. [Alarm clock, using C and Simple_OS]

The program shall fulfill the following requirements:
Clock with alarm functionality shall be implemented, It shall be possible to set the time, It shall be possible to set the alarm time, the alarm shall be enabled when the alarm time is set, the alarm shall be activated when the alarm is enabled, and when the current time is equal to the alarm time, an activated alarm must be acknowledged. Acknowledgement of an alarm shall lead to the alarm being disabled, the alarm is enabled again when a new alarm time is set, an alarm which is not acknowledged shall be repeated every 10 seconds. The program shall communicate with a graphical user interface, where the current time shall be displayed, and where the alarm time shall be displayed when the alarm is enabled. It shall be possible to terminate the program, using a command which is sent from the graphical user interface.

Database operating systems

PROGRAM 6 – Transactions and Concurrency - Database operating systems
Exercises

Assume any application (e.g. banking) on your own and do the following exercises.
1. Investigate and implement the ObjectStore's concurrency options.
2. Implement the concurrency conflict that occurs between multiple client applications.
3. Observe and implement the implication of nested transactions.

Distributed operating systems

PROGRAM 7 – Distributed operating systems

1. Design a RMI Lottery application. Each time you run the client program -- “java LotteryClient n”, the server program “LotteryServer” will generate n set of Lottery numbers. Here n is a positive integer, representing the money you will spend on Lottery in sterling pounds. Write this program in a proper engineering manner, i.e. there should be specifications, design (flow chart, FD, or pseudo code), coding, test/debug, and documentation.

2. Consider a distributed system that consists of two processes which communicate with each other. Let P be a state predicate on the local state of one process and Q be a state predicate on the local state of the other process. Assume that neither P nor Q are stable (i.e. closed).

   Design a superimposed computation which detects that there exists an interleaving of underlying events in this system where at some state P ^ Q holds. (A superposed computation is one that does not a ect the underlying system; it may 'read" but not \write" the state of the underlying system. Events in a superposed computation may occur in at the same instant as the underlying events and/or at different instants.) State any assumptions you make.
   [Hint: Use vector clocks.]
1. Creation of HTML pages with frames, links, tables and other tags
2. Usage of internal and external CSS along with HTML pages
3. Client side Programming
   i. JavaScript for displaying date and comparing two dates
   ii. Form Validation including text field, radio buttons, check boxes, list box and other controls
4. Usage of ASP/JSP objects response, Request, Application, Session, Server, ADO etc
   i. Writing online applications such as shopping, railway/air/bus ticket reservation system with set of ASP/JSP pages
   ii. Using sessions and cookies as part of the web application
5. Writing Servlet Program using HTTP Servlet
6. Any online application with database access
7. Creation of XML document for a specific domain
8. Writing DTD or XML schema for the domain specific XML document
9. Parsing an XML document using DOM and SAX Parsers
10. Sample web application development in the open source environment

TOTAL : 45 PERIODS

UNIT I WIRELESS COMMUNICATION FUNDAMENTALS 9

UNIT II TELECOMMUNICATION SYSTEMS 11

UNIT III WIRELESS NETWORKS 9

UNIT IV NETWORK LAYER 9

UNIT V TRANSPORT AND APPLICATION LAYERS 7

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:

CS9252 GRID COMPUTING L T P C
UNIT I INTRODUCTION TO GRID COMPUTING 7

UNIT II GRID COMPUTING ARCHITECTURE 8
Grid Computing anatomy – Next generation of Grid computing initiatives–Merging the Grid services architecture with Web services architecture.

UNIT III GRID COMPUTING TECHNOLOGIES 11
OGSA – Sample use cases that drive the OGSA platform components – OGSI and WSRF–OGSA Basic Services – Security standards for grid computing.

UNIT IV GRID COMPUTING TOOL KIT 10

UNIT V HIGH LEVEL GRID SERVICES 9
High level grid services – OGSI .NET middleware Solution Mobile OGSI.NET for Grid computing on Mobile devices.

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:
UNIT I AUTOMATA

UNIT II REGULAR EXPRESSIONS AND LANGUAGES
Regular Expression – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata.

UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES

UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES
Normal Forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM.

UNIT V INDECIDABILITY
A Language That Is Not Recursive Enumerable – An Undecidable Problem that Is RE – Undecidable Problems about TM – Post’s Correspondence Problem, The Class P And NP.

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:
UNIT III  NEURAL NETWORKS  9
Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks –
Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement
Learning – Unsupervised Learning Neural Networks – Adaptive Resonance architectures –
Advances in Neural networks.

UNIT IV  FUZZY LOGIC  9
Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy
Decision Making.

UNIT V  NEURO-FUZZY MODELING  9
Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification
and Regression Trees – Data Clustering Algorithms – Rulebase Structure Identification –
Neuro-Fuzzy Control – Case studies.

TOTAL : 45 PERIODS

TEXT BOOKS:
2. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”,Prentice
   Hall, 1995.
3. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and

REFERENCES:
UNIT III DISTRIBUTED RESOURCE MANAGEMENT 10
Distributed Shared Memory – Data-Centric Consistency Models – Client-Centric Consistency Models – Ivy – Munin – Distributed Scheduling – Distributed File Systems – Sun NFS.

UNIT IV FAULT TOLERANCE AND CONSENSUS 7

UNIT V CASE STUDIES 8
Distributed Object-Based System – CORBA – COM+ – Distributed Coordination-Based System – JINI.

TOTAL : 45 PERIODS

REFERENCES:

CS9256 MULTIMEDIA SYSTEMS  L T P C
3 0 0 3

UNIT I INTRODUCTION AND QOS 9

UNIT II OPERATING SYSTEMS 9
Real-Time Processing-Scheduling-Interprocess Communication-Memory and Management-Server Architecture-Disk Management.

UNIT III FILE SYSTEMS AND NETWORKS 9
Traditional and Multimedia File Systems-Caching Policy-Batching-Piggy backing-Ethernet-Gigabit Ethernet-Token Ring-100VG Any LAN-Fiber Distributed Data Interface (FDDI)- ATM Networks-MAN-WAN.

UNIT IV COMMUNICATION 9

UNIT V SYNCHRONIZATION 9
Synchronization in Multimedia Systems-Presentation-Synchronization Types-Multimedia Synchronization Methods-CASE Studies-MHEG-MODE-ACME.

TOTAL : 45 PERIODS
TEXT BOOK:

REFERENCES:

CS 9257 XML AND WEB SERVICES L T P C
UNIT I XML TECHNOLOGY FAMILY 9

UNIT II ARCHITECTING WEB SERVICES 9

UNIT III WEB SERVICES BUILDING BLOCK 9

UNIT IV IMPLEMENTING XML IN E-BUSINESS 9

UNIT V XML AND CONTENT MANAGEMENT 9

TOTAL: 45 PERIODS

TEXT BOOKS
REFERENCES

CS9258 BIO INFORMATICS

UNIT I INTRODUCTORY CONCEPTS

UNIT II SEARCH ENGINES AND DATA VISUALIZATION

UNIT III STATISTICS AND DATA MINING

UNIT IV PATTERN MATCHING

UNIT V MODELING AND SIMULATION

TOTAL : 45 PERIODS

REFERENCES:
CS9259 NETWORK SECURITY L T P C 3 0 0 3

UNIT I INTRODUCTION 9

UNIT II PUBLIC KEY ENCRYPTION 9
RSA - Elliptic Curve Cryptography - Number Theory Concepts

UNIT III MESSAGE AUTHENTICATION 9
Hash Functions - Digest Functions - Digital Signatures - Authentication Protocols.

UNIT IV NETWORK SECURITY PRACTICE 9

UNIT V SYSTEM SECURITY 9

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:

CS9260 EMBEDDED SYSTEMS L T P C 3 0 0 3

UNIT I EMBEDDED COMPUTING 9
Challenges of Embedded Systems – Embedded system design process. Embedded processors – ARM processor – Architecture, ARM and Thumb Instruction sets

UNIT II EMBEDDED C PROGRAMMING 9

UNIT III OPTIMIZING ASSEMBLY CODE 9

UNIT IV PROCESSES AND OPERATING SYSTEMS 9
Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Exception and interrupt handling - Performance issues.
UNIT V EMBEDDED SYSTEM DEVELOPMENT
Meeting real time constraints – Multi-state systems and function sequences. Embedded software development tools – Emulators and debuggers. Design methodologies – Case studies – Complete design of example embedded systems.

TOTAL : 45 PERIODS

REFERENCES:

CS9261 DIGITAL IMAGING L T P C
3 0 0 3

UNIT I FUNDAMENTALS OF IMAGE PROCESSING

UNIT II IMAGE ENHANCEMENT

UNIT III IMAGE SEGMENTATION AND FEATURE ANALYSIS

UNIT IV MULTI RESOLUTION ANALYSIS AND COMPRESSIONS

UNIT V APPLICATIONS OF IMAGE PROCESSING

TOTAL : 45 PERIODS

REFERENCES:
UNIT I

UNIT II
Basics of software testing – test generation from requirements – finite state models – combinatorial designs - test selection, minimization and prioritization for regression testing – test adequacy, assessment and enhancement

UNIT III
Testing strategies – white box and black box approach – integration testing – system and acceptance testing – performance testing – regression testing - internationalization testing – ad-hoc testing – website testing – usability testing – accessibility testing
Test plan – management – execution and reporting – software test automation – automated testing tools

UNIT IV

UNIT V
Project progress control – costs – quality management standards – project process standards – management and its role in SQA – SQA unit

TOTAL : 45 PERIODS

REFERENCES:
UNIT II  AD-HOC NETWORK ROUTING & TCP  9

UNIT III  WSN -MAC  9

UNIT IV  WSN ROUTING, LOCALIZATION & QOS  9

UNIT V  MESH NETWORKS  9

TOTAL : 45 PERIODS

REFERENCES:

CS9264  DATA WAREHOUSING AND DATA MINING  LT P C
3 0 0 3

UNIT I

UNIT II

UNIT III
UNIT IV

UNIT V
Mining Object, Spatial, Multimedia, Text and Web Data:
Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

REFERENCES

CS9265 PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS

UNIT I

UNIT II

UNIT III
Markovian FIFO Queuing Systems – M/M/1 – M/M/a – M/M/∞ - M/G/1 – M/M/m/m and other Markov-Non-Markovian and self-similar models – Network of Queues – Burke’s Theorem – Jackson’s Theorem.

UNIT IV
Multi-User Uplinks/Downlinks - Capacity Regions - Opportunistic Scheduling for Stability and Max Throughput - Multi-Hop Routing - Mobile Networks - Throughput Optimality and Backpressure

UNIT V

TOTAL : 45 PERIODS
TEXT BOOKS:

REFERENCES:

CS9266 AGENT BASED INTELLIGENT SYSTEMS L T P C

UNIT I INTRODUCTION 9

UNIT II KNOWLEDGE REPRESENTATION AND REASONING 9
Logical Agents-First order logic-First Order Inference-Unification-Chaining-Resolution Strategies-Knowledge Representation-Objects-Actions-Events

UNIT III PLANNING AGENTS 9

UNIT IV AGENTS AND UNCERTAINTY 9

UNIT V HIGHER LEVEL AGENTS 9
Knowledge in Learning-Relevance Information-Statistical Learning Methods-Reinforcement Learning-Communication-Formal Grammar-Augmented Grammars- Future of AI.

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:
UNIT I  VISUALIZATION  

UNIT II  FOUNDATIONS FOR DATA VISUALIZATION  
Visualization stages – Experimental Semiotics based on Perception Gibson’s Affordance theory – A Model of Perceptual Processing – Types of Data.

UNIT III  COMPUTER VISUALIZATION  

UNIT IV  MULTIDIMENSIONAL VISUALIZATION  

UNIT V  CASE STUDIES  
Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCE:
UNIT II OBJECT AND OBJECT RELATIONAL DATABASES 9
Concepts for Object Databases: Object Identity – Object structure – Type Constructors –
Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies –
Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG
feature sin SQL/Oracle – Case Studies.

UNIT III XML DATABASES 9
JDBC – Information Retrieval – Data Warehousing – Data Mining

UNIT IV MOBILE DATABASES 9
Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management -
Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control -
Transaction Commit Protocols- Mobile Database Recovery Schemes

UNIT V MULTIMEDIA DATABASES 9
Multidimensional Data Structures – Image Databases – Text/Document Databases- Video
Databases – Audio Databases – Multimedia Database Design.

TOTAL : 45 PERIODS

REFERENCES:
   Education/Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design,
4. C.J.Date, A.Kannan and S.Swamynathan,”An Introduction to Database Systems”, Eighth
UNIT IV    IN STREAM ACTIVITIES IN PROJECTS  
Project Initiation – Project Planning – Execution and Tracking – Project Wind up – Concept of Process/Project Database.

UNIT V    ENGINEERING AND PEOPLE ISSUES IN PROJECT MANAGEMENT  

TOTAL : 45 PERIODS

REFERENCES:
4. Bob Hughes and Mike Cotterell, "Software Project Management".

CS9270   COMPONENT BASED TECHNOLOGY LT P C  
3 0 0 3

UNIT I    INTRODUCTION  

UNIT II    JAVA COMPONENT TECHNOLOGIES  

UNIT III   CORBA TECHNOLOGIES  

UNIT IV    COM AND .NET TECHNOLOGIES  

UNIT V    COMPONENT FRAMEWORKS AND DEVELOPMENT  

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCE: