WITH EFFECT FROM THE ACADEMIC YEAR 2009-2010

SCHEME OF INSTRUCTION AND EXAMINATION

B.E. IV/IV (REGULAR)

COMPUTER SCIENCE & ENGINEERING

SEMESTER - I

Sl. No.	Syllabus Ref. No.	Subject	Scheme of Instruction		Scheme of Examination		
			Periods per Week		Duration in Hrs	Maximum Marks	
			L/T	D/P		Univ. Exam	Sessionals
		THEORY					
1.	CS 401	Distributed Systems	4	-	3	75	25
2.	CS 402	Artificial Inteligence	4	-	3	75	25
3.	CS 403	Compiler Construction	4	-	3	75	25
4.	CS 404	Principles & Applications of Embedded Systems	4	-	3	75	25
5.		ELECTIVE - I	4	-	3	75	25
		PRACTICALS					
1.	CS 431	Distributed Systems Lab	-	3	3	50	25
2.	CS 432	Embedded Systems Lab	-	3	3	50	25
3.	CS 433	Compiler Constuction Lab.	-	3	3	50	25
3.	CS 434	Project Seminar	-	3	-	-	25
		Total	**20**	**12**	**--**	**525**	**225**

ELECTIVE - I

CS 411 Information Security
CS 412 Simulation and Modeling
CS 413 Image Processing
CS 414 Adhoc and Sensor Networks
CS 415 Middleware Technologies
CS 416 Advanced Computer Architectures

WITH EFFECT FROM THE ACADEMIC YEAR 2009-2010

CS 401

DISTRIBUTED SYSTEMS

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Characterization of Distributed Systems

Introduction, Examples of distributed systems, Resource sharing and the web, Challenges.

System Models

Introduction, Architectural models, Fundamental models.

Operating System Support

Introduction, The operating system layer, Protection, Processes and threads, Communication and invocation, Operating system architecture.

UNIT-II

Interprocess Communication

Introduction, The API for the internet protocols, External data representation and marshalling.

Client server communication, Group communication, Case study Interprocess communication in UNIX.

Distributed objects and Remote Invocation

Introduction, Communication between distributed objects, Remote procedure call,

Events and notifications, Case study: Java RMI.

Name Services

Introduction, Name services and the Domain Name System, Directory services, Case study of the X.500 Directory Service.

UNIT – III

Time and Global States

Introduction, Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, Distributed debugging.

Coordination and Agreement

Introduction, Distributed mutual exclusion, Elections, Multicast communication, Consensus and related problems .

UNIT – IV

Transactions and Concurrency Control

Introduction, Transactions, Nested transactions, Locks, Optimistic concurrency control.

Timestamp ordering, Comparison of methods for concurrency control.

Distributed Transactions

Introduction, Flat and nested distributed transactions, Atomic commit process, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

Replication

Introduction, System model and group communication, Fault-tolerant services.

Case study: The gossip architecture, CODA .

UNIT – V

Distributed Shared Memory

Introduction, Design and implementation issues, Sequential consistency and Ivy case study.

Release consistency and Munin case study, Other consistency model.

Distributed File Systems

Introduction, File service architecture, Case study: Sun Network File System.

Enhancements and further developments.

Suggesting Reading:

1. Colouris, Dollimore, Kindberg, *"Distributed Systems Concepts and Design"* 4th Ed. Pearson Education, 2009.
2. Andrew S. Tanenbaum, Van Steen, *"Distributed Systems"*, Pearson Education, 2002.
3. Singhal M, Shivratari N.G, *"Advanced Concepts in Operating Systems"* McGraw Hill, 1994.
4. Pradeep K Sinha, *"Distributed Operating Systems : Concepts and Design"*, Pearson Education Asia India, 2007

CS 402

ARTIFICIAL INTELLIGENCE

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Introduction, Definition, history and applications of AI, Search in State Spaces: Agents that plan, Uninformed search, Algorithm A*, Heuristic Functions and Search Efficiency, Alternative Search Formulations and Applications, Adversarial Search.

UNIT – II

Knowledge Representation and Reasoning: The Propositional Calculus, Resolution in Propositional Calculus, The Predicate Calculus, Resolution in Predicate Calculus, Rule-Based Expert Systems, Representing Common Sense Knowledge.

UNIT-III

Reasoning with Uncertain Information (Nilsson).

Planning (Nilsson): The Situation Calculus, Planning.

UNIT-IV

Learning from Observations: Learning decision-trees using Information theory, Learning General Logical Descriptions, Neural Networks: Perceptron, Multilayer feed-forward network, Rule Learning.

UNIT-V

Natural Language Processing: Communication among agents, Speech Recognition: Signal Processing, Speech Recognition Model (Language Model + Acoustic Model), The Viterbi Algorithm.

Suggested Reading:

1. Nils J. Nilsson (1988) *Artificial Intelligence: A New Synthesis*, Elsevier.
2. Stuart Russell, Peter Norvig (1995), *Artificial Intelligence – A Modern Approach*, Pearson Edition/PHI.
3. Elaine Rich and Kevin Knight (2009), *Artificial Intelligence*, 3rd Ed. Tata McGraw Hill.
4. George F Luger (2009), *Artificial Intelligence, Structures and strategies for Complex Problem solving*, Pearson Edition.

CS 403

COMPILER CONSTRUCTION

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Introduction – programs related to compilers, Translation process, Major data structures, Other issues in compiler structure, Boot strapping and porting.

Lexical Analysis – The role of Lexical Analyzer, Input Buffering, Specification of Tokens,
Recognition of Tokens, The Lexical-Analyzer Generator Lex.

UNIT-II

Syntax Analysis – Introduction, Top-Down parsing, Bottom-Up parsing, Introduction to LR Parsing, More powerful LR parsers, Using Ambiguous Grammars, Parser Generator Yacc.

UNIT-III

Syntax Directed Translation – Syntax Directed Definitions, Evaluation Orders for SDDs, Applications of Syntax Directed Translation.

Intermediate code generation – Variants of syntax trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Back patching, Switch-statements, Intermediate Code for procedures.

UNIT-IV

Storage Organization – Stack Allocation of Space, Access to Non-local Data on the Stack, Heap Management, Introduction to Garbage Collection.

Code Generation – Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Peephole Optimization,

Register Allocation and Assignment, Machine-independent Optimizations , The Principal Sources of Optimizations.

UNIT-V

Linkers and Loaders – Basic Loader functions, Design of an Absolute Loader, A simple bootstrap loader, Machine-dependent and independent features, Relocation, Program Linking, Algorithms And Data Structures For a Linking Loader, Automatic Library Search, Loader Options , Loader Design options, Linkage Editing, Dynamic linking.

Suggested Reading:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman – *Compilers: Principles, Techniques & Tools* – Pearson Education
2. Leland L Bech – *System Software: An Introduction to Systems Programming* – Pearson Education Asia.
3. Kenneth C Louden – *Compiler Construction: Principles and Practice* – Cengage Learning.

CS 404

PRINCIPLES & APPLICATIONS OF EMBEDDED SYSTEMS

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Embedded Computing: Introduction, Complex Systems and Microprocessor, Embedded System Design Process, Formalisms for System Design, Design Examples, The 8051 Architecture: Introduction, 8051 Micro controller Hardware, Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts.

UNIT-II

Basic Assembly Language Programming Concepts: Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051, Data Transfer and Logical Instructions.

Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions, Further Details on Interrupts.

UNIT-III

Applications: Interfacing with Keyboards, Displays, D/A and NO Conversions, Multiple Interrupts, Serial Data Communication, Introduction to Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.

UNIT-IV

Basic Design Using a Real-Time Operating System: Principles, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory and Power, An example RTOS like uC-OS (Open Source).

Embedded Software Development Tools:

Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System, Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

UNIT-V

Introduction to advanced architectures: ARM and SHARC, Processor and memory organization and Instruction level parallelism, Net advanced embedded systems: Bus protocols, 12C bus and CAN bus, Internet-Enabled Systems, Design Example-Elevator Controller.

Suggested Reading:

1. *Computers and Components,* Wayne Wolf Elsevier.
2. *The 8051 Microcontroller,* Third Edition, Kenneth J.Ayala, Thomson.
3. *An Embedded Software Primer,* David E. Simon, Pearson Education
4. *Embedding system building blocks,* Labrosse, via CMP publishers.
5. *Embedded Systems,* Raj Kamal, Tata McGraw Hill.

CS 411

INFORMATION SECURITY
(Elective - I)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction: Characteristics of Information, Components of Information Systems, Securing components, balancing Security and Access.

The Security System Development Life Cycle, Security Professionals and the organization,

Security Investigation Phase, Need for security, Threats, Attacks.

UNIT-II

Legal, Ethical and Professional Issues in Information Security.

Ethical Component in Information System, Codes of Ethics, Certification.

Security Analysis: Risk Management, Identifying and assessing risk, Controlling Risk.

UNIT –III

Logical Design: Blue print for security.

Security Policy, standards and Practices.

Design of Security Architecture.

Physical Design: Security Technology, Physical Design of Security SDLC Firewalls, Dialup

Protection, Intrusion Detection Systems, Scanning and analysis tools, Content filters.

UNIT-IV

Cryptography: The basic elements of cryptography, symmetric (Symmetric Key-DES, IDEA, and AES) and public key cryptography (Public Key Encryptions-RSA).

UNIT-V

Message digest (MD-5, SHA), Digital signatures.

SSL and SET: SSL and SET protocols, Internet transactions using both SSL and SET.

Suggested Reading:

1. Michael E. Whitman and Hebert J Mattord, *Principles of Information Security,* 2nd Ed. Cengage Learning 2008.
2. William Stallings, *Cryptography and Network Security,* Pearson Education, 2000.
3. Nina Godbole, *Information Systems Security,* Wiley-2009.

CS 412

SIMULATION AND MODELING
(Elective - I)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction to Simulation, Advantages and Disadvantages of Simulation, Areas of application, System and System Environment, Components of a system, Discrete and Continuous Systems, Model of a System, Types of Models, Discrete-Event System Simulation, Steps in a Simulation Study, Simulation Examples.

UNIT-II

Overview of statistical models and queuing systems, Programming languages for simulation, Continuous and discrete simulation languages – FORTRAN, GPSS, SIMAN, SIMSCRIPT, SLAM and MODSIM III

UNIT-III

Random Numbers: generation, properties of random numbers, generation of pseudo-random numbers, tests for random numbers, Random variate: generation, inverse transformation technique, uniform distribution, exponential distribution, Weibul's distribution, triangular distributions, Direct transformation for the normal distribution, convolution method of Erlang distribution, Acceptance rejection techniques: Poisson distribution, Gamma distribution.

UNIT – IV

Input data analysis: Data Collection, Identify the distribution, parameter and estimation. Goodness of fit tests: Chi square test-KS test, Multivariate and time series input models, Verification and validations of simulation models, Model building, verification and validation: Verification of simulation models, Calibration and validation of models face validity, Validation of model assumptions, validation input/output Transformations,

Input/output validation using historical input data, Input/output validation using Turing test.

UNIT – V

Output data analysis, stochastic nature of output data, Types of simulation with respect to output analysis, Measures of performance and their estimation, Output analysis for terminating simulations, Output analysis for steady-state simulations, Comparison and evaluation of alternative system designs: Comparison of several system designs, Statistical models for estimating the effect of design alternatives.

Suggesting Reading:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, and David M. Nicol. *Discrete-Event System Simulation,* Pearson Education Asia, 2001.
2. Narsingh Deo. *System Simulation with Digital Computers.* Prentice Hall of India, 1979.
3. Anerill M Law and W. David Kelton, *Simulation modeling and anlaysis.* McGrw Hill, 2009.

CS 413

IMAGE PROCESSING
(Elective - I)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction to Digital Image Processing, Origins and Applications of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of Digital Image Processing System, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization.

UNIT-II

Filtering in the Frequency Domain: Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform (DFT) of One Variable, Extension to Function of Two Variables, Some Properties of the 2-D Discrete Fourier Transform , Image Smoothing and Sharpening using Frequency Domain Filters.

UNIT-III

Intensity Transformations and Spatial Filtering: Histogram Processing, Fundamental of Spatial Filtering, Smoothing and Sharpening Spatial Filters, Image Segmentation: Point, Line and Edge Detection, Thresholding, Region-Based Segmentation.

UNIT-IV

Image Compression: Fidelity Criteria, Image Compression Models, Image Formats, Containers and Compression Standards, Compression Methods: Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-Length Coding.

UNIT-V

Restoration: Noise Models, Inverse filtering, Least squares Filtering. Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods.

Suggested Reading:

1. Gonzalez R.C., Woods R.E: *Digital Image Processing,* Pearson Education, Third Edition 2008.
2. William K. Pratt, *"Digital Image Processing"*, John Wiley & Sons Inc. 3rd Edition, 2001.
3. McAndrew, *Introduction to Digital Image Processing* , Cengage Learning 2004.
4. Sonka, Hlavac, Boyle, *Digital Image Processing and Computer Vision,* Cengage learning , 2008.
5. Rosenfeld A. Kak AC., *Digital Picture Processing Vol.I & II Acad,* Press, 2nd Edition, 1982.

CS 414

ADHOC AND SENSOR NETWORKS

(Elective - I)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Adhoc Networks:

Introduction and Definitions, Adhoc Network Applications, Design Challenges.

Evaluating Adhoc Network Protocols –the Case for a Test bed.

Routing in Mobile Adhoc Networks:

Introduction, Flooding , Proactive Routing, On Demand Routing, Proactive Versus on demand Debate, Location based Routing.

UNIT-II

Multicasting in Adhoc Networks:

Introduction, Classifications of Protocols, Multicasting Protocols, Broadcasting, Protocol Comparisons, Overarching Issues.

Transport layer Protocols in Adhoc Networks:

Introduction , TCP and Adhoc Networks, Transport Layer for Adhoc Networks: Overview, Modified TCP, TCP-aware Cross-layered Solutions.

Adhoc Transport Protocol.

UNIT-III

QoS Issue in Adhoc Networks:

Introduction , Definition of QoS, Medium Access Layer, QoS Routing.

Inter-Layer Design Approaches.

Security in Mobile Adhoc Networks:

Vulnerabilities of Mobile Adhoc Networks , Potential Attacks, Attack Prevention Techniques , Intrusion Detection Techniques.

UNIT-IV

Introduction and Overview of Wireless Sensor Networks:
Introduction :Basic Overview of the Technology.

Applications of wireless Sensor Networks:
Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN applications, Another Taxonomy of WSN Technology.

Basic Wireless Sensor Technology:
Introduction, Sensor Node Technology, Sensor Taxonomy.

UNIT-V

Wireless Transmission Technology and Systems:
Introduction, Radio technology Primer, Available Wireless Technologies.

Medium Access Control Protocols for Wireless Sensor Networks:
Introduction, Background, Fundamentals of MAC Protocols.

Suggested Reading:

1. Prasant Mohapatra and Srihanamurthy, *"Ad Hoc Networks Technologies and Protocols"*, Springer, Springer International Edition, 2009.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati, *"Wireless Sensor Networks"*, A John Wiley & Sons, Inc., Publication-2007.

CS 415

MIDDLEWARE TECHNOLOGIES
(Elective - I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT –I

CLIENT/SERVER CONCEPTS
Client/Server : File Server, Database server, Group server, Object server, Web server. Middleware – General middleware , Service specific middleware, Client/Server Building blocks, RPC, Messaging Peer to Peer, Web Services- SOA, SOAP, WSDL, REST Services.

UNIT-II

EJB ARCHITECTURE
EJB : EJB Architecture , Overview of EJB software architecture, View of EJB, Conversation, Building and Deploying EJBs , Roles in EJB.

UNIT-III

EJB APPLICATIONS
EJB Session Beans , EJB clients, EJB Deployment , Building an application with EJB.

UNIT-IV

CORBA
CORBA, Distributed Systems, Purpose, Exploring CORBA alternatives, Architecture overview , CORBA and networking model, CORBA object model, IDL , ORB , Building an application with CORBA.

UNIT-V

COM
COM , Data types , Interfaces, Proxy and stub, Marshalling , Implementing Server/Client , Interface pointers, Object Creation, Invocation, Destruction , Comparison between COM and CORBA , Introduction to .NET , Overview of .NET architecture, Marshalling, Remoting

Suggested Reading:

1. Robert Orfali, Dan Harkey and Jeri Edwards, *"The Essential Client/ server Survival Guide"* . Galgotia publications Pvt. Ltd., 2002. (Unit 1)
2. Tom Valesky, *"Enterprise Java Beans"*, Pearson Education, 2002. (Unit 2 & 3)
3. Jason Pritchard. *"COM and CORBA side by side"*, Addison Wesley, 2000 (Unit 4 & 5)
4. Jesse Liberty, *"Programming C#"*, 2nd Edition, O'Reilly press,2002. (Unit 5)
5. Arno Puder, Kay Romere and Frank Pilhofer, *"Distributed Systems Architecture"*, Morgan Kaufman 2006.

CS 416

ADVANCED COMPUTER ARCHITECTURES
(Elective - I)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Computational Models: The concept of a computational model, Basic computational models, the von Neumann computational model, key concepts relating to computational models.

The concept of Computer Architecture: Evaluation and interpretation, Interpretation of the concept of computer architectures at different levels of abstraction, as a multilevel hierarchical framework, Extensions and description of computer architectures.

Introduction to Parallel Processing: Basic concepts, Types and levels pf parallelism, classification of parallel architectures, basic parallel techniques, Relationships between languages and parallel architectures.

Introduction to ILP-Processors: Evaluation and overview of ILP-Processors, Dependencies between instructions, Instruction scheduling, preserving sequential consistency, the speed-up potential of ILP-Processing.

Pipelined Processors: Basic concepts, Design space of pipelines, Overview of pipelined instruction processing, Pipelined execution of integer and Boolean instructions, Pipelined processing of loads and stores.

UNIT-II

VLIW Architectures: Basic Principles, Overview of proposed and commercial VLIW architectures, Case study : The Trace 200 family.

Superscalar Processors : Processing of Control Transfer Instructions-introduction, Basic approaches to branch handling, Delayed branching, Branch processing, Multiway branching, Guarded execution.

Code Scheduling for ILP-Processors: Introduction, Basic block scheduling, Loop scheduling, Global scheduling.

UNIT –III

Introduction to Data-Parallel Architectures: Introduction, connectivity, Alternative architectural classes.

SIMD Architectures: Introduction, design space, Fine-grained SIMD architectures, Coarse-grained SIMD architectures.

Associative and Neural Architectures: Introduction, Associative processing- An example: the associative string processor, Application array mapping, Neural computers.

UNIT-IV

Data : Parallel Pipelined and Systolic Architectures: Introduction, Pipelines, Systolic architectures.

Vector Architectures: Introduction, word length, vectorization, pipelining, parallel computing streams, technology- the Cray family, The Convex C4/XA system.

Introduction to MIMD Architectures: Architectural concepts, Problems of scalable computers, Main design issues of scalable MIMD computers.

UNIT –V

Multi-threaded Architectures: Introduction, computational models, von Neumann-based multi threaded architectures, dataflow architectures, Hybrid multi-threaded architectures. Distributed Memory MIMD Architectures: Introduction, direct interconnection networks, Fine-grain systems, Medium- grain systems, Coarse-grain multi-computers.

Shared Memory MIMD Architectures : Introduction, Dynamic interconnection networks, Cache coherence, Synchronization and event ordering in multi-processors, UMA, NUMA, CC_NUMA, COMA machines.

Outlook: Introduction, Semiconductor technology, Interconnection technology, Optical computing, Bio-electronic computing, future directions.

Suggested Reading:

1. Sima, Fountain, Kacsuk, *"Advanced Computer Architectures: A design space approach"*, Pearson Education, 2004
2. Richard Y. Kain, *"Advanced Computer Architecture: A Systems Design Approach"*, Prentice Hall India, 2005.
3. David E. Culler, Jaswinder Pal Singh and Anoop Gupta, *"Parallel Computer Architecture: A hardware software approach"*, Morgan Kaufmann publishers, 2009.
4. Kai Hwang , *"Advanced Computer Architecture"*, Mc Graw Hill, 1999.
5. John L.Hennessy & David A Patterson, *"Computer architecture A Quantitative Approach"*, Morgan Kaufmann Publishers, Inc, 1996.

CS 431

DISTRIBUTED SYSTEMS LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Develop an FTP Client. Provide a GUI interface for the access of all the services.
2. Implement a mini DNS protocol using RPC.
3. Implement a chat server using JAVA.
4. Implement a 2PC for distributed transaction management.
5. Study of NFS.

CS 432

EMBEDDED SYSTEMS LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Use of 8-bit and 32-bit Microcontrollers (such as 8051 Microcontroller, ARM2148 / ARM2378, LPC 2141/42/44/46/48), Microcontroller and C compiler (Keil, Ride etc.) to:
   a) Interface Input-Output and other units such as: Relays, LEDs, LCDs, Switches, Keypads, Stepper Motors, Sensors, ADCs, Timers.
   b) Demonstrate Communications: RS232, IIC and CAN protocols.
   c) Develop Control Applications such as: Temperature Controller, Elevator Controller, Traffic Controller.
2. Development of Embedded Application using FPGAs, CPLDs, VHDL and Xilinx Programmable Logic Design Tools:
   a) Four- bit ALU
   b) Pseudo -Random Number Generator
3. Development and Porting of Real Time Applications on to Target machines such as Intel or other Computers using any RTOS.
   I. Understanding Real Time Concepts using any RTOS through demonstration of:
      a) Timing.
      b) Multi-Tasking.
      c) Semaphores.
      d) Message Queues.
      e) Round-Robin Task Scheduling.
      f) Preemptive Priority based Task Scheduling.
      g) Priority Inversion.
      h) Signals.
      i) Interrupt Service Routines
   II. Application development using any RTOS:
      a) Any RTOS Booting.
      b) Application Development under any RTOS.

CS 433

COMPILER CONSTRUCTION LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1&2	Scanner stand alone program.
3&4	Scanner program using Lex.
5	SLR parser generation.
6	LR parser generation.
7&8	Parser generation using Yacc.
9&10	Code generation.
11&12	Code optimization.

CS 434

PROJECT SEMINAR

Instruction 3 Periods per week
Sessional 25 Marks

Oral presentation is an important aspect of engineering education. The objective of the

Seminar is to prepare the student for a systematic and independent study of the state –of- the- art topics in a broad area of his/her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects of a seminar presentation.

- Literature Survey .
- Organization of the material .
- Presentation of OHP slides/PC presentation .
- Technical writing .

Each student is required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board .
2. Give a 20- minute presentation through OHP, PC, Slide projector followed by a 10- minute discussion.
3. Submit a report on the seminar topic with a list of reference and slides used.

Seminars are to be scheduled from the 3rd week to the last week of semester and any change in schedule should be discouraged. For award of Sessional marks students are to be judged by at least two faculty members on the basis of an oral and written presentation as well as their involvement in the discussions.

SCHEME OF INSTRUCTION AND EXAMINATION
B.E. IV/IV (REGULAR)
COMPUTER SCIENCE & ENGINEERING

SEMESTER - II

Sl. No.	Syllabus Ref. No.	Subject	Scheme of Instructions		Scheme of Examination		
			Periods per Week		Duration in Hrs	Maximum Marks	
			L/T	D/P		Univ. Exam	Sessionals
		THEORY					
1.	CS 451	Data Mining	4	-	3	75	25
2.		ELECTIVE - II	4	-	3	75	25
3.		ELECTIVE - III	4	-	3	75	25
		PRACTICALS					
1.	CS 481	Data Mining Lab	-	3	3	50	25
2.	CS 482	Seminar	-	3	-	-	25
3.	CS 483	Project	-	6	Viva voce	Gr*	50
		TOTAL	**12**	**12**	-	**275**	**175**

*Excellent / Good / Very Good / Satisfactory / Unsatisfactory

ELECTIVE – II

CS 461 High Performance Computing
CS 462 Soft Computing
CS 463 Software Quality and Testing
CS 464 Information Storage and Management
CS 465 Human Computer Interaction
ME 411 Entrepreneurship

ELECTIVE – III

CS 471 Information Retrieval Systems
CS 472 Natural Language Processing
CS 473 Real Time Systems
CS 474 Advanced Databases
CS 475 Multimedia Systems

CS 451

DATA MINING

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Major issues in Data Mining.

Data Preprocessing : Needs Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation, Data Warehouse and OLAP Technology for Data Mining /Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining.

UNIT-II

Data Mining Primitives, Languages and System Architectures : Data Mining Primitives, Data Mining Query Languages, Designing Graphical User Interfaces Based on a Data Mining Query Language, Architectures of Data Mining Systems, Concepts Description : Characterization and Comparison , Data Generalization and Summarization- Based Characterization, Analytical Characterization, Analysis of Attribute Relevance, Mining Class Comparisons, Discriminating between Different Classes, Mining Descriptive Statistical Measures in Large Databases.

UNIT-III

Mining Association Rules in Large Databases : Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

UNIT-IV

Classification and Prediction : Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Backpropagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.

UNIT-V

Cluster Analysis Introduction : Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis, Mining Complex Types of Data : Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Mining Spatial

Databases, Mining Multimedia Databases, Mining Time-Series and Sequence Data, Mining Text Databases, Mining the World Wide Web.

Suggested Reading:

1. *Data Mining – Concepts and Techniques* - Jiawei Han & Micheline Kamber Harcourt India.
2. *Data Mining Introductory and advanced topics* – Margaret H Dunham,Pearson education.
3. *Data Mining Techniques* – Arun K Pujari, University Press.
4. *Data Warehousing in the Real World* – Sam Anahory & Dennis Murray Pearson Edn
5. *Data Warehousing Fundamentals* – Paulraj Ponnaiah Wiley Student ed.

CS 461

HIGH PERFORMANCE COMPUTING

(Elective - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Overview of Grid Computing Technology, History of Grid Computing, High Performance Computing, Cluster Computing, Peer-to-Peer Computing, Internet Computing, Grid Computing Model and Protocols, Types of Grids: Desktop Grids, Cluster Grids, Data Grids, High-Performance Grids, Applications and Architectures of High Performance Grids, High Performance Application Development Environment.

UNIT-II

Open Grid Services Architecture, Introduction, Requirements, Capabilities, Security Considerations.

GLOBUS Toolkit: Introduction, GLOBUS Architecture, Grid Resource Allocation and Management service (GRAM), Execution Management, Data Access and Transfer, GridFTP, Reliable File Transfer (RFT), Replica Location Service (RLS), Data Replication Service (DRS), Service Discovery, Grid Control, Building New Services.

UNIT-III

Overview of Cluster Computing, Cluster Computer and its Architecture, Clusters Classifications, Components for Clusters, Cluster Middleware and SSI, Resource Management and Scheduling, Programming Environments and Tools, Cluster Applications, Cluster Systems, The Berkeley Network Of Workstations (NOW) project, The High Performance Virtual Machine (HPVM) project, The Beowulf project, The Solaris MC (Multicomputer) project.

UNIT – IV

Beowulf Cluster: The Beowulf Model, Application Domains, Beowulf System Architecture,Software Practices, Next Steps in Beowulf-Class Computing, Beowulf in the 21st Century, Parallel Programs for Clusters, Parallel Programming with MPI, Parallel Virtual Machine (PVM).

UNIT – V

Overview of Cloud Computing, Types of Cloud, Cyberinfrastructure, Service Oriented Architecture (SOA), Infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS), Cloud Computing Components: Infrastructure, Storage, Platform, Application, Services, Clients, Cloud Computing Architecture.

Suggesting Reading :

1. Ahmar Abbas. *Grid Computing: Practical Guide To Technology & Applications.* Firewall Media, 2004.
2. Joshy Joseph and Craig Fellenstein. *Grid Computing.* Pearson Education, 2004.
3. Ian Foster, et al. *The Open Grid Services Architecture,* Version 1.5 (GFD.80). Open Grid Forum, 2006. (available at http://www.ogf.org)
4. Ian Foster. *Globus Tool kit Version 4: Software for Service-Oriented Systems.* IFIP International Conference on Network and Parallel Computing, Springer-Verlag LNCS 3779, pp 2-13, 2006. (available at http://www.globus.org/)
5. Rajkumar Buyya. *High Performance Cluster Computing: Architectures and Systems.* Prentice-Hall India, 1999.

CS 462

SOFT COMPUTING
(Elective - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction : Introduction to Soft Computing, Artificial Neural Networks: An Introduction, Fundamental Concepts, Evolution of Neural Networks, Basic Models of Artificial Neural Network, Important Terminologies of ANNs, McCulloch-Pitts Neuron, Linear Separability, Hebb Network.

UNIT II

Supervised Learning Neural Network: Perceptron networks, Adaline, Madaline, Back Propagation Network , Radial basis function network.

UNIT III

Unsupervised Learning Neural Network: Kohonen self organizing networks, Adaptive Resonance Theory.

Associate Memory Networks: Bidirectional Associative Memory Network, Hopfield networks.

UNIT IV

Fuzzy Logic: Introduction of Classical sets and Fuzzy sets, Fuzzy relations, Tolerance and equivalence relations, Membership functions, Defuzzification, Fuzzy Arithmetic and Fuzzy Measures.

UNIT V

Genetic Algorithms: Introduction, Basic operations Terminology, Traditional Algorithm vs. Genetic Algorithm, Simple genetic algorithm, General Genetic Algorithm, Classification – Genetic Programming, Applications.

Suggested Reading:

1. Dr S N Sivanandam, Mrs S N Deepa, *"Introduction to Soft Computing"*, Wiley India Publications, April, 2007.
2. K,-L.Du and M.N.S.Swamy, (2008), *"Neural Networks in a Soft Computing Framework"*, Springer International Edition.
3. Jyhshing Roger Jang, Chuen Tsai Sun, Mizutani E, (2002), "Neuro Fuzzy and Soft computing: A Computational approach to learning and machine intelligence", Prentice Hall, New Delhi.
4. Goldberg, David E., (2002),"Genetic Algorithms in Search, Optimization and Machine Learning", Addison- Wesley, New Delhi.
5. Timothy J. Ross, (1997) *"Fuzzy logic with Engineering application"*, Tata McGraw Hill, New Delhi.

CS 463

SOFTWARE QUALITY AND TESTING
(Elective - II)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Software Quality Assurance Framework and Standards.

SQA Framework: Definition of Quality, Software Quality Assurance, Components of Software Quality Assurance , Software Quality Assurance Plan: Steps to develop and implement a Software Quality Assurance Plan , Quality Standards: ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma, 6 Sigma

UNIT-II

Software Quality Assurance Metrics and Measurement Software Quality Metrics, product Quality metrics, In-Process Quality Metrics, Metrics for Software Maintenance, Examples of Metric Programs , Software Quality metrics methodology: Establish quality requirements, Identify Software quality metrics, implement the software quality metrics, analyze software metrics results, validate the software quality metrics, Software quality indicators -- Fundamentals in Measurement theory

UNIT-III

Software Testing Strategy and Environment Establishing testing policy, structured approach to testing, test factors, Economics of System Development Life Cycle (SDLC) Testing Software Testing Methodology ,Defects hard to find, verification and validation, functional and structural testing, workbench concept, eight considerations in developing testing methodologies, testing tactics checklist

UNIT-IV

Software Testing Techniques : Black-Box, Boundary value, Bottom-up, Branch coverage, Cause-Effect graphing, CRUD, Database, Exception,

Gray-Box, Histograms, Inspections, JADs, Pareto Analysis, Prototyping, Random Testing, Risk-based Testing, Regression Testing, Structured Walkthroughs, Thread Testing, Performance Testing, White-Box Testing ,Software Testing Tools, Taxonomy of Testing tools, Methodology to evaluate automated testing tools, Load Runner, Win runner and Rational Testing Tools, Java Testing Tools, JMetra, JUNIT and Cactus.

UNIT-V

Testing Process, Eleven Step Testing Process: Assess Project Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report test results, testing software installation, Test software changes, Evaluate Test Effectiveness,Testing Specialized Systems and Applications Testing Client/Server , Web applications, Testing off the Shelf Components, Testing Security, Testing a Data Warehouse

Suggested Reading:

1. *Effective Methods for Software Testing*, 2nd Edition by William E. Perry, Second Edition, Published by Wiley & Sons
2. *Software Quality*, by Mordechai Ben-Menachem/Garry S. Marliss, by Cengage Learning publication 2008.
3. *Foundations of Software Testing*, by Graham, Veenendaal, Evans, Black, Cengage Learning 2007.
4. *Testing and Quality Assurance for Component-based Software*, by Gao, Tsao and Wu, Artech House Publishers
5. *Software Testing Techniques, by Bories Beizer,* Second Edition, Dreamtech Press

CS 464

INFORMATION STORAGE AND MANAGEMENT
(Elective - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction to Storage Technology

Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

UNIT-II

Storage Systems Architecture

Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment , Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics and performance implications, Concept of RAID and its components , Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,High-level architecture and working of an intelligent storage system.

UNIT-III

Introduction to Networked Storage

Evolution of networked storage, Architecture, components and topologies of FC-SAN, NAS, and IP-SAN , Benefits of the different networked storage options, Understand the need for long-term archiving solutions and describe how CAS fulfills the need , Understand the appropriateness of the different networked storage options for different application environments.

UNIT-IV

Information Availability , Monitoring & Managing Datacenter

List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime, Differentiate between business continuity (BC) and disaster recovery (DR), RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures , Architecture of backup/recovery and the different backup/ recovery topologies , replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities.

Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center

UNIT-V

Securing Storage and Storage Virtualization

Information security, Critical security attributes for information systems, Storage security domains, List and analyze the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes.

Suggested Reading:

1. *Corporation, Information Storage and Management,* Wiley, ISBN number: 04702942134.
2. Robert Spalding, *"Storage Networks: The Complete Reference"*, Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, *"Building Storage Networks"*, Tata McGraw Hill, Osborne, 2001.
4. Meeta Gupta, *"Storage Area Network Fundamentals"*, Pearson Education Limited, 2002.

CS 465

HUMAN COMPUTER INTERACTION
(Elective - II)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT –I

Importance of the User interface, Characteristics of Graphical and Web User Interfaces,

User Interface Designee Process – knowing the client, understanding business function, principles of good screen design.

UNIT –II

System menus and Navigation schemes, Kinds of windows, Device based controls, Screen based controls, Test and Messages.

UNIT –III

Feedback, guidance and Assistance, internationalization and Accessibility, Graphics, Icons and Images, Colors Layout windows and pages.

UNIT –IV

Interaction design- Introduction, goals, usability, Conceptualizing interaction – problem space, conceptual models, interface metaphors, interaction paradigms, Cognition, conceptual frameworks for cognition, Collaboration and communication Social mechanisms, conceptual frame works.

UNIT -V

Affective aspects, expressive interfaces, user frustration, agents, Process of interaction design- activities, characteristics, practical issues, life cycle models, Design, Prototyping and Construction – prototyping, conceptual design, physical design.

Evaluation – Introduction, frame work, Testing and Modeling users – kinds of tests, doing user testing, experiments, predictive models.

Suggested Reading:

1. Wilbert O. Galitz – *"The essential guide to user interface design"*, Wiley Dreamtech, 2002.
2. Preece, Rogers, Sharp – *"Interaction design"*, John Wiley, 2002

CS 411

ENTREPRENEURSHIP
(Elective - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT –I

Indian Industrial Environment – Competence, Opportunities and challenges, Entrepreneurship and economic growth. Small Scale Industry in India Objectives, Linkage among small medium and heavy industries. Types and forms of enterprises.

UNIT –II

Identification and characteristics of entrepreneurs. Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas and their sources. Choice of Technology – Collaborative interaction for Technology development.

UNIT–III

Project formulation. Analysis of market demand. Financial and profitability analysis and technical analysis. Project financing in India.

UNIT–IV

Project Management during construction phase, project organization, project planning and control using CPM, PERT Techniques. Human aspects of project management. Assessment of tax burden.

UNIT– V

Behavioral aspects of entrepreneurs: Personality – determinants , attributes and models.

Leadership concepts and models. Values and attitudes. Motivation aspects. Change behavior. Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and time management matrix.

Suggested Reading:

1. Vasant Desai, *Dynamics of Entrepreneurial Development and Management*, Himalya Publishing House, 1997.
2. Prasanna Chandra, *Project – Planning. Analysis, Selection, Implementation and Review,* Tata McGraw Hill publishing Company Ltd. 1995.
3. Stephen R. Covey and Roger Merrill A., *First Things First,* Simon and Schuster Publication, 1994.
4. Sudha G.S., *Organizational Behavior,* National Publishing house, 1996

CS 471

INFORMATION RETRIEVAL SYSTEMS
(Elective - III)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT –I

Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital

Libraries and Data Warehouses Information Retrieval System Capabilities: Search, Browse, Miscellaneous.

UNIT –II

Cataloging and Indexing: Objectives, Indexing process, Automatic Indexing, Information Extraction.

Data structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, signature file structure, Hypertext data structure.

UNIT –III

Automatic Indexing: Classes of automatic indexing, Statistical indexing Natural language, Concept indexing, Hypertext linkages.

Document and Term Clustering: Introduction, Thesaurus generation, Iterm clustering, Hierarchy of clusters.

UNIT –IV

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Weighted searches of Boolean systems, Searching the Internet and hypertext Information Visualization: Introduction Cognition and perception, Information visualization technologies.

UNIT –V

Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems. Information system Evaluation: Introduction, Measures used in system evaluation, Measurement example- TREC results.

Suggested Reading:

1. Kowalski, Gerlad: *Information Storage and Retrieval Systems: Theory Implementation,* Springer, 2nd Ed. 2009.
2. Frakes, W.B. Rcaedo Baeza-Yates: *Information Retrieval Data Structures and Algorithms,* Prentice Hall, 1992.

CS 472

NATURAL LANGUAGE PROCESSING
(Elective - III)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction to natural language understanding:

What is NLU. Evaluating Computational models of language. Knowledge and language. Representation and ambiguity. A warning about names in representations. The organization of actual systems.

Linguistic background: An outline of English:

Words. The elements of Simple noun phrases. The elements of simple sentences. Prepositional phrases. Embedded sentences. Complements. Adjective Phrases.

UNIT-II

Basic parsing Techniques: Grammars and sentence structure. What makes a good grammar. Top-down parsing methods. Bottom-up parsing methods. Mixed mode methods:

Features and Augmented Grammars:

Augmented Transition Networks. Useful features systems. A sample of ATN grammar for assertions. Verb complements and presetting registers. Augmenting chart parsers. Augmenting logic grammars. Generalized feature manipulation.

UNIT-III

Grammars for Natural Language: Handling Movement Local Movement. Wh-questions and Hold mechanism. Relative clauses. Using a Hold list in the mixed mode parser. Handling movement in logic grammars. Slashed categories: An alternative to hold lists. A comparison of the methods using constraints.

Towards Deterministic Parsing.

Human Preferences in parsing. Shift-reduce parsers, Shift reduce parsers and ambiguity. Look ahead in parsers. The Marcus Parser.

UNIT-IV

Semantics and a Logical Form:

Why derive a logical form. Types and Features. Selectional restrictions. Case relations. The structure of verbs. Semantic networks. The logical form.

Semantic Interpretation.

UNIT-V

Strategies for semantic interpretation:

A sample domain. Semantic grammars. A simple interleaved syntactic and semantic analyzed. Semantic interpretation based on preferences. Rule-by-rule semantic interpretation based on the lambda-calculus. Rule-by-rule interpretation using variables. Semantically directed parsing techniques. Issues in semantic interpretation.

Scooping phenomena. Modifiers and noun phrases. Adjective phrases. Noun-noun modifiers. Lexical ambiguity. Tense and Aspect.

Suggested Reading:

1. James Allen: *Natural language understanding,* Low Price edition, Pearson Education, second edition, 2004.
2. Akshar Bharati, Vineet Chaitanya, Rajeev Sangal, *Natural Languages Processing,* PHI, 1995.
3. Daniel Jurafsky, James H. Martin, *Speech and Language Processing,* Pearson Education.

CS 473

REAL TIME SYSTEMS
(Elective - III)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction Definition of Real Time, Applications of Real-Time Systems, A Basic Model of a Real-Time Systems, Characteristics of Real-Time Systems, Safety and Reliability, Types of Real-Time Tasks, Timing Constraints, Modeling Timing Constraints.

UNIT-II

Real-Time Task Scheduling Some Important Concepts, types of Real-Time Tasks and Their Characteristics, Task Scheduling, Clock-Driven Scheduling, Hybrid Schedulers, Event-Driven Scheduling, Earliest Deadline First (EDF) Scheduling, Rate Monotonic Algorithm, Some Issues Associated with RMA, Issues in Using RMA in Practical Situations.

Handling Resource Sharing and Dependencies among real-Time Tasks: Resource Sharing Among Real Time Tasks, Priority Inversion, Priority Inheritance Protocol, Highest Locker Protocol, Priority Ceiling Protocol, Different Types of Priority Inversions Under PCP, Important Features of PCP, Some Issues in Using a Resource Sharing Protocol, Handling Task Dependencies.

UNIT-III

Scheduling Real-Time Tasks in Multiprocessor Multiprocessor Task Allocation, Dynamic Allocation of Tasks, Fault-Tolerant Scheduling of Tasks, Clocks in Distributed Real-Time systems, Centralized Clock Synchronization, Distributed Clock Synchronization.

Commercial Real-Time Operating Systems Time Services, Features of a Real-Time Operating System, Unix as a Real-Time Operating System, Unix – Based Real-Time Operating Systems, Windows as a

Real-Time Operating System, POSIX, A Survey of Contemporary Real-Time Operating Systems, Benchmarking Real-Time Systems.

UNIT-IV

Real-Time Communication Examples of Applications Requiring Real-Time Communication, Basic Concepts, Real-Time Communication in a LAN, Hard Real-Time Communication in LAN, Bounded Access Protocols for LANs, Performance Comparison, Real-Time Communication Over Packet Switched Networks, QoS Framework, Routing, Resource Reservation, Tate Control, QoS Models.

UNIT-V

Real-Time Databases Example Applications of Real-Time Databases, Review of Basic Database Concepts, Real-Time Databases, Characteristics of Temporal Data, Concurrency Control in Real-Time Databases, Commercial Real-Time Databases.

Suggested Reading:

1. Rajib Mall *"Real Time System Theory & Practice"* Pearson Education Asia.
2. Jane W.S. Liu *"Real Time Systems"*, Pearson Education Asia-2001
3. R. Bennett, *"Real-Time Computer Control"*, Prentice-Hall, 1994
4. Shem Tov Levi & Ashok K. Agrawala, *"Real Time System Design"*, McGraw Hill Publishing Company-1990.
5. C.M. Krishna and Kang G. Shin, "Real Time Systems", McGraw Hill Companies Inc., 1997.

CS 474

ADVANCED DATABASES
(Elective - III)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Entity Relationship Review, Generalization & Specialization, Categories and Categorization.

UML Classes – Generalization & Specialization, Associations, Additional forms of Associations, Realization and Interface classes.

The SQL Standard: Advanced Relational Features.

UNIT-II

Object-Oriented Databases: Need for complex data Types, The Object-Oriented Data Model, OO- languages, Persistent Programming Languages, Persistent C++ systems, Persistent JAVA systems.

Object- Relational databases: Nested Relations, Complex types, Inheritance, Reference types, Querying with complex types, Functions & Procedures, O-O versus O-R systems.

Mapping Object-Oriented Conceptual Models to the Relational Data Model.

UNIT-III

Object-Oriented Databases and the ODMG Standard – ODMG Standard. The ODMG Object Definition Language, Mapping O-O Conceptual Models to ODL, The ODMG Object query language

The SQL Standard: Object-Relational Features – Built-in Constructed Types, User Defined Types, Typed Tables, Type and Table Hierarchies, A Closer Look at Table Hierarchies, Reference Types, Mapping to the SQL Standard

UNIT-IV

XML and databases – Overview of XML, DTD, XML Schema, Data Exchange.

Database System Architecture: Centralized and Client-Server architectures, Server System Architectures, Parallel Systems, Distributed Systems, Materialized Views.

UNIT-V

Parallel Databases: Introduction I/O parallelism, inter query parallelism, intra query parallelism, interoperation parallelism, Interoperation parallelism, Design of Parallel systems.

Distributed Databases: Homogeneous and Heterogeneous databases, Distributed data storage, Distributed transactions, Commit Protocols, Concurrency control in distributed databases, Availability, Distributed query processing, Heterogeneous distributed databases, Directory systems.

Suggested Reading:

1. Suzanne W. Dietrich, Susan D. Urban, *"An Advanced course in Database Systems"*, First edition, 2008, Pearson Education.
2. Abraham Silberschatz, Henry F Korth, S Sudarshan, *"Database System Concepts"*, Fifth Edition, 2006 McGraw Hill publication.
3. P Rob, C Coronel, *"Database Systems"*, 2000 Thomson Learning.

CS 475

MULTIMEDIA SYSTEMS
(Elective - III)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT – I

Multimedia : An Overview: Introduction, Multimedia Presentation and Production, Characteristics of a Multimedia Presentation, Multiple Media, Utilities of Multisensory Perception, Hardware and Software Requirements, Uses of Multimedia, Promotion of Multimedia Based Content, Steps for Creating a Multimedia Presentation.

Digital Representation: Introduction, Analog Representation, Waves, Digital Representation, Need for Digital Representation, Analog to Digital Conversion, Digital to Analog Conversion, Relation between Sampling Rate and Bit Depth, Quantization Error, Fourier Representation, Pulse Modulation, Importance and Drawbacks of Digital Representation.

Visual Display Systems: Introduction, Cathode Ray Tube(CRT), Video Adapter Card, Video Adapter Cable, Liquid Crystal Display(LCD), Plasma Display Panel(PDP).

UNIT –II

Text: Introduction, Types of Text, Unicode Standard, Font, Insertion of Text, Text Compression, File Formats.

Image: Introduction, Image types, Seeing Color, Color Models, Basic Steps for Image Processing, Scanner, Digital Camera, Interface Standards, Specifications of Digital Images, Color Management System(CMS), Device Independent Color Models, Gamma and Gamma Correction, Image Processing Software, File Formats, Image Output on Monitor, Image Output on Printer.

Graphics: Introduction, Advantage of Graphics, Uses of Graphics, Components of a Graphics System, Coordinate Systems, Line Drawing Algorithms, Filling Algorithms, Clipping Algorithms, Plotter,

Transformations, 3D Graphics, 3D Modeling, Surface Characteristics and Texture, Lights.

UNIT –III

Audio: Introduction, Acoustics, Nature of Sound Waves, Fundamental Characteristics of Sound, Musical Note and Pitch, Psycho-Acoustics, Elements of Audio Systems, Microphone, Amplifier, Loudspeaker, Audio Mixer, Digital Audio, Synthesizers, Musical Instrument Digital Interface(MIDI), MIDI Messages, MIDI Connections, General MIDI (GM) Specifications, Basics of Staff Notation, Sound Card, Audio Transmission, Audio Recording Devices, Audio File Formats and CODECs, Software Audio Players, Audio Recording Systems, Digital Audio Broadcasting, Audio and Multimedia, Voice Recognition and Response, Audio Processing Software.

Video: Introduction, Analog Video Camera, Transmission of Video Signals, Video Signals formats, Television Broadcasting Standards, Digital Video, Digital Video Standards, PC Video, Video Recording Formats and Systems, Video File Formats and CODECs, Video Editing, Video Editing Software. Animation: Introduction, Historical Background, Uses of Animation, Keyframes and Tweening, Types of Animation, Computer Assisted Animation, Creating Movement, Principles of Animation, Some Techniques of Animation, Animation on the Web, 3D Animation, Camera, Special Effects, Creating Animation, Rendering Algorithms, Animation Software, File Formats.

UNIT – IV

Compression: Introduction, CODEC, Types of Compression, Types of Redundancies, Lossless/Statistical Compression Techniques, GIF Image Coding Standard, Lossy/Perceptual Compression Techniques, JPEG Image Coding Standard, MPEG Standards Overview, MPEG-1 Audio, MPEG-1 Video, MPEG-2 Audio, MPEG-2 Video, MPEG-4, MPEG-7, Fractals.

CD – Technology: Introduction, Compact Disc(CD), CD Formats, Magneto-Optical Discs, CD Interface, Laserdisc(LD), Error Handling, DVD, DVD-Formats.

Multimedia Architecture: Introduction, User Interfaces, Windows Multimedia Support, Hardware Support, Distributed Multimedia

Applications, Real – time Protocols, Playback Architectures, Streaming Technologies, Temporal Relationships, Synchronization, Multimedia Database Systems(MMDBS), Feature Extraction of Image, Feature Extraction of Audio, Feature Extraction of Video, Similarity Metrics, Indexing Mechanisms, Characteristics of Multimedia Databases, Benchmarking of MMDBS, Object Oriented Approach.

UNIT – V

Multimedia Documents: Introduction, Document and Document Architecture, Designing a Multimedia Interchanges Format, Markup, Standard Generalized Markup Language(SGML), Open Document Architecture(ODA), Multimedia and Hypermedia Information Coding Expert Group(MHEG), Hypermedia Time based Structuring Language (HyTime), Open Media Framework(OMF), Digital Copyrights.

Multimedia Application Development: Introduction, Software Life Cycle Overview, ADDIE Model, Conceptualization, Content Collection and Processing, Story, Flowline, Script, Storyboard, Implementation, Authoring Metaphors, Testing and Feedback, Final Delivery, Report Writing/Documentation, Case Study, Computer Games.

Virtual Reality: Introduction, Forms of Virtual Reality, VR Applications, Software Requirements, Peripheral Devices, Virtual Reality Modeling Language(VRML).

Future Directions

Suggested Reading:

1. Ranjan Parekh, *"Principles of Multimedia"*, Tata McGraw Hill,2008.
2. Tay Vaughan, *"Multimedia : Making It Work"*, Seventh Edition Tata McGraw Hill, 2008.
3. Ralf Stein Metz Clara Nahrstedit, *"Multimedia: Computing, Communication and Applications"*, Pearson Education, 2001.
4. John F. Koegel Buford, *"Multimedia Systems"*, Addison Wesley, 1994.

CS 481

DATA MINING LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

The objective of the lab exercises is to use data mining techniques to identify customer segments and understand their buying behavior and to use standard databases available to understand DM processes using WEKA (or any other DM tool).

1. Gain insight for running pre- defined decision trees and explore results using MS OLAP Analytics.
2. Using IBM OLAP Miner – Understand the use of data mining for evaluating the content of multidimensional cubes.
3. Using Teradata Warehouse Miner – Create mining models that are executed in SQL. (BI Portal Lab: The objective of the lab exercises is to integrate pre-built reports into a portal application)
4. Publish cognos cubes to a business intelligence portal. Metadata & ETL Lab: The objective of the lab exercises is to implement met idata import agents to pull metadata from leading business intelli ence tools and populate a metadata repository. To understand ETL processes.
5. Import metadata from specific business intelligence tools and populate a meta data repository. Publish metadata stored in the repository.
6. Load data from heterogeneous sources including text files into a pre-defined warehouse schema. Case study
7. Design a data mart from scratch to store the credit history of customers of a bank. Use this credit profiling to process future loan applications.
8. Design and build a Data Warehouse using bottom up approach titled *'Citizen Information System'*. This should be able to serve the analytical needs of the various Governments Departments and also provide a global integrated view.

CS 482

SEMINAR

Instruction	3	Periods per week
Sessional	25	Marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his/her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects of a seminar presentation.

- Literature Survey
- Organization of the material
- Presentation of OHP slides/PC presentation
- Technical writing

Each student is required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board
2. Give a 20 minutes presentation through OHP, PC, Slide projector followed by a 10 minute discussion.
3. Submit a report on the seminar topic with a list of reference and slides used.

Seminars are to be scheduled from the 3rd week to the last week of semester and any change in schedule should be discouraged.

For award of Sessional marks students are to be judged by at least two faculty members on the basis of an oral and written presentation as well as their involvement in the discussions.

CS 483

PROJECT

Instruction	6	Periods per week
Duration of University Examination		Viva voce
University Examination		Grade*
Sessional	50	Marks

Solving a real life problem should be the focus of U.G projects. Faculty members' should propose the projects brief (scope and references) well in advance which should be made available to the students through department library. The project could be classified as Hardware, Software, Modeling, Simulation etc., It should involve one or many elements of techniques such as Analysis, Design and Synthesis. The Department will appoint a Project coordinator who will coordinate the following

- Grouping of students (Max. 3 in group)
- Allotment of Projects and Project Guides
- Project monitoring at regular intervals

All Projects allotment will be completed by the 4th week of the 4the year I semester, so that students get sufficient time for completion of the project.

All Projects will be monitored at least twice in a semester through student's presentation. Sessional marks should be based on the grading/ marks awarded by monitoring committee of faculty members and marks given by the supervisors. Effort should be made that some of the projects are carried out in industries with the help of industry co-coordinators. Problems can also be invited from the industries to be worked out through UG projects.

Common norms will be established for final documentation of the project report by the respective departments.

***Excellent / Good / Very Good / Satisfactory / Unsatisfactory**

Note: 3 periods of contact load will be assigned to each project guide.