Shri Vaishnav Vidyapeeth Vishwavidyalaya
Master of Technology (Computer Science Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCS201		**Advance Computer Architecture & Organization**	3	-	-	3	60	20	20	-	-

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective:

1. Describe current and emerging trends in computer architectures, focusing on performance and the hardware/software interface.
2. Analyzing fundamental issues in architecture design and their impact on application performance.
3. Identify the performance and efficiency in advanced multiple-issue processors
4. Identify and Analyzing various memory models.
5. Describe various techniques to enhance a processors ability.

Course Outcomes:

1. Know the classes of computers, and new trends and developments in computer architecture
2. Understand pipelining, instruction set architectures, memory addressing.
3. Understand the performance metrics of microprocessors, memory, networks.
4. Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.
5. Understand exploiting ILP using dynamic scheduling, multiple issue, and speculation.
6. Understand multithreading by using ILP and supporting thread-level parallelism (TLP).
7. Understand the performance and efficiency in advanced multiple-issue processors.
8. Understand symmetric shared-memory architectures and their performance.
9. Understand multiprocessor cache coherence using the directory based and snooping class of protocols.
10. Understand the various models to achieve memory consistency.

UNIT I

Overview of Parallel Processing and Pipelining Processing, study and comparison of uni-processors and parallel processors, Evolution of parallel processors, Necessity of high performance,

Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism.

UNIT II

Principles and implementation of Pipelining, Pipeline Architecture, Study and comparison of processors with and without pipelining, Linear pipeline processor, Nonlinear pipeline processor Instruction pipeline design, Mechanisms for instruction pipelining, pipeline hazards, Dynamic instruction scheduling -score boarding and Tomosulo's algorithm, Branch handling techniques, Arithmetic Pipeline Design, Static arithmetic pipeline, Multifunctional arithmetic pipelines. Superscaler pipeline design, Super pipeline processor design.

UNIT III

Study and comparison of Vector and array processors,Vector Processing Principles,
Vector instruction types, Vector-access memory schemes. Vector supercomputer architecture, SIMD Computer Organization Masking and Data network mechanism, distributed memory model and shared memory model, Parallel Algorithms For Array Processors: Matrix Multiplication. Sorting, SIMD computer organization, Implementation issues of Matrix multiplication and sorting on array processor and their analysis

UNIT IV

Microprocessor Architectures, study and comparison of Loosely and Tightly coupled multiprocessors.Loosely and Tightly coupled multiprocessors, Processor characteristics of multiprocessors, Inter Processor communication network, Time shared bus, Crossbar switch, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherence, Snoopy protocols, Directory based protocols. Message routing schemes in multicomputer network, deadlock and virtual channel.

UNIT V

Study of Architecture of Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions, Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing, Message passing parallel programming, Shared Memory Programming, Data Parallel Programming. Implementation issues of a multithreaded program.

Text books:

1. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill international Edition
2. J.P.Hayes, "computer Architecture and organization"; MGH.
3. V.Rajaranam & C.S.R.Murthy, "Parallel computer"; PHI Learning.
4. Kain,"Advance Computer Architecture: - A System Design Approach", PHI Learning
5. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing.
6. Hwang and Briggs, "Computer Architecture and Parallel Processing"; MGH.
7. David E. Callav & Jaswinder Pal Singh Marge Kaufmann"Advance Computer Architecture", EIS India.
8. Sajjan G. Shiva, Taylar & Francis, "Advance Computer Architecture

Practical's List:

1. Pi Calculation for implementing parallel programming
2. Implement Array Processing in respect of an array processor

3. Write a program for implementing Client server architecture.
4. Implement Reservation Table program for pipelining.
5. Implementation of multithreading in java.
6. Implement RMI using one web application.
7. Implement Remote Procedure Call on windows.
8. Implement Client – server communication in C/C++/Java.
9. Write a program to calculate access time of each storage device for same file. Case study of VLIW processor, Pentium pro, CRAY Computer systems.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCS202		**Advance Database Management System**	2	-	2	3	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective:

1. Describe database management system internals. Understand and describe internal algorithms in detail. Decide on optimization issues given a known database workload, by manipulating indexes, choosing more adequate data types, and modifying queries.
2. Identify opportunities for the use of the object model, and design and code client code to manipulate an object database.
3. Analyze and optimize transactional code, identifying causes of possible anomalies and correct them.
4. Identify and be able to use recent and advanced database techniques (e.g. in concurrency control, buffer management, and recovery).
5. Analyze, describe and use other models than the Relational. Analyze, compare and evaluate alternative database architectures and models in different application contexts. Identify limitations of the standard Relational databases in certain application domains, e.g. for multidimensional data, or unstructured data.

Course Outcomes:

1. Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
2. Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.
3. Be familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing.
4. Master the basics of query evaluation techniques and and query optimization.
5. Be familiar with the basic issues of transaction processing and concurrency control.

UNIT I

Introduction to Database Systems: Database System Concepts and Architecture, Data Models, Data Independence, SQL: DDL, DML, DCL, Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF.Query Processing and Optimization: Query Processing, Syntax Analyzer, Query Decomposition, Query Optimization, Heuristic Query Optimization, Cost Estimation, Cost Functions for Select, Join, Query

Evaluation Plans.

UNIT II
Object Oriented and Object Relational Databases Object Oriented Concepts, Object Oriented Data

Model, Object Definition Language, Object Query Language, Object Relational Systems, SQL3, ORDBMS Design.

UNIT III
Transaction Processing and Concurrency Control: Transaction Processing Concepts, Concurrency Control Techniques: Two-phase Locking, Timestamp Ordering, Multiversion, Validation, Multiple Granularity Locking.

UNIT IV
Backup and Recovery: Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Buffer Management.

UNIT V
Introduction to Data Warehousing and Data Mining: Introduction to OLAP, OLTP, Data Warehouse, Data Marts, Data Mining, Data Mining Process. Distributed Databases: Distributed Database Concepts, Advantages and Disadvantages, Types of Distributed Database Systems, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Five Level Schema Architecture, Query Processing, Concurrency Control and Recovery in Distributed Databases. Commercial Databases: Commercial Database Products, Familiarity with IBM DB2 Universal Database, Oracle, Microsoft SQL Server, MySQL, their features.

References:
1. C. J. Date: An Introduction to Database Systems , Addison-Wesley
2. Avi Silberschatz, Henry F. Korth ,S. Sudarshan ,Data Base System Concepts, TMH
3. Patrick O'Neil & Elizabeth O'Neil, Database Principles, Programming and Performance,
4. Morgan Kaufmann Hardcourt India
5. Gillenson, Fundamental of Data Base Management Sytem, Willey India
6. Ceri & Pelagatti, Distributed Databases Principles & Systems,TMH
7. Paulraj Ponniah, Data Ware Housing Fundamental, Willey India.
8. Jiawei Han, Data Mining Concept & Techniques, Elsevier Pub.

Practical's List:
1. Distributed Database for Bookstore
2. Deadlock Detection Algorithm for distributed database using wait- for graph
3. Object Oriented Database – Extended Entity Relationship (EER)
4. Parallel Database – University Counselling for Engineering colleges
5. Parallel Database – Implementation of Parallel Join & Parallel Sort
6. Active Database – Implementation of Triggers & Assertions for Bank Database
7. Deductive Database – Constructing Knowledge Database for Kinship Domain (Family Relations)
8. Study and Working of WEKA Tool
9. Query Processing – Implementation of an Efficient Query Optimizer
10. Designing XML Schema for Company Database

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							THEORY		PRACTICAL		
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MTCS203		**Simulation and Modeling**	2	0	2	3	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT I
Basic Simulation Modeling: The Nature of simulation system, models and simulation, discrete-event simulation, simulation of a single-server queuing, alternative approaches to modeling and coding simulations, network simulation, parallel and distributed simulation, simulation across the internet and web based simulation, steps in a sound simulation study, other types of simulation: continuous simulation, combined discrete-continuous simulation, Monte Carlo simulation, advantages, disadvantages and pitfalls of simulation.

UNIT II
Modeling Complex Systems: Introduction, list processing in simulation, approaches to stering lists in a computer linked storage allocation
Simulation examples using any simulation language: Single-server Queuing simulation with time-shared computer model, job-shop model, and event-list manipulation.

UNIT III
Discrete System Modeling: Classification of simulation models the simulation process, system investigation validation and translation, simulation of complex discrete-event systems with application in industrial and service organization tactical planning and management aspects, Random variable generation and analysis.

UNIT IV
Simulation Software: Comparison of simulation packages with programming languages classification of simulation software, general-purpose simulation packages, object-oriented simulation, building valid, credible and appropriately detailed simulation models, experimental design, sensitivity analysis and optimization simulation of manufacturing systems.

UNIT V
Embedded System Modeling: Embedded systems and system level design, models of computation, specification languages, hardware/software code design, system partitioning, application specific processors and memory, low power design
Real-Time system modeling, Fixed Priority scheduling, Dynamic Priority Scheduling
Data Communication Network modeling, IP network intradomain (e.g. OSPF, RIP) routing simulation.

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References:

1. Law Kelton,"Simulation Modeling and Analysis", McGraw-Hill
2. Geoffrey Gordon,"System Simulation", PHI
3. Communication Systems S. Haykin, John Willy & Sons.
4. Communication Systems: A.B. Carlson, Mc-Graw-HW.

Practical's List:

1. Simulate CPU scheduling algorithm using queueing system a) FCFS b) SJF c) Priority.
2. Simulate multiplxer/concentrator using queuing system.
3. Simulate congestion control algorithms.. Simulate Disk scheduling algorithms.. Simulate a Manufacturing shop and write a program in GPSS.
4. Simulate Telephone system model and write a program in SIMSCRIPT
5. Implementation of Link state routing algorithm
6. Implementation of data encryption and decryption
7. Implementation of VoIP using OPNET network simulator.
8. Install Network Simulator 2 and study network topologies.

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							THEORY		PRACTICAL		
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MTCS211		**Expert System**	2	-	2	3	60	20	20	-	50

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. Study of computing and mathematics appropriate to the discipline.
2. Study to analyze a problem, and identify and define the computing requirements appropriate to its solution.
3. Study to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
4. Study to use current techniques, skills, and tools necessary for computing practice.
5. To understand the concept of Expert system and inteligent system.

Course Outcomes:

1. An ability to apply knowledge of computing and mathematics appropriate to the discipline.
2. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
3. An ability to design, implements, and evaluate a computer-based system, process, component, or program to meet desired needs.
4. An ability to use current techniques, skills, and tools necessary for computing practice.
5. To understand the concept of Expert system and intelligent system.

UNIT I

Introduction to Expert System, Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents Artificial Intelligence programming techniques.

UNIT II

Knowledge Representation and Reasoning: ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

UNIT III

Machine Learning and Knowledge Acquisition: learning from memorization, examples, explanation,

and exploration. learning nearest neighbour, naive Bayes, and decision tree classifiers, Q-learning for learning action policies, applications.

UNIT IV

Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

UNIT V

Fuzzy Sets , Operations on Fuzzy Sets , Fuzzy Relations - Fuzzy Rules and Fuzzy Reasoning , Fuzzy Inference Systems , Fuzzy Logic , Fuzzy Expert Systems , Fuzzy Decision Making. Machine Learning Techniques , Machine Learning Using Neural Nets , Genetic Algorithms (GA) , Applications of GA in Machine Learning - Machine Learning Approach to Knowledge Acquisition. Support Vector Machines for Learning , Linear Learning Machines , Support Vector Classification – Support Vector Regression - Applications.

Textbooks:

1. The Engineering of Knowledge-based Systems, A.J. Gonzalez and D. D. Dankel, Prentice Hall. Donald A.Waterman,
2. 'A Guide to Expert Systems', Pearson Education.
3. Elain Rich and Kevin Knight, 'Artificial Intelligence', Second Edition Tata McGraw Hill,
4. Janakiraman, K.Sarukesi, 'Foundations of Artificial Intelligence and Expert Systems', Macmillan Series in Computer Science

References:

1. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications
2. Rich E and Knight K, Artificial Intelligence, TMH, New Delhi.
3. Bose, Neural Network fundamental with Graph , Algo.& Appl, TMH
4. Kosko: Neural Network & Fuzzy System, PHI Publication
5. Klir & Yuan ,Fuzzy sets & Fuzzy Logic: Theory & Appli.,PHI Pub.
6. Hagen, Neural Network Design, Cengage Learning

Practical's List :

1. Implement A*, AO* algorithms.
2. Implement Naive Bays Algorithm.
3. Implement Knowledge Representation and reasoning.
4. Implement Fuzzy reasoning .

5 . Implement Fuzzy Inference Theorem.

6. Implement Machine learning Algorithms.
7. Explain different types of Expert System.

8 . Explain Intelligent Agents..

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCS212		**Grid Computing**	2	-	2	3	60	20	20	-	50

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Objectives:

1. To provide knowledge of network protocols
2. To provide experiences with object-oriented programming
3. To provide good working knowledge in Java
4. To provide basics of client/server programing
5. To provide fundamental knowledge of XML

Course Outcomes:

1. Understand the need for and evolution of Grids in the context of processor- and data-intensive applications
2. Be familiar with the fundamental components of Grid environments, such as authentication, authorization, resource access, and resource discovery.Be able to design and implement Grid computing applications using Globus or similar toolkits
3. To know the application of grid computing .Be able to justify the applicability, or non-applicability, of Grid technologies for a specific application.

UNIT I
Introduction and Overview Of Grid Computing Early Grid Activities,Current Grid Activities,An Overview of Grid Business areasgrid Applications,Grid Infrastructure

UNIT II
Web Services And Related Technologies Service , Oriented Architecture-Web Service Architecture-XML, Related Technologies, and Their Relevance to Web services-XML Messages and Enveloping-Service Message Description Mechanisms-Relationship between Web 31 Service and Grid Service , Web Service Interoperability and the Role of the WS-I Organization

UNIT III
Distributed Object Technology For Grid Computing (Ogsa) Introduction to Open Grid Services Architecture(OGSA), Commercial Data CenterNational Fusion Collaboratory, The OGSA Platform Components 96

UNIT IV

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Open Grid Services Infrastructure (Ogsi) Introduction-Grid Services-A High-Level Introduction to OGSI , Introduction to Service Data Concepts , Grid Service: Naming and Change Management Recommendations.

UNIT V

OGSA BASIC SERVICES AND THE GRID COMPUTING TOOLKITS

Common Management Model(CMM)-Security Architecture- GLOBUS GT3 Toolkit: Architecture-GLOBUS GT3 Toolkit: Architecture, Programming model, High level services .

Text books :

1.Joshy Joseph & Craig Fellenstein, "Grid Computing", Pearson/PHI PTR- 2003.
2. Ahmar Abbas, "Grid Computing: A Practical Guide to technology and Applications", Charles River media – 2003.

References:

1.Ian Foster & Carl Kesselman, The Grid 2 – Blueprint for a New Computing Infrastructure , Morgan Kaufman – 2004.
2. Joshy Joseph & Craig Fellenstein, "Grid Computing", Pearson Education 2004.
3. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, "Grid Computing: Making the Global Infrastructure a reality", John Wiley and sons, 2000

Practical's List :

1 . Experiments on computing paradigms.

2. Experiment on Web services

3. Use of Globus Tool Kits – GT3 & GT4.

4. Experiment on Ontology language.

5. Experiment on Semantic Grid Portal Tool kit.

6. Experiment on Autonomic Computing Projects.

7. Experiment on Grid Security.

8. Experiment on Grid Monitoring System –Any one per batch.

9. Experiment on scheduling systems.

10. Experiment on Grid portals.

11. Experiment on clouds of different organization (any one).

12. Experiment on virtualization and SOA into the cloud.

13. Experiment on cloud storage and data security.

14. Experiment on Best practices in cloud.

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							THEORY		PRACTICAL		
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MTCS213		**Human Computer Interaction**	2	-	2	3	60	20	20	-	50

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:
1. To facilitate communication between students of psychology, design, and computer science on user interface development projects.
2. To provide the future user interface designer with concepts and strategies for making design decisions.
3. To expose the future user interface designer to tools, techniques, and ideas for interface design.
4. To introduce the student to the literature of human-computer interaction.

UNIT I
Introduction: Importance of user Interface , definition, importance ofgood design. Benefits of good design. A brief history of Screen design,The graphical user interface , popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user Interface popularity, characteristics- Principles of user interface.

UNIT II
Design process , Human interaction with computers, importance of human ,characteristics human consideration, Human interaction speeds, and understanding business junctions Screen Designing:- Design goals , Screen planning and purpose, organizing screen elements, ordering of screen data and content , screen navigation and flow , Visually pleasing composition , amount of information , focus and emphasis , presentation information simply and meaningfully , information retrieval on web , statistical graphics , Technological consideration in interface design.

UNIT III
Windows , New and Navigation schemes selection of window, selection of devices based and screen based controls.

UNIT IV
Components , text and messages, Icons and increases , Multimedia, colors, uses problems, choosing colors. Software tools , Specification methods, interface , Building Tools.

UNIT V
Interaction Devices , Keyboard and function keys , pointing devices , speech recognition digitization and generation , image and video displays , drivers.

Text books :

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1. The essential guide to user interface design, Wilbert O Galitz, WileyDreamTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.

Reference :

1. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd,Russell Bealg, Pearson Education
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech,
3. User Interface Design, Soren Lauesen , Pearson Education.

Practical's List :

1.Othogonal Corners.

2. Web page Aesthetics.

3. Metabolic Pathways.

4. Graph Algorithms.

5. DAG Map.

6. Euler Diagrams.

7.Shortest Path.

8. Aural Table.

9. Screen Layout.

10. Spring Dynamic Graph.

11.Graph Aesthetics.

12. Small multiplies/Animation.

13. Entity-Relationship Diagrams.

14. UML notation

15. Smalltalk

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							THEORY		PRACTICAL		
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MTCS214		**Embedded System**	2	-	2	3	60	20	20	-	50

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:
1. Students have knowledge about the basic functions of embedded systems.
2. Students have knowledge about the basic concepts of embedded systems.
3. Students have knowledge about the basic structure of embedded systems.
4. Students have knowledge about the applications of embedded systems.
5. Students have knowledge about the development of embedded software.

UNIT I
Arm Processor Architecture Architecture, Registers, Interrupts & Vector Table, I/O Ports, ARM Processor family, JTAG, I2C bus

UNIT II
Arm Programming Instructions Instruction Set: Data processing instructions, Addressing modes, Load Store Instructions, PSR (Program Status Register) Instructions, Conditional Instructions, Interrupt Instructions

UNIT III
C Programming Integrated Development Environment (IDE) for C/C++ Programming, C/C++ Programs using Function Calls, Pointers, Structures, Integers & Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution & Loops

UNIT IV
Interfacing Peripherals Interfacing: ADC & DAC, Sensors, Memory, LCD Display,

UNIT V
Stepper Motor DC Motor, SD-MMC Card, Biometric & RFID, ZIGBEE, GSM Interfaces, Debugging Tools

References:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield, ―ARM System Developer's Guide Designing and Optimizing System Software‖, Elsevier 2008.
2. Brooks, Cole, ―Embedded Microcontroller Systems, Real Time Interfacing‖, Thomson Learning 1999 . Steve Furber, ―ARM system on Chip Architecture‖, Addision Wesley
3. Trevor Martin, ―The Insider's Guide to The Philips ARM

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4. Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series‖ Hitex Ltd. . ARM Architecture Reference Manual
5. Website www.arm.com BTEC-7

Practical's List

1. Study of ARM7 & ARM9 Bit Processor Architecture and Pin Diagram.
2. Study of Interrupt structure in ARM Processors
3. Write ARM Processor program to Flash LED
4. Interfacing of an LCD Display
5. Write a program to interface an ADC
6. Write a program to generate a Ramp waveform using DAC interface
7. Write a program to control a Stepper Motor
8. Write a program to control the speed of DC motor
9. Interface relays and write a program to control them
10. Interface ZIGBEE with ARM to control more external devices
11. Interfacing of Biometric information recorder
12. Interfacing RFID module with ARM Microcontroller

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							THEORY		PRACTICAL		
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MTCS221		**Network & Web Security**	2	-	2	3	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. Understand the fundamental principles of access control models and techniques, authentication and secure system design.
2. Apply methods for authentication, access control, intrusion detection and prevention.
3. Identify and mitigate software security vulnerabilities in existing systems.
4. Understand the role of firewalls, IPSec, Virtual Private Networks and identity management, etc.
5. Understand Web Server vulnerabilities and their counter measures.

Course Outcomes:

Provide students with a high level understanding of how information security functions in an organization. Topics will be both business and technology - centric.

1. To master information security governance, and related legal and regulatory issues,
2. To master understanding external and internal threats to an organization,
3. To be familiarity with information security awareness and a clear understanding of its importance,
4. To be familiar with how threats to an organization are discovered, analyzed, and dealt with,
5. To master fundamentals of secret and public cryptography,
6. To master protocols for security services,
7. To be familiar with network security threats and countermeasures.

UNIT I

Introduction to Security in Networks – Characteristics of Networks – Intrusion – Kinds of security breaches – Plan of attack - Points of vulnerability – Methods of defense – Control measures – Effectiveness of controls

UNIT II

Basic encryption and decryption, Encryption techniques, Characteristics of good encryption systems, Secret key cryptography, Data Encryption Standard, International Data Encryption Algorithm, Advanced Encryption Standard, Hash and MAC algorithms

UNIT III

Public Key encryptions, Introduction to number theory, RSA algorithm, Diffie-Hellman Digital

Signature standard, Elliptic Curve cryptography, Digital signatures and authentication, Trusted intermediaries, Security handshake pitfalls

UNIT IV

Network security basics, TCP/IP vulnerabilities Layer wise: Packet Sniffing, ARP spoofing, port scanning, IP spoofing, TCP syn flood, DNS Spoofing, Internet Security Protocols: SSL, TLS, IPSEC, Secure Email and S/MIME, Denial of Service: Classic DOS attacks, Source Address spoofing, ICMP flood, SYN flood, UDP flood, Distributed Denial of Service, Defenses against Denial of Service Attacks. Firewalls, Intrusion Detection Systems: Host Based and Network Based IDS, Honey pots.

UNIT V

User Authentication and session management, Cookies, Secure HTTP, SQL Injection Techniques, Cross Site Scripting, Cross-Site Request Forgery, Session Hijacking and Management, Phishing and Pharming Techniques, Web Services Security.

Text Books:

1. Computer Security Principles and Practice, by William Stallings, Pearson Education.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security: Private Communication in a public world", Prentice Hall India, 2nd Edition, 2002.
3. Security in Computing by Charles P. Pfleeger , Pearson Education
4. Computer Security by Dieter Gollman, 3 rd Edition, Wiley India.
5. Cryptography and Network Security by Behrouz A. Forouzan, TATA McGraw hill.

References:

1. Information security Principles and Practice by Mark Stamp, Wiley publication
2. Network security bible 2nd edition, Eric Cole, Wiley India.

Practical's List

1. Design and implement the RSA cryptosystem.
2. Implement Digital signature scheme using RSA.
3. Simulate the Buffer overflow attack.
4. Simulate the Salami attack.
5. Design and implement a program for adding passwords to a file. The program should be able to filter out weak passwords (based on dictionary words or variants) and store the strong passwords by creating a hash of user ID and password.
6. Study of a packet sniffer like wireshark, or tcpdump. Use this tool to capture and analyze data in packets.
7. Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc
8. Detect ARP spoofing using open source tool ARPWATCH
9. Install an IDS (e.g. SNORT) and study the logs.
10. Use of iptables in linux to create firewalls.
11. Implement a simple SQL injection attack.

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCS222		**MOBILE COMMUNICATION**	2	-	2	3	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective:

The objectives of the course Mobile Cellular Communications are

1. To impart the fundamentals concepts of mobile communication systems.
2. To introduce various technologies and protocols involved in mobile communication.
3. To enable the student to synthesis and analyze wireless and mobile cellular communication systems over a stochastic fading channel
4. To provide the student with an understanding of advanced multiple access techniques
5. To provide the student with an understanding of diversity reception techniques
6. To give the student an understanding digital cellular systems (GSM, cdmaOne, GPRS, EDGE, cdma2000, W-CDMA, and LTE etc)

Course Outcome:

1. By the end of the course, the student will be able to analyze and design wireless and mobile cellular systems.
2. By the end of the course, the student will have the ability to work in advanced research wireless and mobile cellular programs.
3. No specific programming language is required.

UNIT I

Introduction to Cellular Mobile Systems: A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, overview of generations of cellular systems.

Elements of Cellular Radio Systems Design and Interference: General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems, Introduction to co-channel interference, co-channel measurement design of antenna system, antenna parameter and their effects.

UNIT II

Cell Coverage for Signal & Antenna Structures: General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model – characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation, Characteristics of basic antenna structures, antenna at cell site, mobile antennas.

Frequency Management & Channel Assignment, Hand Off & Dropped Calls: Frequency Management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment, Why hand off, types of handoff and their characteristics, dropped call rates & their evaluation.

UNIT – III

Modulation methods and coding for error detection and correction: Introduction to Digital modulation techniques, modulation methods in cellular wireless systems, OFDM, Block Coding, convolution coding and Turbo coding.

Multiple access techniques: FDMA, TDMA, CDMA: Time-division multiple access (TDMA), code division multiple access (CDMA), CDMA capacity, probability of bit error considerations, CDMA compared with TDMA.

UNIT IV

Mobile IP – Dynamic Host Configuration Protocol-Mobile Ad Hoc Routing Protocols– Multicast routing-TCPover Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery –Transmission/Timeout Freezing-Selective Retransmission – Transaction Oriented TCP- TCP over 2.5 / 3Gwireless Networks

UNIT V

APPLICATION LAYER:WAP Model- Mobile Location based services -WAP Gateway –WAP protocols – WAP user agent profile- caching model-wireless bearers for WAP - WML – WMLScripts – WTA - iMode- SyncML.

Text Books:

1. William, C. Y. Lee, “Mobile Cellular Telecommunications”, 2nd Edition, McGraw Hill, 1990.
2. Mischa Schwartz, “Mobile Wireless Communications”, Cambridge University Press, UK, 2005

Reference:

1. “Mobile Communication Hand Books”, 2nd Edition, IEEE Press.
2. Theodore S Rappaport, “Wireless Communication Principles and Practice”, 2nd Edition, Pearson Education, 2002.
3. Lawrence Harte, “3G Wireless Demystified”, McGraw Hill Publications, 2001.
4. Kaveh Pahlavan and Prashant Krishnamurthy”, Principles of Wireless Networks”, PHI, 2001

Practical’s List

01) Experiment of Wireless channel modeling and diversity using MATLAB
02) Experiment of broadband wireless channel modeling using MATLAB
03) Experiment of Spread Spectrum communication technique using MATLAB
04) Experiment of CDMA using MATLAB
06) Perform following experiments using CDMA trainer kit a-Spread spectrum and dispread spectrum experiment b-Carrier extraction experiment
07) CDMA mobile communication system using CDMA trainer kit .
08) Experiment of 3G network using 3G UMTS Communications Network Lab.
09) Experiment of 4G network using 4G LTE Communications Network Lab 11) Analysis of MIMO Diversity using MATLAB
10) Experiment of UWB system using MATLAB
11) To perform an experiment for Voice and data quality testing for 3G

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							THEORY		PRACTICAL		
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MTCS223		**Wireless Sensor Ad-hoc Network**	2	-	2	3	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Objective:

1. To introduce the characteristics, basic concepts and systems issues in mobile and pervasive computing
2. To illustrate architecture and protocols in pervasive computing and to identify the trends and latest development of the technologies in the area
3. To give practical experience in the area through the design and execution of a modest research project
4. To design successful mobile and pervasive computing applications and services
5. To evaluate critical design tradeoffs associated with different mobile technologies, architectures, interfaces and business models and how they impact the usability, security, privacy and commercial viability of mobile and pervasive computing services and applications

Course Outcome:

1. To discover the characteristics of pervasive computing applications including the major system components and architectures of the systems
2. To analyze the strengths and limitations of the tools and devices for development of pervasive computing systems
3. To explore the characteristics of different types of mobile networks on the performance of a pervasive computing system.
4. To analyze and compare the performance of different data dissemination techniques and algorithms for mobile real-time applications
5. To develop an attitude to propose solutions with comparisons for problems related to pervasive computing system through investigation.

UNIT I

What is an Ad Hoc Network? Heterogeneity in Mobile Devices , Wireless Sensor Networks ,Traffic Profiles , Types of Ad hoc Mobile Communications , Types of Mobile Host Movements Challenges Facing Ad hoc Mobile Networks , Ad hoc wireless Internet . Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks , Classifications of Routing Protocols , Table Driven Routing Protocols , Destination Sequenced Distance Vector (DSDV) , Wireless Routing Protocol (WRP) , Cluster Switch Gateway Routing (CSGR) , Source, Initiated On, Demand Approaches , Ad hoc On, Demand Distance Vector Routing (AODV) , Dynamic Source Routing (DSR) ,Temporally Ordered Routing Algorithm (TORA) , Signal Stability Routing (SSR) ,Location, Aided Routing (LAR) ,

Power, Aware Routing (PAR) , Zone Routing Protocol (ZRP).

UNIT II

Issues in Designing a Multicast Routing Protocol , Operation of Multicast Routing Protocols , An Architecture Reference Model for Multicast Routing Protocols , Classifications of Multicast Routing Protocols , Tree, Based Multicast Routing Protocols, Mesh ,Based Multicast Routing Protocols , Summary of Tree and Mesh based Protocols , Energy, Efficient Multicasting ,Multicasting with Quality of Service Guarantees , Application , Dependent Multicast Routing ,Comparisons of Multicast Routing Protocols - Design Goals of a Transport Layer Protocol for Ad hoc Wireless Networks ,Classification of Transport Layer Solutions , TCP over Ad hoc Wireless Networks- Security in Ad Hoc Wireless Networks , Network Security Requirements , Issues and Challenges in Security Provisioning , Network Security Attacks , Key Management , Secure Routing in Ad hoc Wireless Networks.

UNIT III

Issues and Challenges in Providing QoS in Ad hoc Wireless Networks , Classifications of QoS Solutions , MAC Layer Solutions , Network Layer Solutions , QoS Frameworks for Ad hoc Wireless Networks Energy Management in Ad hoc Wireless Networks , Introduction , Need for Energy Management in Ad hoc Wireless Networks , Classification of Energy Management Schemes , Battery Management Schemes , Transmission Power Management Schemes , System Power Management Schemes.

UNIT IV

Single node architecture Hardware components, energy consumption of sensor nodes, Network architecture , Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks. physical layer and transceiver design consideration in wireless sensor networks, Energy usage profile, choice of modulation, Power Management , MAC protocols , fundamentals of wireless MAC protocols, low duty cycle protocols and wakeup concepts, contention-based protocols, Schedule-based protocols SMAC, BMAC, Traffic adaptive medium access protocol (TRAMA), Link Layer protocols fundamentals task and requirements, error control, framing, link management.

UNIT V

Gossiping and agent-based uni-cast forwarding, Energy-efficient unicast, Broadcast and multicast, geographic routing, mobile nodes, Data-centric routing , SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing , COUGAR, ACQUIRE, Hierarchical Routing , LEACH,PEGASIS, Location Based Routing , GAF, GEAR, Data aggregation , Various aggregation techniques. Introduction to TinyOS , NesC, Interfaces, modules, configuration, Programming in TinyOS using

Text Books:

1. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Prentice Hall, PTR, 2004.
2. C. K. Toh, “Ad Hoc Mobile Wireless Networks Protocols and Systems”, Prentice Hall, PTR, 2001.
3. Charles E. Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.
4. Kazem Sohraby, Daniel Minoli and Taieb Znati, “ Wireless Sensor Networks Technology- Protocols and Applications”, John Wiley & Sons, 2007.
5. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: an information processing approach”, Else vier publication, 2004.

Reference:

1. C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, "Wireless Sensor Networks", Springer publication, 2004.
2. Holger Karl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John wiley publication, Jan 2006.
3. K.Akkaya and M.Younis, " A Survey of routing protocols in wireless sensor networks", Elsevier Adhoc Network Journal, Vol.3, no.3,pp. 325-349, 2005.
4. Philip Levis, " TinyOS Programming", 2006 – www.tinyos.net.
5. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey", computer networks, Elsevier, 2002, 394 - 422.
6. Jamal N. Al-karaki, Ahmed E. Kamal, "Routing Techniques in Wireless sensor networks: A survey", IEEE wireless communication, December 2004, 6 – 28.

Practical's List

1. Develop unicast routing protocols using any suitable Network Simulator for (Mobile Ad hoc Networks) MANET to find the best route using the any one of routing protocols from each category from table-driven (e.g., link state or DSDV) on demand (e.g., DSR, AODV, TORA), hybrid (e.g., ZRP, contact-based architectures) and hierarchical (e.g., cluster based.) The efficient path/route should be established for source and destination data transmission using routing protocols. Understand the advantages and disadvantages of each routing protocol types by observing the performance metrics of the routing protocol. In that way the best application/environment suitable routing protocol can be identified in each category.

2. Develop multicast routing protocols using any suitable Network Simulator for MANET in which session nodes are connecting through either tree(MAODV, MCEDAR) or mesh (ODMRP, CAMP, FGMP) structure. Analyze the performance metrics of multicast routing protocols with unicast routing protocols.

3. Develop MAC Protocol using any suitable Network Simulator for MANETs to send the packet without any contention through wireless link using the following MAC protocols; (CSMA/CA (802.11), MACA, MACAW, PAMAS, and SMAC). Analyze its performance with increasing node density and mobility.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCS224		**Distributed Computing**	2	-	2	3	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective:
The course is intended to provide basic foundation with fundamental concepts and mechanisms of distributed computing systems. Most of the issues discussed in this course material are the essence of advanced operating systems.
Broad coverage as follows:
1. Introduction to distributed computing systems (DCS)
2. DCS design goals, Transparencies, Fundamental issues
3. Distributed Coordination
4. Process synchronization
5. Inter-process communication

UNIT I
Characterization of Distributed Systems, Introduction, Examples, Resource Sharing and the Web, Challenges. System Models, Architectural, Fundamental. Interprocess Communication, Introduction, API for Internet protocols, External data representation and marshalling, Client, server communication, Group communication, Case study: Interprocess Communication in UNIX.

UNIT II
Distributed Objects and Remote Invocation, Introduction, Communication between distributed objects, Remote procedure calls, Events and notifications Case study: Java RMI.
Operating System Support, Introduction, OS layer, Protection, Processes and threads, Communication and invocation OS architecture.

UNIT III
Distributed File Systems, Introduction, File service architecture Case Study: Sun Network File System, Enhancements and further developments. Name Services, Introduction, Name Services and the Domain Name System, Directory Services, Case Study: Global Name Service.

UNIT IV
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 V

Distributed Shared Memory, Introduction, Design and implementation issues, Sequential consistency and Ivy case study Release consistency and Minim case study, other consistency models. CORBA Case Study, Introduction, CORBA RMI, CORBA services.

Text book:

1. George Coulouris, Jean Dollimore, Tim Kindberg, , "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005.

References:

1 A.tS. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
2. M.L.Liu, “Distributed Computing Principles and Applications”, Pearson Addison Wesley, 2004.
3. Mukesh Singhal, “Advanced Concepts In Operating Systems”, McGrawHill Series in Computer Science, 1994.
4. Nancy A. Lynch, "Distributed Algorithms", The Morgan Kaufmann Series in Data Management System, Morgan Kaufmann Publishers, 2000.

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCS206		**Network Analysis Lab**	-	-	2	1	-	-	-	30	20

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To provide students with an overview of the concepts and fundamentals of Computer Network Simulator
2. To familiarize with the basic taxonomy and terminology computer networking area and understanding the simulation concept and tools.
3. To experience the designing and managing of communication protocols while getting a good Exposure to the TCP/IP protocol suite

Course Outcomes:

After completion of this course learner will be able to:

1. Conceptualize all the OSI Layers.
2. Use appropriate network tools to build network topologies
3. Install and configure an open source tool and Network Simulator
4. Test simple protocols in a laboratory scenario.

UNIT I

Introduction to design, troubleshooting and modelling of computer networking environments. Introduction of discrete events based simulation tools, understanding the different networking properties.

UNIT II

Introduction to Socket Programming, Applications development using socket programming, Understanding Client Server model, Understating the concept of data communication in networking environment, Introduction to network design and troubleshooting using networking tools for network addressing, Address Resolution Protocol (ARP), ping, ICMP, IP routing, IP fragmentation, route discovery.

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UNIT III

Understanding the performance impact of network using CSMA / CA protocol, design networking environment for comparative study of CSMA/CD protocols, Error Detection / Error Correction Techniques, TCP and UDP.

UNIT IV

Introduced to the network modelling and simulation. analyse network traces using wireshark software, Introduction to modelling and simulation tools, build simple networking models using the simulation modelling tools.

UNIT V

Perform simulations, evaluate the design approaches and expected network performance using NS-2. Modelling, Configuration and Performance Analysis of the different Network types using, NS-2, NS-3 and OMNeT++.

Text Books:

1. A.S. Tanenbaum, "Computer Networks", Pearson Education, Fourth Edition.
2. B.A. Forouzan, "Data Communications and Networking", TMH, Fourth Edition.

Reference Books:

1. Computer Networking- A Top-Down approach, 5th edition, Kurose and Ross, Pearson.
2. Computer Networking and the Internet (5th edition), Fred Halsall, Addison Wesley.
3. TCP/IP Protocol Suite (3rd edition), Behrouz Forouzan, McGraw Hill.

List of Practical's (Suggested):

1: Experiment with ARP.
2: IP addressing and subnet masking.
3: Troubleshooting Experiments with ICMP.
4: IP routing
5: Experiments with UDP.
6: TCP experiments.
7: Introduction to OMNET++ Modeler & Modelling and simulation Small Internetworks & M/M/1 Queue.
8: OMNET++ based experiment.
9: Exemplified Project: Modelling, Configuration and Performance Analysis of the Exemplified Lab Network using OMNET++ Modeler.

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MTCS207		**Software Construction Lab**	-	-	2	1	-	-	-	-	50

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Objectives:-

1 Apply the fundamentals of software construction as outlines in this course to an actual software development project.
2. Demonstrate by example the key construction life cycle models
3. Interpret key practical construction considerations such as design, languages, coding, testing, quality and reuse
4. Evaluate and provide examples of the key construction technologies in a typical software construction project
5. Explain the application of software construction tools such as GUI builders, unit testing tools, profiling, performance analysis and slicing tools.

Course Outcomes:-

1. Students will able to understand tools used in software construction.
2. Students will able implement software process models & can use CASE tools.
3. Students will able prepare projects plan and implement projects.

UNIT 1

Course Modules: Software Construction Fundamentals, Minimizing Complexity, Anticipating Change, Constructing for Verification, Reuse Standards in Construction,

UNIT II

Construction in Life Cycle Models, Construction Planning, Construction Measurement, Construction Design, Construction Languages, Coding.

UNIT III

Construction Testing, Construction for Reuse, Construction with Reuse, Construction Quality, Integration

UNIT IV

API Design and Use, Object-Oriented Runtime Issues, Parameterization and Generics, Assertions, Design by Contract, and Defensive Programming, Error Handling, Exception Handling, and Fault Tolerance, Executable Models, State-Based and Table-Driven Construction Techniques, Runtime

Configuration and Internationalization, Grammar-Based Input Processing, Concurrency Primitives Middleware

UNIT V

Constructing Heterogeneous Systems, Performance Analysis and Tuning, Platform Standards, Test-First Programming.

Development Environments, GUI Builders, Unit Testing Tools,Profiling, Performance Analysis, and Slicing Tools

Text Books:

1. Karl J. Lieberherr, Ian M. Holland, Assuring Good Style for Object-Oriented Programs, 1989, LieberherrHolland89.
2. D. L. Parnas, On the criteria to be used in decomposing systems into modules, 1972, Parnas72
3. W. Wulf and Mary Shaw, Global variable considered harmful, 1973, WulfShaw84
4. John Hughes, Why functional programming matters, 1990 Hughes89
5. Robert C. Martin, Design principles and design patterns, Martin00.

Practical's List:

1. Introduction to UML and Course Outlines. Tools Description.
2. Introduction to Rational Rose and Practical Implementation.
3. Introduction to class Diagram.
4. Class Diagram in Detail and Tasks Done by using Rational Rose.
5. Introduction to Use-case Diagram, its Detail and implementation by using Rational Rose.
6. Lab Quiz: 01 (Use-case Diagram)
7. Introduction to Sequence Diagram.
8. Sequence Diagram in Detail and Tasks by using Rational Rose.
9. Introduction of Component Diagram and its implementation by using Rational Rose.
10. Introduction to Collaboration Diagram and Task by using Rational Rose.
11. Test cases and Few Scenarios of test-cases in real life.
12. Introduction to TestLog and An implementation on it.
13. Lab Quiz: 02 (Test-cases)
14. Parser Language: Introduction and Code Generation Technique.
15. Presentations based on Parser Language.