ESTD : 1946

THE NATIONAL INSTITUTE OF ENGINEERING
MYSORE – 8

(Autonomous Institution under VTU)

Bachelor of Engineering

Scheme of VII-VIII Semester

B.E (Computer Science and Engineering)

(2020-2021)

Department of Computer Science and Engineering

VII SEMESTER

B.E - COMPUTER SCIENCE AND ENGINEERING

Scheme of Teaching and Examination (Autonomous Scheme)

Sl. No	Subject Code	Course Title	Teaching Dept	Contact Hours / Week				Credits
				L	T*	P*	Total	
1	CS0445	Distributed Operating System	CS & E	4	0	0	4	4
2	CS0521	Cryptography and Network Security	CS & E	4	2	0	6	5
3	CS0422	Parallel Processing Architecture and Algorithms	CS & E	4	0	0	4	4
4	CS------	Elective – IV	CS & E	3	0	0	3	3
5	CS------	Elective – V	CS & E	3	0	0	3	3
6	CS------	Elective – VI	CS & E	3	0	0	3	3
7	CS0205	Project Phase-I	CS & E	0	0	4	4	2
			TOTAL				27	24

VIII SEMESTER

B.E - COMPUTER SCEINCE AND ENGINEERING

Scheme of Teaching and Examination (Autonomous Scheme)

Sl. No	Subject Code	Course Title	Teaching Dept	Contact Hours / Week				Credits
				L	T*	P*	Total	
1	CS0501	Cloud Computing	CS & E	4	0	2	6	5
2	CS------	Elective –VII	CS & E	3	0	0	3	3
3	CS------	Elective – VIII	CS & E	3	0	0	3	3
4	CS0110	Seminar	CS & E	0	0	2	2	1
5	CS0602	Project Phase -II	CS & E	0	0	12	12	6
6	CS0113**	Journal Publication #	CS & E	0	0	2	2	1
			TOTAL				30	19 / 15

ELECTIVES FOR 7th SEM

ELECTIVE GROUP 4

Sl No	Subject Code	Subject Name
1.	CS0326	Storage Area Networks
2.	CS0319	Concurrent Programming
3.	CS0304	Decision Support Systems
4.	CS0322	Unix Systems Programming

ELECTIVE GROUP 5

Sl No	Subject Code	Subject Name
1.	CS0318	Linux Internals
2.	CS0320	Design of Unix Operating Systems
3.	CS0325	Introduction to Data Mining
4.	CS0311	Operations Research

ELECTIVE GROUP 6

Sl No	Subject Code	Subject Name
1.	CS0331	Embedded Systems
2.	CS0303	Pervasive Computing
3.	CS0327	Protocol Engineering
4.	CS0328	ADHoc Networks

ELECTIVES FOR 8th SEM

ELECTIVE GROUP 7

Sl No	Subject Code	Subject Name
1.	CS0317	Real Time Systems
2.	CS0316	Advanced Java
3.	CS0324	Big data Analytics
4.	CS0314	Web Programming

ELECTIVE GROUP 8

Sl No	Subject Code	Subject Name
2.	CS0330	Wireless and Mobile Networks
3.	CS0305	Wireless Communication Networks
4.	CS0306	Parallel Algorithms

DISTRIBUTED OPERATING SYSTEM (4:0:0)

Sub code: CS0445 **CIE: 50%**

Hrs/week: 04 **SEE: 50%**

SEE Hrs: 3 Hrs **Max Marks: 100**

Course Outcomes

On successful completion of the course the students will be able to

1. Explain the essentials of the Distributed Operating System
2. Apply suitable synchronization algorithm to solve problems in distributed system.
3. Make use of an appropriate Election Algorithm and explain the Transaction Model.
4. Illustrate the process allocation mechanisms in distributed system.
5. Analyze the design of Distributed File System and its implementations.
6. Explain the importance of distributed shared memory and consistency models.

UNIT 1

Introduction to distributed systems: What is a distributed system? Goals, Advantages of distributed systems, disadvantages over centralized and independent PCs. Bus-based, switched multi-processors and multi-computers, Networking, true distributed and multi-processor time sharing systems.

***SLE**: Design issues* **8 Hours**

UNIT 2

Synchronization in distributed Systems-I: Clock synchronization: Logical clocks, Physical clocks, Clock synchronization algorithms, use of synchronized clocks.

Mutual exclusion: A centralized algorithm, A distributed algorithm, A token ring algorithm.

***SLE:** comparison of the 3 Algorithms* **9 Hours**

UNIT 3

Synchronization in distributed systems-II: Election algorithms: The bully algorithm, A ring algorithm.
Atomic transactions: Introduction, the transaction model, implementation.

***SLE**: Concurrency control* **9 Hours**

UNIT 4

Threads: Introduction, usage, design issues for thread package, implementing thread package, **Processor allocation**: models, design issues, implementation issues, example algorithms

SLE: *Threads and RPC, Scheduling in distributed systems* **9 Hours**

UNIT 5

Distributed File systems

Distributed file system design: File system interface, directory server interface, semantic file sharing, Distributed file system implementation: file usage, system structure, caching, replication.

SLE: *Sun's NFS* **8 Hours**

UNIT 6

Distributed shared memory
Introduction, What is shared memory?, consistency models: strict, sequential,

SLE: *Page based distributed shared memory* **9 Hours**

Text Book:

1. **Distributed Operating systems** Andrew S. Tanenbaum, 3rd edition, Pearson publication, 2007

Reference Book:

1. **Distributed systems, concepts and design**, G. Colouris, J. Dollimore and Tim Kinderg, 3rd edition, Pearson publications.

CRYPTOGRAPHY AND NETWORK SECURITY (4:2:0)

Sub code: CS0521 **CIE: 50%**

Hrs/week: 06 **SEE: 50%**

SEE Hrs: 3 Hrs **Max Marks: 100**

Course Outcomes

On successful completion of the course the students will be able to

1. Explain the foundations of Cryptography and network security. Critical evaluation of the risks and threats to networked computers. Demonstration of the various mechanisms to protect data and their limitations. Demonstrate detailed knowledge of the role of encryption to protect data using DES.

2. Demonstrate advanced encryption technique like AES.

3. Familiarize with cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel using public key algorithms.

4. Verify the integrity of the messages transmitted via an insecure channel and unique identification of the originator of any message using MAC.

5. Explain the different key management and digital signature systems.

6. Discuss security at system level, malicious programs, IDS, Firewalls.

UNIT 1

Introduction to Symmetric-Key Encipherment: Security Goals, Cryptographic Attacks, Services and Mechanism, Techniques.
Traditional Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers.
Introduction to Modern Symmetric-Key Ciphers: Modern Block Ciphers, Modern Stream Ciphers.

Data Encryption Standard (DES): Introduction, DES Structure (overview only), Security of DES.

SLE: *Stream and Block Ciphers, Multiple DES-Conventional Encryption Algorithms.*

10 Hours

UNIT 2

Advanced Encryption Standard (AES): Introduction, Transformations, Key expansion, The AES Ciphers, Examples, Analysis of AES.
Encipherment Using Modern Symmetric-Key Ciphers: Use of Modern Block Ciphers (overview only).

SLE: *Use of Stream Ciphers (overview only).* **8 Hours**

UNIT 3

Asymmetric-Key Cryptography: RSA Cryptosystems, ElGamal Cryptosystem, Elliptic curve crypto systems (overview only).

SLE: *Rabin Cryptosystem* **9 Hours**

UNIT 4

Message Integrity and Message Authentication: Message Integrity, Random Oracle Model, Message Authentication.

Digital Signature: Comparison, Process, Services, Attacks of Digital Signature, Digital Signature Schemes.
SLE: *Variations and Applications.* **9 Hours**

UNIT 5

Entity Authentication: Introduction, Passwords, Challenge-Response, Biometrics.
Key Management: Symmetric-Key Distribution, Kerberos, Symmetric-key Agreement.

SLE: *Public-Key Distribution.* **8 Hours**

UNIT 6
System Security: Malicious programs, worms, Viruses, Intrusion Detection Systems, Firewalls: Definitions, Construction and Working Principles

SLE: *Application Layer Firewalls*

8 Hours

Note: Implementation of the concepts taught in the theory classes will be done in Tutorial sessions**.**

Text Book:

1. **Cryptography and Network Security**, BehroozForouzan, SIE, 2nd Edition, McGraw-Hill.

Reference Books:

1. **Cryptography and Network Security**, Principles and Practice; Fifth Edition. By William Stallings, Prentice Hall.
2. **Handbook of Applied Cryptography**, A. Menezes, P. and S. Vanstone. CRC Press.

PARALLEL PROCESSING ARCHITECTURE AND ALGORITHMS (4:0:0)

Sub code: CS0422 **CIE: 50%**

Hrs/week: 04 **SEE: 50%**

SEE Hrs: 3 Hrs **Max Marks: 100**

Course Outcomes

On successful completion of the course the students will be able to

1. Understand pipelining, which is a rudimentary form of parallelism.

2. Introduce popular parallel architectures such as linear array, Grid, Torus, binary tree and 2D mesh.

3. Discuss parallel algorithm complexity and various models of parallelism algorithms.

4. Discuss how problems such as semi group computation, routing etc can be solved efficiently on
various parallel architectures

5. Analyze popular problems such as sorting, convex hull etc were discussed.

6. Analyze circuit level sorting along with examples of practical significance such as discrete fourier
transform, fast FFT etc were discussed.

UNIT 1

Pipelined Data Paths Pipelining Concepts , Pipeline Stalls or Bubbles, Pipelined Data Path Design, Pipelined Control, Optimal pipelining, Data Dependencies and Hazards, Data Forwarding, Pipeline Branch Hazards , Branch Prediction, Advanced Pipelining , Exceptions in a Pipeline.

SLE: *pipeline timing and performance.* **8 Hours**

UNIT 2

Introduction to Parallelism Why Parallel Processing? A Motivating Example, Types of Parallelism: A Taxonomy, Roadblocks to Parallel Processing, Effectiveness of Parallel Processing. A Taste of Parallel Algorithms Some Simple Computations, Some Simple architectures, Algorithms for a Linear Array, Algorithms for a Binary Tree, algorithms for 2D Mesh, Algorithms with Shared Variables.

SLE: *Parallel Processing Ups and Downs* **9 Hours**

UNIT 3

Parallel Algorithm Complexity: Asymptotic Complexity, Algorithm Optimality and Efficiency, Complexity classes, Parallelizable Tasks and the NC Class, Parallel Programming Paradigms, Solving Recurrences.

Models of Parallel Processing: SIMD versus MIMD Architectures, Global versus Distributed Memory, the PRAM Shared-Memory model, Distributed-Memory or Graph Models, Circuit Model and Physical Realizations.

***SLE**: Development of Early Models* **9 Hours**

UNIT 4

RAM and Basic Algorithms: Data Broadcasting, Semi group or Fan-in Computation, Parallel Prefix Computation, Ranking the Elements of a Linked List , Matrix Multiplication, Sequential Ranked- Based Selection , A Parallel Selection Algorithm.

***SLE:** PRAM Sub models and Assumptions.* **9 Hours**

UNIT 5

More Shared-Memory Algorithms: A Selection-Based Sorting Algorithm, Alternative Sorting Algorithms, Convex Hull of a 2D Point Set ,Some Implementation Aspects. Data Access Problems and Caching, Coordination and synchronization.

***SLE:** Cache Coherence Protocols.* **8 Hours**

UNIT 6

Sorting and Selection Networks: What is a Sorting Network? , Figures of Merit for Sorting Networks, Design of Sorting Networks, Other Classes of Sorting Networks, Selection Networks. Other Circuit-Level Examples : Searching and Dictionary Operations ,A Tree-structured Dictionary Machine ,Parallel Prefix Computation , Parallel Prefix Networks, The Discrete Fourier Transform , Parallel Architectures for FFT.

***SLE:** Batcher Sorting Networks.* **9 Hours**

Text Books:

1. **B. Parhami, Computer Architecture**, From Microprocessors to Supercomputers, Oxford University Press, Indian edition, 2005

2. **B. Parhami, Introduction to Parallel Processing,** Algorithms and Architectures, Plenum series, KLUWER ACADEMIC PUBLISHERS, 2002,Kluwer's eBook store at: http://www.ebooks.kluweronline.com

Reference Books:

1. **Advanced Computer Architecture, Parallelism, Scalability, Programmability–** Kai Hwang,TataMc- Grawhill, 2003.

2. **Computer Architecture, A Quantitative Approach,** John L. Hennessey and David A. Patterson: –4th Edition, Elsevier, 2007.

3. **Parallel Computer Architecture, A Hardware /Software Approach,** David E. Culler, Jaswinder Pal Singh, Anoop Gupta, – Morgan Kaufman, 1999.

PROJECT PHASE - I (0:0:4) (2 credits)

Sub Code: CS0205 **CIE: 50%**

Hrs/week: 04 **SEE: 50%**

See Hrs: 2 Hrs **Max Marks: 100**

Course outcomes

On successful completion of the course the students will be able to:

1. Identify a real world engineering problem and formulate it.

2. Outline a software project plan to check the feasibility of the solution in terms of both time and cost and carry out Analysis.

3. Evaluate the available tools by Literature survey and adapt it to develop a suitable design.

VIII SEMESTER

CLOUD COMPUTING (4:0:2)

Sub code: CS0501 **CIE : 50%**

Hrs/week: 06 **SEE : 50%**

SEE Hrs: 3 Hrs **Max Marks:100**

Course Outcomes

On successful completion of the course the students will be able to

1. Overview of Cloud Computing and various distributed system models with enabling technologies.

2. Analyze various Computer Clusters for Scalable Parallel Computing.

3. Acquire the clear understanding of Virtual Machines and Virtualization of Clusters.

4. Acquire the basic knowledge of Cloud Platform Architecture over Virtualized Data Centers.

5. Acquire the clear understanding of Service-Oriented Architectures for Distributed Computing.

6. Develop various applications using Cloud Programming and Software Environments.

UNIT 1

Introduction: Defining Cloud Computing, Cloud Types: NIST Model, Cloud Cube Model, Deployment models, Service Models. Characteristics of Cloud Computing, Benefits of Cloud computing, Disadvantages of cloud computing.
Distributed System Models and Enabling Technologies: System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency.

SLE: *Parallel and distributed Programming model, Energy Efficiency in Distributed computing*

8 Hours

UNIT 2

Computer Clusters for Scalable Parallel Computing: Clustering for Massive Parallelism, Computer Clusters and MPP Architectures, Design Principles of Computer Clusters, Cluster Job and Resource Management.

***SLE**: Analysis of Top 500 Supercomputers, Cluster Job Management System, Tianhe-1A.*

8 Hours

UNIT 3

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management.

***SLE**: Virtualization for Data-Center Automation.* **10 Hours**

UNIT 4

Cloud Platform Architecture over Virtualized Data Centers: Cloud Computing and Service Models, Data-Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS, and Azure.

***SLE**: Inter-cloud Resource Management.* **9 Hours**

UNIT 5

Service-Oriented Architectures for Distributed Computing: Services and Service-Oriented Architecture, Message-Oriented Middleware,Discovery, Registries, Metadata, and Databases, Workflow in Service-Oriented Architectures.

***SLE:** Portals and Science Gateways* **9 Hours**

UNIT 6

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine,Emerging Cloud Software Environments.

***SLE**: Programming on Amazon AWS and Microsoft Azure* **8 Hours**

Text Books:

1. **Cloud Computing Bible** by Barrie Sosinsky, Wiley India (Chapter 1).
2. **Distributed And Cloud Computing**, Hwang, Kai; Fox, Geoffrey C; Dongarra, Jack J. ELSEVIER INDIA PVT. LTD (Chapter 1, 2, 3, 4, 5, 6)

Reference Books:

1. **Cloud Computing for Dummies** by Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper (Wiley India Edition).
2. **Cloud Security** by Ronald Krutz and Russell Dean Vines, Wiley-India.

3. **Cloud Computing**, A Practical Approach, Anthony T Velte.

4. **Google Apps** by Scott Granneman,Pearson

5. **A Brief Guide to Cloud Computing**, An Essential Introduction to the Next Revolution in Computing,ChristopherBarnatt.

SEMINAR (0:0:2) (1 credit)

Sub code: CS0110 **Hrs/week: 02**

Course outcomes

On successful completion of the course the students will be able to

1. Identify current trends in a specific area of interest.
2. Identify real world issues by conducting literature survey of the area.
3. Understand and interpret the results of technical work as indicated by the literature.
4. Demonstrate both technical report writing and presentation skills.
5. Summarize effectively, so as to improve both oral and written skills.

PROJECT PHASE-II (0:0:12) (6 credits)

Sub code: CS0602 **Hrs/week: 12**

Course outcomes

On successful completion of the course the students will be able to:

1. Implement the proposed design of phase- I.

2. Compute the results obtained from the implementation.

3. Verify and validate the obtained results using various test cases.

4. Demonstrate and present the project.

5. Prepare a detailed technical report of the project work carried out.

6. Publish the work in a reputed journal/conference

JOURNAL PUBLICATION (0:0:2) (1 credit)

Sub code: CS0113 **Hrs/week: 2**

Course outcomes

On successful completion of the course the students will be able to:

1. Demonstrate the working of new model/method/algorithm in conference.
2. Produce the technical work and results through journals.

ELECTIVES

STORAGE AREA NETWORKS (3:0:0)

Course code	**:CS0326**	**CIE**	**: 50%**
Hrs./ Week	**: 03**	**SEE**	**: 50%**
SEE Hrs.	**: 3 Hours**	**Max. Marks**	**: 100**

Course Outcomes

On successful completion of the course the students will be able to

1. Explain basic concepts of storage networks, such as I/O techniques, disk subsystems
2. Compare various RAID levels in storage virtualization
3. Explain I/O technologies and Network Attached Storage.
4. Summarize Network File systems and file servers, Storage virtualization and virtualization at various levels and use storage networks for data sharing, data protection, and digital archiving.
5. Classify types of Storage virtualization in the network, SAN Architecture and Hardware devices.
6. Explain Software Components of SAN and Configuration options for SAN.

UNIT 1

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages.

Intelligent Disk Subsystems -1: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels.

SLE: *Case study: Replacing a server with Storage Networks* **6 Hours**

UNIT 2

Intelligent Disk Subsystems -2, I/O Technologies -1: Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access.

SLE: *Availability of disk subsystems* **6 Hours**

UNIT 3

I/O Technologies- 2: SCSI.

Network Attached Storage: Fibre Channel Protocol Stack;

SLE: *The Physical I/O path from the CPU to the Storage System* **6 Hours**

UNIT 4

File System And NAS: Local File Systems; Network file Systems and file servers.

Storage Virtualization-1: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level.

SLE*: Case Studies: Direct Access File System.* **7 Hours**

UNIT 5

Storage Virtualization-2: Symmetric and Asymmetric storage virtualization in the Network.

SAN Architecture and Hardware devices: Overview, creating a Network for storage; SAN Hardware devices, Thefibre channel switch, Host Bus adaptors.

SLE*: Hardware devices: - Putting the storage in SAN* **7 Hours**

UNIT6

Software Components of SAN: The switch's Operating system, Device Drivers, The Supporting the switch's components.

SLE*: Configuration options for SANs -. The Evolving Network Connections*

7 Hours

TEXTBOOKS:

1. **Storage Networks Explained,** Ulf Troppens, Rainer Erkens and Wolfgang Muller, John Wiley & Sons, 2003.
2. **Storage Networks: The Complete Reference,** Robert Spalding, Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. **Information storage and management**, EMC Education services, Wiley India 2009, G Somasundaram, Alok, Srivatsava
2. **Storage Area Network Essentials: A Complete Guide to understanding and Implementing SANs,** Richard Barker and Paul Massiglia, John Wiley India, 2002.
3. **Storage Networking Fundamentals** Marc Farley, Cisco Press, 2005.

CONCURRENT PROGRAMMING (3:0:0)

Sub code	**: CS0319**	**CIE**	**: 50 %Marks**
Hrs / week	**: 03**	**SEE**	**: 50 %Marks**
SEE Hrs	**: 03 Hours**	**Max. Marks**	**: 100**

Course Outcomes

On successful completion of the course the students will be able to

1. Illustrate sequential programming paradigm and concurrent programming model with an example. Acquainted with Pascal-FC compiler.
2. Demonstrate process life cycle and process scheduling and how it is handled in Pascal-FC
3. Discuss various ways of process synchronization such as message passing model, mutual exclusion, shared variables.
4. Explain in detail message passing model and remote invocation.
5. Discuss semaphores - a synchronization primitive.
6. Point Out the advanced synchronization constructs such as critical regions and Monitors. Also analyze concurrency architecture in embedded systems.

UNIT 1

The Nature and Uses of Concurrent Programming: Introduction, Sequential Programming as a total ordering, Breaking away from the sequential paradigm, Concurrent programming as a partial ordering, The motivation for concurrent programming, An inherently concurrent problem domain, Problems in concurrent programming

***SLE**: Introducing Pascal-FC* **6 Hours**

UNIT 2

Process Representation and Life-cycle: The concept of process, Process Structures, Process states and transitions, Process management and the run-time support system

***SLE**: Timing in Pascal-FC* **6 Hours**

UNIT 3

Process interaction: Active and passive entities, The Ornamental Gardens Problem, Mutual exclusion and other synchronizations, Synchronization using simple shared variables, Synchronization primitives for shared variable solutions.
SLE*: The correctness of concurrent programs* **7 Hours**

UNIT 4

Synchronous Message-passing: Alternative Language models, Selective waiting, Communication by channel, The select construct, Concurrency and non-determinism,
Remote Invocation: Basic model
SLE: *Remote invocation and selective waiting* **7 Hours**

UNIT 5

Semaphores: Definition of semaphores, Pascal-FC's Semaphores, Mutual exclusion with semaphore, Fairness and semaphores, Semaphore invariants, Condition synchronization with semaphores
SLE: *Why Semaphores? Evaluation of semaphores* **6 Hours**

UNIT 6

Conditional Critical Regions and Monitors: Beyond semaphores, Critical regions, Conditional critical regions, Monitors for mutual exclusion, Condition synchronization with monitors, Illustrative examples of the use of monitors
SLE: *Concurrency Architectures: Introduction, Embedded systems architecture* **7 Hours**

TEXT BOOK:

1. Concurrent Programming: Alan Burns, Geoffrey Davis, Addison-Wesley (1993).

REFERENCE BOOKS:

1. **Concurrent Programming – Principles and Practice:** Gregory R. Andrews, The Benjamin/Cummings Publishing Company, Inc (1991).
2. **Concurrent Programming:** (Edited by) NarainGehani, Andrew D. McGettrick,Addison Wesley (1988).
3. **Principles of Concurrent Programming:** M. Ben-Ari, Prentice-Hall (1982).
4. **Concurrent Programming:** C. R. Snow, Cambridge University Press (1992).
5. **On Concurrent Programming:** Fred B. Schneider, Springer, 1st Edition (1997)

DECISION SUPPORT SYSTEM (3:0:0)

Sub Code **CS0304** CIE:**50% Marks**
Hrs/ Week: **3** SEE: **50% Marks**
SEE Hrs: **03** Max. Marks: **100**

Course Outcome:

On successful completion of the course the students will be able to

1. Explain the use of Computers in Decision support systems and its various applications

2. Develop decisions based on intelligence

3. Illustrate DSS and its components of DSS

4. Develop Mathematical models and set goals for the decision.

5. Develop DSS by using various tools techniques and methods.

6. Compare Enterprise decision support systems and Knowledge Management

UNIT 1

DECISION-MAKING AND COMPUTERIZED SUPPORT: Management Support Systems: An Overview, Managers. and Decision-Making , Managerial Decision-Making and Information Systems, Managers and Computer Support, Computerized Decision Support and the Supporting Technologies, A Framework for Decision Support, The Concept of Decision Support Systems , Group Support Systems, Enterprise Information Systems, Knowledge Management Systems, Expert Systems, Artificial Neural Networks , Advanced Intelligent Decision Support Systems
SLE: *Hybrid Support Systems , ABE Automation Makes Faster and Better Decisions with DSS*

6 Hrs

UNIT 2

Decision-Making Systems, Decision-Making: Introduction and Definitions, Systems, Models, Phases ofthe Decision-Making Process, Decision-Making: The Intelligence Phase, Decision-Making: The Design Phase, Decision-Making:The Choice Phase, Decision-Making: The Implementation Phase, How Decisions Are Supported, Personality Types, Gender, Human CognitiorI, and Decision Styles, The Decision-Makers,
SLE :*Clay Process Planning at IMERYS: A Classical Caseof Decision-Making*

7 Hrs

UNIT 3

Decision Support Systems: DSS Configurations, What Is a DSS?, Characteristics and Capabilities of DSS, Components of DSS, The Data Management Subsystem, The Model Management Subsystem, The User Interface (Dialog) Subsystem, The Knowledge-Based Management Subsystem, The User, DSS Hardware, DSS Classifications.
Modeliug and Analysis: MSS Modeling, Static and Dynamic Models, Certainty, Uncertainty, and Risk, Influence Diagrams, MSS Modeling with Spreadsheets, Decision Analysis of a Few Alternatives (Decision Tables and Decision Trees)
SLE: The Advantage of Petro Vantage: Business IntelligencelDSS Creates an E-Marketplace

7 Hrs

UNIT 4

Mathematical Modelling: The Structure of MSS Mathematical Models, athematical Programming Optimization, Multiple Goals, Sensitivity Analysis, What-If, and Goal Seeking, Problem-Solving Search Methods, Heuristic Programming, Simulation, Visual Interactive Modeling and Visual Interactive Simulation

Business Intelligence: Data Warehousing, Data Acquisition, Data Mining, BusinessAnalytics, and Visualization: The Nature and Sources of Data, Data Collection, Problems, and Quality, The Web / Internet and Commercial Database Services.

SLE: *Quantitative Software Packages, Model Base Management, Database Management Systems in Decision Support Systems / Business Intelligence*

7 Hrs

UNIT 5

Decision Support System Development:
Introduction to DSS Development, The Traditional System Development Life Cycle, Alternative Development Methodologies, Proto typing: The DSS Development Methodology, Change Management, DSS Technology Levels and Tools, DSS Development Platforms, DSS Development Tool Selection, Team-Developed DSS.

SLE: *End User Developed DSS, Putting The DSS Together*

6 Hrs

UNIT 6

COLLABORATION, COMMUNICATION, ENTERPRISE DECISION SUPPORT SYSTEMS, AND KNOWLEDGE MANAGEMENT: Collaborative Computing Technologies: Group Support Systems, Group Decision-Making, Communication, and Collaboration, Communication Support, Collaboration Support: Computer-Supported Cooperative Work, Group Support Systems, Group Support Systems Technologies, Group systems Meeting room and Online, The GSS Meeting Process.
SLE: *Distance Learning, Creativity and Idea Generation*

7 Hrs

TEXT BOOK:

1. Decision Support Systems and Intelligent Systems - Efraim Turban. Jay E. Aronson, Ting Peng Liang:, 7th Edition, Prentice-Hall of India, 2006.

REFERENCE BOOKS

1.Frada Burstein, Clyde W. Holsapple, International Handbooks Information System, Handbook on decision support systems 1: Basic Themes, First edition, ISBN 3540487123, 9783540487128, 9783540487135, Springer-Verlag Berlin Heidelberg publisher, 2008
2.Vicki L. Sauter, Decision Support Systems for Business Intelligence, 2nd edition, ISBN 0470433744, 9780470433744, Wiley publication, 2011

UNIX SYSTEM PROGRAMMING (3:0:0)

Sub code	**: CS0322**	**CIE**	**: 50 %**
Hrs / week	**: 3**	**SEE**	**: 50 %**
SEE Hrs	**: 03 Hours**	**Max. Marks**	**: 100**

Prerequisite: Computer Concepts

Course Outcome

On successful completion of the course the students will be able to

1. Describe basic features and file I/O functions of UNIX operating system.
2. Explain various aspects of files and directories in UNIX
3. Explain about process environment and process control in UNIX.
4. Illustrate concepts and uses of signals in UNIX.
5. Apply thread concepts and POSIX thread functions for multi-threaded programming in UNIX.
6. Use inter-process communication mechanisms in UNIX for achieving process interaction.

UNIT 1

UNIX System Overview: Introduction, Unix architecture, System calls and Library Functions.

File I/O Introduction, File Descriptors, open Function, create Function, close Function, lseek Function, read Function, write Function, File Sharing, Atomic Operations, dup and dup2.

SLE: *UNIX Standardization, UNIX System Implementations*

7 Hours

UNIT 2

Files and Directories Introduction, stat, Set-User-ID and Set-Group-ID, access Function, umask Function, chmodFunctions, Sticky Bit, chown Functions, File Size,File Truncation, File Systems, link, unlink, remove, and rename Functions, Symbolic Links, symlink Functions, File Times, utime Function.

SLE*: File Types, File Access Permissions*

7 Hours

UNIT 3

Process Environment Introduction, main Function, Process Termination, Command-Line Arguments,Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions

Process Control Introduction, Process Identifiers, fork Function, vfork Function, exit Functions, wait and waitpid Functions.

SLE*: Race Conditions, exec Functions, Changing User IDs and Group IDs.*

7 Hours

UNIT 4

Signals Introduction, Signal Concepts, signal Function, Reentrant Functions, Reliable Signal Terminology and Semantics, kill and raise Functions, alarm and pause Functions, sigprocmask Function, sigpending Function, sigaction Function, sigsetjmp and siglongjmp Functions, sigsuspend Function.

***SLE**: Unreliable signals, Interrupted System calls*

6 Hours

UNIT 5

Threads: Introduction, Thread Concepts, Thread Identification, Thread Creation, Thread Termination, Thread Synchronization.

Daemon Processes: Introduction, Daemon Characteristics, Coding Rules
***SLE**: Single-Instance Daemons, Daemon Conventions.*

6 Hours

UNIT 6

Interprocess Communication: Introduction, Pipes, popen and pclose Functions, Coprocesses, FIFOs, XSI IPC, Message Queues, Semaphores

Network IPC: Sockets Introduction, Socket Descriptors, Addressing, Connection Establishment.

***SLE**: Data Transfer, Socket Options*

6 Hours

TEXT BOOK

1. **Advanced Programming in the UNIX Environment** – W. Richard Stevens and Stephen A Rago, 2nd Edition, Pearson Education / PHI, 2005.

REFERENCE BOOK

1. **The Design of the UNIX Operating System** – Maurice J Bach, Pearson Education PHI, 1987.

LINUX INTERNALS (3:0:0)

Sub code : CS0318	**CIE : 50 %**
Hrs / week : 03	**SEE : 50 %**
SEE Hrs : 3 Hours	**Max. Marks : 100**

Course Outcome

On successful completion of the course the students will be able to

1. Explain Linux Operating System basics, Kernel., booting process
2. Analyze memory management in Linux
3. Describe Inter process Communication and compare File Systems in Linux
4. Experiment with Device Drivers in Linux.
5. Illustrate Network Implementation and Debugging.
6. Make Use Kernel related commands.

UNIT 1

Linux-The Operating System: Main Characteristics, Linux Distributions: Compiling the kernel, Where is everything?, Compiling , Additional Configuration facilities

Introduction to kernel: important data structures, main algorithms, implementation of system Calls **The Booting process:** Carrying out the booting processes,

SLE: *LILO-the Linux Loader, GRUB, Etc.,* **7 Hours**

UNIT 2

Memory Management: The Architecture-independent Memory model, The Virtual address space of a process, Block device caching, Paging under Linux

SLE: *Paging under linux* **6 Hours**

UNIT 3

Interprocess communication: Synchronization in the kernel, Communication via files, Pipes, System V IPC

File System: Basic principles, The representation of file system in kernel, The ext2,

SLE: *Debugging using ptrace, procfile system, ext3* **6 Hours**

UNIT 4

Device Drivers Under Linux: Character and Block devices, Hardware, Polling, interrupts, and waiting queues.

SLE: *Implementing a driver, Dynamic and static drivers*

7 Hours

UNIT 5

Network Implementation: Introduction and overview, Important structures, Network Devices under Linux

Modules and Debugging: what are modules?, Implementation in the kernel, the meaning of object sections for modules, and kernels, parameter transfer and examples, What can be implemented as a module?, the kernel daemon, Simple data swapping between modules,.

SLE: *Configuring the network interface, An example module, Debugging.*

7 Hours

UNIT 6

Kernel-Related Commands: Overview of the system's memory, ps-output of processes statistics, top-the CPU charts, init-primus inter pares, shutdown the system, strace monitoring a process, trace-route Ariadne's paths in the internet,.

SLE: *Configuring a serial interface, configuring the parallel interface, Building a directory tree*

6 Hours

TEXT BOOKS:

1. **Linux Kernel Programming**, M. Beck, et.al., III edition, Pearson Education 2002
2. **Linux Kernel Development**, Robert Love, Pearson Education 2004
3. **Understanding the Linux Kernel**, Daniel Bovet, Marco Cesati., III Edition, O'rielly Publications, 2005

DESIGN OF THE UNIX OPERATING SYSTEM (3:0:0)

Sub code : CS0320 **CIE : 50 %Marks**

Hrs / week : 03 **SEE : 50 %Marks**

SEE Hrs : 03 Hours **Max. Marks : 100**

Course outcome:

On successful completion of the course the students will be able to

1. Understand the Unix system concepts
2. Understand the design of Unix Kernel and buffer cache
3. Demonstrate a clear view of the File System
4. Understand the structure of processes in UNIX OS
5. Understand the concept of Process Control and Management
6. explain the concept of memory management and I/O subsystems

UNIT 1

Overview of the UNIX System

System structure, user perspective, Operating System services, assumption about H/W. Architecture of UNIX operating system, introduction to system concepts, kernel data structure

SLE: *System Administration* **6 Hours**

UNIT 2

The Buffer Cache

Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks

SLE: *Advantages and Disadvantages of Cache* **6 Hours**

UNIT 3

Internal Representation of Files

Inodes, structure of the regular file, directories, conversion of a pathname to inode, super block, inode assignment to a new file, allocation of disk blocks, other file types System Calls for the File System and change Root, Pipes, Mounting and Unmounting File Systems

SLE: *Super Block* **8 Hours**

UNIT 4

The Structure of process

Process stages and transitions, layout of system memory, the context of a process, saving Context of a process, manipulation of the process address space

SLE: *Sleep.* **6 Hours**

UNIT 5

Process Control & Scheduling
Process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, the shell, system Boot and the Init process. Process Scheduling, system call for time, clock

SLE: *Real Time processing* **7 Hours**

UNIT 6

Memory Management and I/O Subsystem
Swapping, Demand paging, Driver Interfaces, Disk Drivers, Streams

SLE: *A Hybrid system with swapping and demand paging*

6 Hours

TEXT BOOK:

1. **The Design of The UNIX Operating System:** Maurice J. Bach, Prentice-Hall.

REFERENCE BOOKS:

2. **UNIX Internals:** Steve D. Pate, Addison-Wesley.
3. **UNIX Operating System Source Code Level Six:** J. Lions, Department of Computer Science, The University of New South Wales.
4. **A commentary on the sixth edition UNIX Operating System:** J. Lions, Department of Computer Science, The University of New South Wales.
5. **Operating Systems – A Practical Approach:** Robert Switzer, Prentice-Hall (1993).
6. **A Practical Approach to Operating Systems:** Malcolm G. Lane, James D. Mooney, Boyd and Fraser Pub. co. (1998).
7. **Operating System Design: The XINU Approach:** Douglas Comer, Prentice Hall, 1st edition (1983).

INTRODUCTION TO DATA MINING (3:0:0)

Sub code : CS0325 **CIE : 50% Marks**

Hrs/week : 03 **SEE : 50% Marks**

SEE Hrs : 03 Hours **Max. Marks : 100**

Course Outcome

On successful completion of the course the students will be able to

1. Understand Data Mining concepts and applications of Data Mining Applications.
2. Discuss Data Preprocessing Techniques.
3. Understand Data Warehouse Implementation.
4. Acquire the knowledge of Data Cube Computation and Data Generalization
5. Acquire clear understanding of Mining Frequent Patterns, Associations, and Correlations
6. Apply the knowledge of Classification and Prediction in real world applications.

UNIT 1

Introduction to Data Mining:

Motivation and importance, What is Data Mining, Relational Databases, Data Warehouses, Transactional Databases, Advanced Database Systems and Advanced Database Applications, Data Mining Functionalities, Interestingness of a pattern Classification of Data Mining Systems.

***SLE**: Major issues in Data Mining.* **6 Hours**

UNIT 2

Data Preprocessing Why Pre-process the Data? Data Cleaning, Data Integration and Transformation Data Reduction, Discretization.

***SLE:** Concept Hierarchy Generation* **6 Hours**

UNIT 3

Data Warehouse and OLAP Technology for Data Mining What is a Data Warehouse? Multi-Dimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Development of Data Cube Technology.

***SLE**: Data Warehousing to Data Mining* **7 Hours**

UNIT 4

Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction—An Alternative Method for Data Generalization and Concept Description

SLE: *Class Description: Presentation of Both Characterization and Comparison*

6 Hours

UNIT 5

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and a Road Map, Efficient and Scalable Frequent Itemset Mining Methods, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis

SLE: *Metarule-Guided Mining of Association Rules*

7 Hours

UNIT 6

Classification and Prediction: What Is Classification? What Is Prediction? , Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Backpropagation, Support Vector Machines, Prediction, Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Model Selection

SLE: *Ensemble Methods*

7 Hours

TEXT BOOK

1. **Data Mining Concepts and Techniques**, Jiawei Han and MichelineKamber, Morgan Kaufman Publications

REFERENCE BOOKS

1. **Introduction to Data Mining**, Adriaan, Addison Wesley Publication

2. **Data Mining Techniques**, A.K.Pujari, University Press

OPERATION RESEARCH (3:0:0)

Sub Code : CS0311 **CIE : 50% Marks**

Hours/Week : 03 **SEE : 50% Marks**

SEE Hours : 03 Hours **Max. Marks : 100**

Course Outcomes:

1. Understand the need for Operation Research for problem solving and apply the same for linear programming model
2. Analyse and apply Simplex Method for problem solving
3. Understand the fundamental and foundation of Simplex Method.
4. Understand Duality Theory and apply the same for problem solving
5. Explore different application areas of Operation Research like Transportation and Assignment Problems
6. Use the knowledge of Operation Research in Game Theory and Decision Making

UNIT 1

Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation. **Introduction to Linear Programming:** Prototype example; The linear programming (LP) model,

SLE: *Assumptions of LP.* **7 hrs**

UNIT 2

Simplex Method - I: The essence of the simplex method; Setting up the simplex method; Algebra of the simplex method; the simplex method in tabular form.

SLE: *Tie breaking in the simplex method* **6 hrs**

UNIT 3

Simplex Method – I: Adapting to other model forms

Simplex Method – II: Foundation of simplex method, the revised simplex method, a fundamental insight

SLE: *Simplex method in Matrix form*

6 hrs

UNIT 4:

Duality Theory: The essence of duality theory; Economic interpretation of duality, Primal dual relationship; Adapting to other primal forms.

SLE: *SOB Method* **6 hrs**

UNIT 5

Transportation and Assignment Problems: The transportation problem, A streamlined simplex method for the transportation problem; The assignment problem.

SLE: *Travelling Salesmen Problem* **7 hrs**

UNIT 6

Game Theory: The formulation of two persons, zero sum games; Solving simple games- a prototype example; Games with mixed strategies. **Decision Analysis:** A prototype example; Decision making without experimentation. Decision making with experimentation

SLE: *Decision tree.* **7 hrs**

TEXT BOOK:

1. Frederick S. Hiller and Gerald J. Lieberman: I**ntroduction to Operations Research: Concepts and Cases**, 9th Edition, Tata McGraw Hill, 2010

REFERENCE BOOK:

1. Wayne L. Winston: **Operations Research Applications and Algorithms**, 4th Edition, Cengage Learning, 2003

EMBEDDED SYSTEMS (3:0:0)

Sub code	**: CS0331**	**CIE**	**: 50 %Marks**
Hrs / week	**: 03**	**SEE**	**: 50 %Marks**
SEE Hrs	**: 03 Hours**	**Max. Marks :**	**100**

Course Outcome

On successful completion of the course the students will be able to

1. Describe the fundamentals of Embedded Systems.

2. Develop necessary skills to understand and design an embedded system application.

3. Identify the challenges of Concurrent Process and its solutions.

4. Compare the advantages of the software Architectures and design an embedded system application using an RTOS.

5. Describe the inter task communication primitives like, semaphores and message queues. and design the hardware along with the choice of the RTOS for the application at hand.

6. Describe the Embedded Software Development Tools and Model the requirements of an application as a set of tasks.

UNIT 1

Custom single-purpose processor design; **RT-level custom single-purpose processor design**; **Optimizing custom single-purpose processors**: optimizing the FSMD, Optimizing the data-path, optimizing the FSM.

SLE : *Optimizing the Original Program.* **7 Hours**

UNIT 2

Timers, counters, and watchdog timers.

State machine models: Introduction; finite-state machines (FSM); Finite-state machines with data path model (FSMD); Using state machines: Describing a system as a state machine, Comparing state machine and sequential program models, Capturing a state machine model in a sequential programming language; Hierarchical/Concurrent state machine model (HCFSM) and the State charts language; Program state machine model (PSM);

SLE : *An introductory example,A basic state machine model.* **7 Hours**

UNIT 3

Concurrent process models: Concurrent processes: Process create and terminate, Process suspend and resume, Process join; Communication among processes: Shared memory, Message passing; Synchronization among processes: Condition variables, Monitors.

Interrupts: The Shared Data Problem.

SLE : *Interrupt Basics.*

7 Hours

UNIT 4

Survey of Software Architecture: Round Robin with Interrupts, Function Queue Scheduling Architecture; Real Time Operating System Architecture, Selecting architecture.

Introduction to RTOS: Tasks and Task States, Tasks and Data, Semaphores and shared data.

SLE: *Round Robin.* **7 Hours**

UNIT 5

Basic Design Using an RTOS: Overview, Principles, An Example, Encapsulating semaphores and Queues, Hard Real-Time Scheduling Considerations.

SLE*: Saving Power.* 6 **Hours**

UNIT 6

Embedded Software Development Tools: Host and Target Machines, Linker/Locator for Embedded Software, getting embedded software into the Target System

SLE: *Environment in which the program operates.* **5 Hours**

TEXT BOOKS

1. **Embedded System Design: A Unified Hardware/ Software Introduction** - Frank Vahid, Tony Givargis, John Wiley & Sons, Inc.2002

2. **An Embedded Software Primer** - David E. Simon: Pearson Education, 1999.

REFERENCE BOOKS

1. **Embedded C:** Michael J. Pont, Pearson Education (2002).

2. **Real-Time Systems and Programming Languages:** Alan Burns and Andy Wellings,

3. **Embedded Systems Building Blocks, Second Edition - Complete and Ready-to-Use Modules in C:** Jean J. Labrosse, CMP; 2nd edition (1999)

PERVASIVE COMPUTING (3:0:0)

Sub Code : CS0303	**CIE : 50% Marks**
Hours/Week : 03	**SEE : 50% Marks**
SEE Hours : 03 Hours	**Max. Marks : 100**

Course outcomes:

On successful completion of the course the students will be able to

1. Discuss the different applications that use pervasive computing and also compare the different device technology available.

2. Assess the different device connectivity using the protocols

3. Use the voice technology in the hand held devices

4. Design and demonstrate some applications using the programming languages

5. Create the user interfaces for a given application

6. Apply the concepts to PDA and to compare the connected devices

UNIT 1

Past, present, future: The vine and fig tree dream, Pervasive computing, the pervasive computing market, m-Business Conclusions and challenges. Email access via WAP and voice.

Device technology: Hardware, Human-machine interfaces, Biometrics, Operating systems,Java for pervasive devices

SLE: Application examples: *Airline check-in and booking,*

7 Hours

UNIT 2

Device connectivity: Protocols, Security, Device management. **WAP and beyond:** Introduction, Components of the WAP architecture, WAP infrastructure, WAP security issues, i-Mode SCCCC

SLE: *Wireless Markup Language, WAP push, Products*

7 Hours

UNIT 3

Voice technology: Basics of speech recognition, Voice standards Speech applications, Speech and pervasive computing, Security. **Personal digital assistants:** History, Device categories,.

SLE: *Personal digital assistant operating systems*

6 Hours

UNIT 4

Server-side programming in Java: Java 2 Enterprise Edition: overview, Servlets, Enterprise Java Beans, Java Server pages, Web services, Model-view-controller pattern

SLE: *Extensible Markup Language*

6 Hours

UNIT 5

Example application: Introduction, , Architecture, Implementation **Access from PCs**: Smart-card-based authentication via the Internet. Access via WAP: WAP functionality.

SLE: *User interfaces overview, implementation*

7 Hours

UNIT 6

Access from personal digital assistants: Extending the example application to personal digital assistants, Implementation for connected devices.

SLE: *Comparison of PDAs, connected devices and different implementations*

6 Hours

TEXT BOOK

1. **Pervasive Computing: Technology and Architecture of Mobile Internet Applications**, *JochenBurkhardt, Thomas Schaeck, Horst Henn, Stefan Hepper, Klaus Rindtorff, Pearson Education, April 2002.*

REFERENCE BOOK

1. **Pervasive Computing: the mobile world**, UweHansmann, springer, 2nd edition, 2003

PROTOCOL ENGINEERING (3:0:0)

Sub code	**: CS0327**	**CIE**	**: 50 %Marks**
Hrs / week	**: 03**	**SEE**	**: 50 %Marks**
SEE Hrs	**: 03 Hours**	**Max. Marks**	**: 100**

Course Outcomes

On successful completion of the course the students will be able to

1. Familiarize with the concept of protocols and their representation and discuss the phases of protocol engineering
2. Identify the components of protocol to be specified and to create formal specification of protocol using finite state machine
3. Design and develop SDL based specification of protocols
4. Apply different types of protocol verification and validation techniques
5. Compare different types of test sequence generation techniques and explain performance parameters
6. Discuss methods for interactive building of correct protocol specification and its implementation issues

UNIT 1

Introduction: Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation, Formal and Informal Protocol Development Methods, Protocol Engineering Phases

Network Reference Model: Layered Architecture, Network Services and Interfaces, Protocol Functions: Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols.

***SLE**: Informal representation of TCP protocol* 6 **Hours**

UNIT 2

Protocol Specification: Components of specification, Service specification, Communication Service Specification Protocol entity specification: Sender, Receiver and Channel specification, Interface specifications, Interactions, Multimedia specifications, Alternating Bit Protocol Specification..

***SLE**: RSVP specification* **6 Hours**

UNIT 3

Protocol Specification Language (SDL): Salient Features. Communication System Description using SDL, Structure of SDL Data types and communication paths. Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification, TCP protocol specification, SDL based platform for network, OSPF, Multi Protocol Label Switching.

***SLE**: BGP* **7 Hours**

UNIT 4

Protocol Verification / Validation: Protocol Verification using FSM, ABP Verification, protocol validation, Protocol Design Errors: Deadlocks, Unspecified Reception, Non-executable Interactions, State Ambiguities, Protocol Validation Approaches: Perturbation Technique, Reachability Analysis, Fair Reachability Graphs, SDL Based Protocol Verification: ABP Verification, SDL Based Protocol Validation: ABP Validation.

***SLE:** Process Algebra based Validation, Reachability Tree of a protocol*

6 Hours

UNIT 5

Protocol Conformance and Performance Testing: Conformance Testing Methodology and Framework, Local and Distributed Conformance Test Architectures, Test Sequence Generation Methods: T, U, D and W methods, Distributed Architecture by Local Methods, Synchronizable Test Sequence, Conformance Testing of RIP, Testing Multimedia Systems, quality of service test architecture (QOS).

***SLE:** Conformance testing with Tree and Tabular Combined Notation (TTCN)*

7 Hours

UNIT 6

Protocol performance testing: Performance Test methods, SDL Based Performance Testing of TCP, Interoperability testing, Scalability testing protocol.

Protocol Synthesis and Implementation: Synthesis methods, Interactive Synthesis Algorithm, Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis,

Requirements of Protocol Implementation, Objects Based Approach to Protocol Implementation, Protocol Compilers.

***SLE**: SDL based performance testing of OSPF* **7 Hours**

TEXT BOOK:

1. PallapaVenkataram and Sunilkumar S. Manvi: Communication Protocol Engineering, PHI, 2004.

REFERENCE BOOK:

1. Mohammed G. Gouda: Elements of Protocol Design, Wiley Student Edition, 2004.

ADHOC NETWORKS (3:0:0)

Sub code	**: CS0328**	**CIE**	**: 50 %**
Hrs / week	**: 03**	**SEE**	**: 50 %**
SEE Hrs	**: 03 Hours**	**Max. Marks**	**: 100**

Course Outcomes

On successful completion of the course the students will be able to

1. Identify the unique issues in ad-hoc wireless networks. Knowledge of the current technology trends for the implementation and deployment of Ad-hoc wireless networks.

2. Identify the challenges in designing MAC protocols for Ad-hoc networks and discuss the working of MAC protocols

3. Explain the challenges in designing Routing Protocols for Ad-hoc networks and discuss the working of Table-Driven Routing protocols

4. Explain the challenges in designing Routing Protocols for Ad-hoc networks and discuss the working of On-Demand Routing protocols

5. Describe the challenges in designing Transport Protocols for Ad-hoc networks and discuss the working of Transport protocols

6. Describe the challenges in designing Security Protocols for Ad-hoc networks and discuss the working of Security protocols

UNIT 1

INTRODUCTION: Cellular and Ad Hoc Wireless networks, Applications of Ad Hoc wireless networks; Issues in Ad hoc wireless networks: Medium Access Scheme, Routing, Multicasting, Transport Layer Protocols, Pricing Scheme, Quality of service positioning, Self-organization, Security, Addressing and Service Discovery, Energy Management, Scalability, Deployment Considerations;

SLE: *Ad hoc wireless Internet.* **7 Hours**

UNIT 2

MAC PROTOCOLS: MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad-hoc wireless Networks, Classification of MAC Protocols, Contention based protocols with reservation mechanisms: D-PRMA, CATA, SRMA/PA, FPRP, HRMA

SLE: *MACA/PR.* **7 Hours**

UNIT 3

ROUTING PROTOCOLS: Routing protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks, Classification of Routing Protocols. TABLE DRIVEN ROUTING PROTOCOLS**:** DSDV, WRP, CGSR

SLE: *STAR protocol* **6 Hours**

UNIT - 4

ROUTING PROTOCOLS- II: On-Demand Routing Protocols: Dynamic source Routing Protocol (DSR), AODV, TORA, LAR, ABR, and FORP.

SLE: *SSA protocol* **6 Hours**

UNIT - 5

TRANSPORT LAYER: Transport Layer Protocols for Ad-hoc wireless Networks: Introduction, Issues in Designing a Transport Layer Protocol for Ad-hoc wireless Networks, Design Goals of a Transport Layer Protocol for Ad hoc wireless Networks, Classification of Transport Layer Solutions, TCP over Ad-hoc wireless Networks: Feedback-Based TCP, TCP with Explicit Failure Notification, TCP-BUS, ,Split TCP.

SLE: *ATP* **7 Hours**

UNIT 6

SECURITY: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & Challenges in Security Provisioning, Network security Attacks, Key Management: Symmetric and Asymmetric key Algorithms, key Management Approaches, key management in Ad-hoc Wireless Networks: Secure routing in Ad hoc wireless Networks: Requirements, SAR protocol,

SLE: *ARAN*

6 Hours

TEXT BOOK

1. **Ad hoc Wireless Networks** – C. Siva Ram Murthy & B. S. Manoj, 2nd Edition, Pearson Education, 2005.

REFERENCE BOOKS

1. **Ad hoc Wireless Networks** – Ozan K. Tonguz and Gianguigi Ferrari, John Wiley, 2006.

2. **Ad hoc Wireless Networking –** Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic Publishers, 2004.

3. **Adhoc Mobile Wireless Networks -** C.K. Toh, Protocols and Systems, Prentice-Hall, 2002.

REAL TIME SYSTEMS (3:0:0)

Sub code	**: CS0317**	**CIE**	**: 50% Marks**
Hrs/week	**: 03**	**SEE**	**: 50% Marks**
SEE Hrs	**: 03 Hours**	**Max. Marks: 100**	

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Comparing Hard and Soft Real Time Systems.
2. Identifying temporal parameters of real time work load.
3. Analyze the fundamental problems of Real Time Systems.
4. Analyze the performances of the real time scheduling.
5. Distinguish between Fixed priority versus Dynamic priority algorithms.
6. Analyze the performances of various real time protocols.

UNIT 1

Hard Versus Soft Real-Time Systems: Jobs and Processors, Release Times, Deadline and Timing Constraints, Hard and Soft timing Constraints, Hard Real-Time Systems, Soft Real-Time Systems.

***SLE**: Application of RTS.* **7 Hours**

UNIT 2

A Reference model of Real-Time systems: Processors and Resources, Temporal Parameters of Real-Time Work load, Periodic task model, Precedence Constraints and Data dependency, other types dependencies.

***SLE**: Scheduling hierarchy, Functional parameters of resources.* **6 Hours**

UNIT 3

Approaches to Real-Time Scheduling: Clock-Driven approach, Weighted Round-Robin approach. Priority driven approach. Dynamic Versus Static Systems, Effective Release times and deadlines, optimality of the EDF and LST algorithms.

***SLE**: off-Line versus on-line scheduling, Non-Optimality of the EDF and LST algorithms.*

7 Hours

UNIT 4

Clock-driven Scheduling: Notations and assumptions, static, Timer-Driven Scheduler, General Structure Cyclic Schedulers Cyclic executives, Improving the average response time of a periodic jobs.

***SLE**: Scheduling Sporadic Jobs.* **6 Hours**

UNIT 5

Priority-Driven Scheduling of Periodic Tasks: Static assumption, Fixed Priority Versus Dynamic Priority algorithms, Maximum Scheduling utilization, Optimality of the RM and DM algorithms,

***SLE**: A schedulability test for fixed-Priority tasks with arbitrary response times.*

6 Hours

UNIT 6

Resources and Resources Access Control: Assumptions on resources and their usage, Effects of resources contention and resources access control Non preemptive critical section, Basic Priority – Ceiling Protocol, Stack-Based priority – Ceiling Protocol, Use of priority-ceiling protocol in Dynamic-Priority Systems, Preemption-Ceiling Protocol.

***SLE**: Real time protocol, Priority-Based Service Disciplines for switched Networks.*

7 Hours

TEXT BOOK

1. **Real Time Systems** – Jane W.S. Liu Pearson Education Asia, First Indian Reprint-2001.

REFERENCE BOOK

1. **Real Time Systems Design and Analysis:** An Engineer's Hand book Second Edition, Lapante.

ADVANCED JAVA (3:0:0)

Sub Code : CS0316	**CIE : 50% Marks**
Hours/Week : 03	**SEE : 50% Marks**
SEE Hours : 03 Hours	**Max. Marks : 100**

Course Outcome

On successful completion of the course the students will be able to

1. Demonstrate the usage of Applet class and its interfaces.
2. Illustrate the main event classes and interfaces used by the AWT along with Creation, management of windows, fonts, output text, and utilize graphics.
3. Discuss standard AWT controls and layout managers
4. Explain the flexibility of GUI components of Swing compare to AWT
5. Discuss building complex systems from software components using Beans and how servlets dynamically extend the functionality of a web server
6. Demonstrate JDBC connectivity to Databases

Unit-1

Applet: The Applet Class,Two Types of Applets, Applet Basics , The Applet Class, Applet Architecture , An Applet Skeleton, Applet Initialization and Termination , Overriding update( ) , Contents Simple Applet Display Methods . Requesting Repainting, A Simple Banner Applet, Using the Status Window ,The HTML APPLET Tag , Passing Parameters to Applets, Improving the Banner Applet , getDocumentBase( ) and getCodeBase( ),AppletContext and showDocument( ) ,Outputting to the Console.

SLE: *The Audio Clip Interface, TheAppletStub Interface* **6 hours**

Unit-2

Event handling in Java: Two Event Handling Mechanisms, The Delegation Event Model, Events classes, source of events, **events listener interfaces,** Using the Delegation Event Model, Adapter Classes.

Introduction to AWT: AWT classes, Windows Fundamental, Working With Frame Windows, Creating A Frame Window In An Applet, Creating A Windowed Program, Displaying Information With In A Window, Working With Graphics, Colors, Fonts, Setting The Paint Mode

SLE: *Inner Classes, Managing text output using FontMetric*

8 hours

Unit-3

Using AWT Controls, Layout Manager and Menus:Control Fundamentals, Labels, Using Buttons, Checkboxes, Checkbox Group, Choice Controls Using Lists, Managing Scroll Bars, Using Text field, Text area, Understanding Layout Managers, Menu bars And Menus, Dialog Boxes.

SLE: *File Dialog*

6 hours

Unit-4

Swing: Introduction To Swing, Origin Of Swing, Swing Is Built On The AWT, Two Key Swing Features, The MVC Connection, Components And Container, Swing Package, Event Handling, Create A Swing Applet, Painting.

Exploring Swing: Jlabel&Imageicon, Jtextfield, The Swing Buttons, Jtabbedpane, Jcrollpane, Jlist, Jcombobox,.

SLE: *trees, Jtable*

6 hours

Unit-5

JavaBeans: What Is JavaBeans, Advantages Of JavaBeans, Introspection, Bound And Constrained Properties, Persistence, Customizers, The API

Introducing Servlets: Background, Life cycle of Servlet, Using Tomcat, A simple Servlet program, API, javax.servlet package, handling HTTP Request and Response, using cookies

SLE: *Beans example, Session Tracking* **7 hours**

Unit-6

JDBC-connectivity to Database: Java Database Connectivity, Database Servers, Database Clients, JDBC (Java Database Connectivity), Working With Oracle Database, Working With MysqlDatabase, Stages in a JDBC Program, Registering The Driver, Connecting To A Database, Preparing SQL Statements, Using JDBC-ODBC , Bridge Driver to connect To Oracle Database, Retrieving Data From MysqlDatabase, retrieving Data From MS Access Database, Improving The Performance of a JDBC Program, Affectof Driver, Affectof Set fetchsize(), AffectOf Prepared statement, Stored Procedures and Callable statement, Types of Result Sets, Storing Images Into Database, Retrieving Images from Database, Storing a file into Database, Retrieving a File from the Database.

SLE: *Results metadata, Database metadata, Types of JDBC Drivers* **6 hours**

TEXT BOOKS

1. Java The Complete Reference, Herbert Schildt,9th Edition, Tata-McGraw-Hill,2014
2. Core JAVA An Integrated Approach, by Dr.R.NageswaraRao, Dreamtech Press,2008

BIG DATA ANALYTICS (3:0:0)

Sub code	**: CS0324**	**CIE**	**: 50 %**
Hours / week	**: 03**	**SEE**	**: 50 %**
SEE Hours	**: 3 Hours**	**Max. Marks**	**: 100**

Course Outcome

On successful completion of the course the students will be able to

1. Overview of Big Data and Related Technologies
2. Analyze Technologies for Handling Big Data and Hadoop Ecosystem
3. Acquire clear understanding of MapReduce Fundamentals and HBase
4. Acquire clear understanding of Virtualizing and Processing Data using MapReduce
5. Acquire a clear understanding of YARN and Mahout
6. Acquire a clear understanding of Hive

UNIT 1

Getting an Overview of Big Data

What is Big Data? , History of Data Management – Evolution of Big Data, Structuring Big Data, Types of Data, Elements of Big Data, Volume, Velocity, Variety ,Veracity ,Big Data Analytics, Advantages of Big Data Analytics, Use of Big Data in Social Networking, Use of Big Data in Preventing Fraudulent Activities, Use of Big Data in Retail Industry.

SLE: *Future of Big Data in Automation Industry*

6 hours

UNIT 2

Introducing Technologies for Handling Big Data and Hadoop Ecosystem

Distributed and Parallel Computing for Big Data, Introducing Hadoop, How does Hadoop Function?, Cloud Computing and Big Data, Features of Cloud Computing, Cloud Deployment Models, Cloud Delivery Models, Cloud Services for Big Data, Cloud Providers in Big Data Market, In-Memory Computing Technology for Big Data, Hadoop Ecosystem, Hadoop Distributed File System, HDFS Architecture, Features of HDFS, MapReduce, Features of MapReduce, HadoopYARN,IntroducingHBase, Combining HBase and HDFS.

SLE*:Sqoop, Flume* **6 hours**

UNIT 3

Understanding MapReduce Fundamentals and HBase

The MapReduce Framework, Exploring the Features of MapReduce, Working of MapReduce, Exploring Map and Reduce Functions, Techniques to Optimize MapReduce Jobs, Hardware/Network Topology,Synchronization, File System, Uses of MapReduce, Role of HBase in Big Data Processing, Characteristics of HBase

SLE *: Installation of HBase* **7 hours**

UNIT 4

Understanding Big Data Technology Foundations and Processing your Data with MapReduce

Exploring the Big Data Stack,Virtualization and Big Data, Virtualization Approaches, Developing a Simple MapReduce Application, Points to Consider while designing MapReduce.

***SLE**: Managing Virtualization with Hypervisor*

6 hours

UNIT 5

Understanding Hadoop YARN Architecture and Mahout

Background of YARN, YARN Architecture, Working of YARN, YARN Schedulers, Backward Compatibility with YARN, YARN Configurations, YARN Commands,What is Mahout?, Machine Learning, Collaborative Filtering, Clustering, Classification, Mahout Algorithms, Environment for Mahout.

***SLE**: YARN Containers*

7 hours

UNIT 6

Exploring Hive

Introducing Hive, Hive Services, Data Types in Hive, Built-In Functions in Hive, Hive DDL, Data Manipulation in Hive, Data Retrieval in Hive, Using Joins in Hive.

***SLE:** Getting Started with Hive Installation* **7 hours**

TEXTBOOK:

1. **Big Data: Black Book,** DT Editorial Services, Wiley India Pvt Ltd, 2015 Edition

REFERENCE BOOKS:

1. Big Data Analytics with R and Hadoop, VigneshPrajapati, -Packt Publishing 2013
2. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1st Edition, AmbigaDhiraj, Wiely CIO Series, 2013.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in HugeData Streams with Advanced Analytics", 1st Edition, Wiley and SAS BusinessSeries, 2012.
4. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.
5. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data EMC Education Services, Wiley India Pvt Ltd

WEB PROGRAMMING (3:0:0)

Sub code : CS0314 **CIE : 50% Marks**

Hrs/ Week : 03 **SEE : 50% Marks**

SEE Hrs : 03 Hours **Max. Marks:50**

Course Outcome

On successful completion of the course the students will be able to

1. Prepare Web pages using HTML/XHTML
2. Illustrate the application of CSS to the web pages
3. Explain the concepts and constructs of JavaScript
4. Demonstrate events handling in JavaScript
5. Create dynamic web pages using JavaScript
6. Discuss the characteristics and syntactic structure of XML document

Unit-1

Fundamentals: Introduction To The Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol, The Web Programmer's Toolbox.

Introduction To XHTML: Origin And Evolution Of HTML And HTML, Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames,.

SLE: *Syntactic Differences between HTML And XHTML* **7 hours**

UNIT-2

Cascading Style Sheets: Introduction, Levels Of Style Sheets, Style Specification Formats, Selector Forms, Property Value Forms, Font Properties, List Properties, Color, The Box Model, Background Images, The <Span> And <Div> Tags, Conflict Resolution.

SLE: *Alignment of text, conflict resolution*

6 hours

Unit-3

The Basics Of JavaScript: Overview Of JavaScript, Object Orientation And JavaScript, General Syntactic Characteristics, Primitives, Operations And Expressions, Screen Output And Keyboard Input, Control Statements, Object Creation And Modification, Arrays, Functions, An Example, Constructors, Pattern Matching using Regular Expressions, Another Example.

SLE: *Errors in Scripts.*

6 marks

Unit-4

JavaScript and XHTML Documents: The JavaScript Execution Environment, the Document Object Model, Element Access in JavaScript, Events and Event handling, Handling Events from Body Elements, Handling events from Button elements, DOM 2 Event Model, The Navigator object

SLE: *Handling Events from Text Box and Password Elements**,** DOM tree Traversal and Modification.*

7hours

Unit-5

Dynamic Document with Javascript: Introduction, Positioning Elements, Moving Elements, Elements, Element Visibility, Changing Colors And Fonts, Dynamic Contents, Stacking Elements, Locating The Mouse Cursors, Reacting To A Mouse Click.

SLE: *Slow Movement of Elements* **6 hours**

Unit-6

Introduction To XML: Introduction, The Syntax Of XML, XML Document Structure, Document Type Definitions, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents With CSS, XSLT Style Sheets,.

SLE: *Dragging and Dropping Elements, XML Processors, Web Services* **7 hours**

TEXT BOOK

1. Robert W. Sebesta : Programming the World Wide Web, 4th Edition, Pearson Education

WIRELESS AND MOBILE NETWORKS (3:0:0)

Sub code: CS0330 **CIE: 50%**
Hrs/ week: 03 **SEE : 50%**
SEE Hrs: 3 Hours **Max Marks : 100**

Course Outcome:

On successful completion of the course the students will be able to

1. Identify and comparison the various mobile technological standards.
2. Describe the basic concepts of mobility and handoff management strategies.
3. Analyze the architecture, call set up procedure and services provided by GSM.
4. Gain knowledge about how number portability can be achieved in both fixed and mobile networks.
5. Understand and analyse the architectures of both GPRS and CDPD in detail.
6. Discuss the various aspects of Unlicensed Mobile Access.

UNIT 1

Introduction to Wireless Communication Systems &Networking: Evolution of Mobile Radio Communication, , examples of Wireless Communication Systems, Cellular Telephone Systems, Principle of Cellular Communication, Comparison of Common Wireless Communications Systems Overview and comparison of , 1G, 2G, 2.5G and 3G and 3.5G

SLE: *4G technologies* **5 Hours**

UNIT 2

Mobility and Handoff management: Handoff, Roaming management, Roaming management under SS7, Strategies for handoff detection, MAHO NCHO, MCHO, channel assignment, radio link transfer, hard handoff

SLE: *Soft handoff* **7 Hours**

UNIT 3:

GSM: GSM architecture, Location tracking and call setup, security, Data Services- HSCSD, GPRS, Unstructured supplementary Service Data, SMS Architecture, SMS Protocol Hierarchy , International GSM Call Setup

SLE: *Reducing the International Call Delivery cost* **7 Hours**

UNIT 4:

Number portability, SRF and challenges: Fixed –network number portability, Number Portability for mobile networks, Mobile Number Portability Mechanisms- SRA-1,SRA-2, ACQ-1.

***SLE**: ACQ-2* **6 Hours**

UNIT 5:

GPRS and CDPD: GPRS Functional Groups, GPRS Architecture, GPRS Network Nodes, GPRS Interfaces Um Interface, CDPD Architecture, CDPD Air Interface, Radio Resource Allocation, Roaming management.

***SLE:** Evolving from GSM to GPRS, Roaming management.*

7 Hours

UNIT 6:

Unlicensed Mobile Access: Introduction **to** UMA**,** Architecture of UMAMobile, Protocols in UMA, Security Mechanism of UMA,Identifiers and Cell Identifiers in UMA, ,UMAN Discovery AND Registration Procedures.

***SLE:** Up interface in UMA, Mode and PLMN Selection* **7 Hours**

TEXT BOOKS:

1. Yi Bing Lin, "***Wireless and Mobile Networks Architecture***", John Wiley, Oct 2, 2008

2. Ajay R. Mishra "***Cellular Technologies for Emerging Markets: 2G, 3G and Beyond",***

Wiley; 1 edition (August 30, 2010)

REFERENCE BOOKS:

1.Raj Kamal, "***Mobile Computing***",Oxford University Press, 2nd edition, September 2012

2. **Wireless Communications, Principles and Practice, second edition,**, Theodore S Rappaport, Pearson Education Asia,2002.

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WIRELESS COMMUNICATION NETWORKS (3:0:0)

Sub code : CS0305 **CIE: 50%**

Hrs/ week :03 **SEE :50%**

SEE Hrs : 3 Hours **Max Marks : 100**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Describe the evolution of wireless communication and early growth of cellular radio around the world.
2. Outline an overview of the major wireless communication systems of 21'st century.
3. Illustrates the fundamental cellular radio concepts, such as frequency reuse, handoff and interference issues.
4. Analyze different ways to model and predict the large scale effects of radio propagation in different operating environments.
5. Explains the most common analog and digital modulation techniques used in wireless communication along with its tradeoffs.
6. Evaluate the Multiple Access Techniques for Wireless Communications, so as to accommodate large number of users and impact the system capacity and infrastructure of cellular systems.

UNIT 1

Introduction to Wireless Communication Systems & Networking: Evolution of Mobile Radio Communication, examples of Wireless Communication Systems, Cordless Telephone System. Cellular Telephone Systems,

SLE: *Comparison of Common Wireless Communications Systems.*

6 Hours

UNIT 2

Modern Wireless Communications Systems: Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks.

SLE: *Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS).*

5 Hours

UNIT 3

The Cellular Concept: System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations. Interference and system capacity, co-channel interference and system capacity, Channel planning for wireless systems.

SLE: *Adjacent channel interference power control for reducing interference.*

7 Hours

UNIT 4

Mobile Radio Propagation: Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection.

SLE: *diffraction and scattering*

7 Hours

UNIT 5

Modulation Techniques for Mobile Radio: Linear Modulation techniques – Binary phases shift keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Constant envelope modulation – Binary Frequency Shift Keying, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK).

SLE: *Frequency modulation Vs amplitude modulation, Amplitude modulation, Angle modulation, Digital Modulation.*

7 Hours

UNIT 6

Multiple Access Techniques for Wireless Communications:

Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum, Multiple Access, Space Division Multiple Access (SDMA), Packet Radio. Protocols.

Wireless Networking.

Introduction to Wireless Networks. Differences Between Wireless and Fixed Telephone Networks. Development of Wireless Networks.

SLE: *Reservation Protocols–Reservation ALOHA, Packet Reservation Multiple Access (PRMA), Capacity of cellular systems.*

7 Hours

TEXT BOOKS

1. **Wireless Communications, Principles and Practice, second edition,**, Theodore S Rappaport, Pearson Education Asia,2002.

REFERENCE BOOKS

1. **Mobile Communications Engineering Theory and Applications, Second Edition**, William C Y Lee McGraw Hill Telecommunications 1998.

2. **Wireless Communications and Networks,** William Stallings Pearson Education Asia, 2002.

PARALLEL ALGORITHMS (3:0:0)

Sub code	**: CS0306**	**CIE**	**: 50 %Marks**
Hrs / week	**: 03**	**SEE**	**: 50 %Marks**
SEE Hrs	**: 03 Hours**	**Max. Marks**	**: 100**

Course Outcome:

On successful completion of the course the students will be able to

1. Compute models such as RAM, PRAM were discussed.
2. Discuss parallel algorithms for well-known problems such as prefix computation, max sum subsequence, array packing.
3. Discuss pointer jumping and divide conquer techniques for parallel programming with examples such as list ranking, merge sort.
4. Discuss parallel algorithms for geometrical problems such as convex hull, All nearest neighbour.
5. Explain graph theory classic problems such as Euler tour, finding connected components, shortest path were explained and parallel solutions.
6. Explain Number theory problems such as primarily test, GCD and numerical problems such as approximation of Taylor series.

UNIT 1

Models of Computation: RAM (Random Access Machine),PRAM (Parallel Random Access Machine),Fundamental Terminology Interconnection Networks.

SLE: *Additional Terminology.*

7 Hours

UNIT 2

Parallel Prefix: Parallel Prefix, Application: Maximum Sum Subsequence, Array Packing.

SLE: *Computing Overlapping Line Segments.*

6 Hours

UNIT 3

Pointer Jumping and divide and Conquer: List Ranking Linked List Parallel Prefix , Merge Sort (Revisited) Selection.

SLE: *Modifications of Quick Sort for Parallel Models.*

6 Hours

UNIT 4

Computational Geometry: Convex Hull, Smallest Enclosing Box, Architecture-Independent Algorithm.

SLE: *All-Nearest Neighbour Problem*

7 Hours

UNIT 5

Graph Algorithms: Fundamental PRAM Graph Techniques, List Ranking via Pointer Jumping, Euler Tour Technique, Tree Contraction.

SLE: *Shortest-Path Problems RAM, PRAM and Mesh.*

6 Hours

UNIT 6

Numerical Problems: Primality, Greatest Common Divisor, Lame's Theorem , Integral Powers, Approximation by Taylor Series.

SLE: *Evaluating a Polynomial.*

7 Hours

TEXT BOOK

1. Algorithms Sequential and Parallel: A Unified Approach, Second Edition,2005, By: RussMiller; Laurence Boxer, Course Technology PTR.

REFERENCE BOOKS

1. **Introduction to Parallel Algorithms,** Joseph JaJa, University of Maryland, Addison-Wesley Professional.
2. **Parallel Algorithms (Hardcover)** by Henri Casanova , Arnaud Legrand, Yves Robert,Publisher: Taylor & Francis /b S Publication (Jul 2008)

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