ESTD : 1946

THE NATIONAL INSTITUTE OF ENGINEERING

MYSORE – 8

(Autonomous Institution under VTU)

Bachelor of Engineering

Scheme of VII Semester

B.E (Computer Science and Engineering)

Department of Computer Science and Engineering

SCHEME OF TEACHING AND EXAMINATION
VII SEMESTER

Sl.No.	Subject Code	Subject	Category	L	T	P	Cr.
1	CS7C01	Cloud Computing	Core	3	2	0	4
2	CS7C02	Object Oriented Modeling and Design	Core	3	2	0	4
3	CS7E2XX	Dept. Elective - 2	Elective	3	0	0	3
3	CS7E3XX	Dept. Elective - 3	Elective	3	0	0	3
4	CS7E4XX	Dept. Elective - 4 (2 Cr)	Elective	2	0	0	2
5	CS7IXX	Industry driven elective	Elective	2	0	0	2
6	CS7OXX	Open Elective	Elective	2	0	0	2
7	CS7C03	Seminar/ Paper presentation	Seminar	0	0	2	1
8	CS7C04	Project Work Phase – 1	Project	0	0	2	1
10	CS7C15	Competency Training	Training	-	-	-	0
	Total Credits						**22**
	Total Contact Hrs						**26**

Dept. Electives II (CS7E2XX)			
Sl. No.	**Subject code**	**Subject**	**L:T:P**
1	CS7E201	Real Time Systems	3:0:0
2	CS7E206	Cyber Security	3:0:0
3	CS7E203	Embedded Systems	3:0:0
4	CS7E204	Operation Research	3:0:0
5	CS7E205	Advanced Algorithms	3:0:0

Dept. Electives III (CS7E3XX)			
Sl. No.	**Subject code**	**Subject**	**L:T:P**
1	CS7E305	Software Project Management	3:0:0
2	CS7E306	Introduction to Blockchain Technology	3:0:0
3	CS7E303	Introduction to Data Mining	3:0:0
4	CS7E304	Advanced Java	3:0:0
Dept. Electives IV (2 Credits) (CS7E4XX)			
Sl. No.	**Subject code**	**Subject**	**L:T:P**
1	CS7E405	Software Testing	2:0:0
2	CS7E406	UI & UX	2:0:0
3	CS7E407	Research Methodology	2:0:0
4	CS7E408	Web Commerce	2:0:0
Industry Driven Elective (2 Credits) (CS7I01)			
Sl. No.	**Subject code**	**Subject**	**L:T:P**
1	CS7I01	Cyber Security	2:0:0

Open Electives (2 Credits) (CS7OXX)			
Sl. No.	**Subject code**	**Subject**	**L:T:P**
1	CS7O01	Introduction to Big Data Analytics	2:0:0
2	CS7O02	Introduction to Data Mining	2:0:0
3	CS7O03	Introduction to Python Programming	2:0:0

VII SEMESTER

CLOUD COMPUTING (3:2:0)

Sub code: CS7C01   **CIE**   **: 50%**

Hrs/week: 05   **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.

MODULE 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: Scalable computing over the Internet, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds.

SLE: Energy Efficiency in Distributed computing

7 Hours

MODULE 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: MOSIX: An OS for Linux clusters and cloud

7 Hours

MODULE 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.   **7 Hours**

MODULE 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.

SLE: Public cloud platforms: Azure, Extended cloud computing services

9 Hours

MODULE 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**

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) 2013, 1st Edition.

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, Christopher Barnatt.

OBJECT ORIENTED MODELING AND DESIGN (3:2:0)

Sub code: CS7C02   **CIE : 50%**

Hrs/week: 05   **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 the importance of Classes, Objects and their relationships.
2. Identify proper classification technique and apply suitable modeling notations.
3. Make use of suitable modeling notations to solve problems.
4. Explain the process mechanisms of software development life cycle.
5. Apply object-oriented techniques to solve real-world applications and study Patterns, idioms.

MODULE 1:

The Object Model: The Foundations of the Object Model, Elements of the Object Model, Applying the Object Model.

Classes and Objects: The Nature of an Object, Relationships among Objects, The Nature of a Class, Relationships among Classes, The Interplay of Classes and Objects, On Building Quality Classes and Objects.

SLE: The Inherent Complexity of Software, the Five Attributes of a Complex System

6 Hours

MODULE 2:

Classification Method: The importance of proper classification,

The unified modeling Language: Diagram Taxonomy,

Structure Diagrams: Class diagrams, Package Diagrams, component Diagrams, Deployment Diagrams, Object Diagrams.

SLE: Key Abstraction Mechanisms, Composite structure Diagram.   **9 Hours**

MODULE 3:

Method: The Unified Modeling Language - Behavior Diagrams: Use Case Diagrams Activity Diagrams State Machine Diagrams.

Interaction Diagrams: Sequence Diagrams, Timing Diagrams, Interaction Overview Diagrams.

SLE: Communication Diagrams.   **9 Hours**

MODULE 4:

Process: First Principles, The Macro Process: The Software development Life cycle, The macro process content Dimension Disciplines, The Micro Process: The Analysis and Design Process: Levels of Abstraction.

Pragmatics: Management and Planning, Staffing, Release Management, Reuse.

SLE: The Micro Process Time Dimension Milestones and phases.   **7 Hours**

MODULE 5:

Control System-Traffic Management: Inception, Elaboration, Construction.

Patterns: What is a pattern and what makes a pattern? Pattern categories: Relationships between patterns, Pattern description. Communication Patterns: Forwarder-Receiver.

SLE: The Benefits and Risks of Object-Oriented Development, Idioms: Introduction, what can idioms provide?, Where to find idioms?

                                                                                   8 Hours

TEXT BOOKS:

1. Object-Oriented Analysis and Design with Applications, Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, KelliA.Houston,3rdEdition, Pearson,2007. (Chapters1,2,3,4,5,6,7,9)
2. Pattern-Oriented Software Architecture, A System of Patterns, Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Volume 1, John Wiley and Sons, 2006.

REFERENCE BOOKS:

1. Object-Oriented Systems Analysis and Design Using UML, Simon Bennett, Steve Mc Rob band Ray Farmer,2ndEdition, TataMcGraw-Hill,2002.
2. Object-Oriented Modeling and Design with UML, Michael Blaha, amesRumbaugh,2ndEdition, PearsonEducation,2005.
3. Object-Oriented Analysis, Design, and Implementation, Brahma Dathan, Sarnath Ramnath, UniversitiesPress,2009.
4. UML 2 Toolkit, Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, Wiley DreamtechIndia,2004.

INDUSTRY DRIVEN ELECTIVE

(CYBER SECURITY) (2:0:0)

Sub Code:	CS7I01	CIE:	50%
Hrs/ Week:	02	SEE:	50%
SEE Hrs:	02 Hours	Max. Marks: 100	

Course Outcomes:

On successful completion of the course, student will be able to:

1. Explain the need of cyber security and different tools used to provide cyber security in corporate environment.
2. Demonstrate detailed knowledge about Different types of Attacks, Security awareness and Risk Management.
3. Demonstrate Hacking into systems and web applications.

MODULE 1:

Introduction: What is cybersecurity?, Scope of Cybersecurity, Different Domains in Cybersecurity, Networking Concepts

Cloud: Introduction to cloud,Difference between on-prem and cloud, Why is everyone moving to the cloud?, Why Cloud is more secure. CIA Triad: What is Confidentiality?, What is Integrity?,What is Confidentiality?, How Security depends on CIA.

Different Tools used in Cybersecurity: SIEM, IPS/IDS , DLP, CASB , MDR, Antivirus, DNS Filtering, Containment , Secure Email Gateway , Application Firewall , DDOS protect , Vulnerability Scanning tools , Pen testing tools.

8 Hours

MODULE 2:

Different types of Attacks: The mindset of the Threat actor, Network Attacks, Network Best practices to reduce the risk of compromise, Application Attacks, How Security Tools can prevent cyber-attacks?

Security Awareness: Juice Jacking, Ransomware, Password reuse, Multifactor, Malvertising, Googlian Attack,   Keystroke logger, Malicious email attachment, Password spraying, Physical security, SIM card hijacking, Fake Wi-Fi, Phishing, Smishing, Clean Desk, Call Spoofing, Catfishing, Email misdelivery, Telephone spoofing, Water Hole attack, Website spoofing.

Risk Management: What is Risk?, What is likelihood?, What is Vulnerability?, How to calculate risk? Gap Analysis, How to conduct risk assessment? Encryption and Hashing.

8 Hours

MODULE 3:

Vulnerability and Pentest: Difference between Vulnerability Scanning and Pentest,Steps involved in hacking, Practical examples of each steps involved in hacking, Practical examples of how to conduct Vulnerability assessments using the following tools: Nmap, Nikto, Dirbuster, Metasploit, Other tools on Kali Linux, Enterprise tools, how to download and run Nessus to conduct Vulnerability Scan, Practical example of a Pentest using Kali Linux.

Policy, Procedure, Standards and Guidelines: Introduction, Usage to make company more secure, Practical examples on how to create different types of policies used by Corporate companies, Incident Response, Business Continuity Planning, Identity Management and Authentication, Different Compliances.

10 Hours

TEXT BOOKS & REFERENCES:

1. (ISC)2 CISSP® Certified Information Systems Security Professional Official Study Guide,Mike Chapple, James Michael Stewart,Darril Gibson, Eighth Edition, Wiley 2018.

2. CEHTM v10 Certified Ethical Hacker, Study Guide,Ric Messier, Wiley 2019.

3. CompTIA® Security+® Review Guide, James Michael Stewart, Fourth Edition, Wiley 2018.

SEMINAR/PAPER PRESENTATION (0:0:2)

Sub Code: **CS7C03**

Hrs/ Week: **02**   **Max. Marks: 50**

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. 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 WORK PHASE - I (0:0:2)

Sub Code: **CS7C04**   **CIE : 50**

Hrs/ Week: **04**

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.

COMPETENCY TRAINING

Sub Code: CS7C15

DEPARTMENT ELECTIVES – II (CS7E2XX)
REAL TIME SYSTEMS (3:0:0)

Sub Code:	CS7E201	**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. Differentiate between Hard and Soft Real Time Systems.

2. Identify temporal parameters of real time work load.

3. Analyze the fundamental problems of Real Time Systems.

4. Demonstrate the use of real time scheduling, to enhance response time.

5. Distinguish between Fixed priority versus Dynamic priority algorithms.

MODULE 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.   **8 Hours**

MODULE 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.   **8 Hours**

MODULE 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.

                                                                                                8 Hours

MODULE 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.   **7 Hours**

MODULE 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.

                                                                                             8 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.

CYBER SECURITY (3:0:0)

Sub Code: : CS7E206   CIE   :   50% Marks

Hrs/Week   : 03   SEE   :   50% Marks

SEE Hrs   : 03   Max Marks   : 100

Course Outcomes:

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

1. Describe the legal perspective of cybercrime and its classifications.
2. Differentiate between various types of cyber attacks.
3. Analyze the implications of security challenges faced by use of mobile devices in an organization.
4. Distinguish the different tools and methods used in cybercrime.
5. Discuss the impact of Phishing.

MODULE 1:

Introduction: Introduction to cybercrime, Cybercrime and information security, who are Cybercriminals, Classification of Cybercrimes, Cybercrime: The Legal Perspectives, An Indian Perspective, Cybercrime and the Indian ITA 2000,A global perspective on cybercrimes.

SLE: Cybercrime era: Survival mantra for the citizens.   **8 Hours**

MODULE 2:

Cyber offenses: Introduction, How criminal plan the attacks, Social engineering, Cyber stalking, Cybercafe and cybercrimes, Botnets: The fuel for cybercrime, Attack vector

SLE: Cloud Computing.   **8 Hours**

MODULE 3:

Cyber crime: Mobile and Wireless devices Introduction, Proliferation of mobile and wireless devices, Trends in mobility, Security challenges posed by mobile devices, Registry setting for mobile devices, Authentication service security, Attacks on mobile/ cell phones, Mobile devices: security implications for organizations, Organization measures for handling mobile, Organizational security policies.

SLE: Measures in mobile computing era, Laptops.   **8 Hours**

MODULE 4:

Tools and method used in Cybercrime: Introduction, Proxy servers and anonymizers, Phishing, Password cracking, Key loggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL injection, Buffer overflow

SLE: Attacks on wireless networks.   **8 Hours**

MODULE 5:

Phishing and identity theft: Introduction, Phishing

SLE: Identity theft (id theft).   **7 Hours**

TEXT BOOK:

1. Cyber Security by Nina Godbole, Belapure, Wiley India, 1st edition copyright 2011, reprint 2013.

REFERENCE BOOK:

1. Computer Forensics and Cyber Crime An Introduction by Marjie T. Britz ,Pearson publication, 3rd edition, 2013. EBOOK:

2. Introduction to computer Networks and cybersecurity by chwan-Hwa, David Irwin, CRC Press, 2013.

EMBEDDED SYSTEMS (3:0:0)

Sub Code:	**CS7E203**	**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. 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, Embedded Software Development Tools and design the hardware along with the choice of the RTOS for the application at hand.

MODULE 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.

Timers, counters, and watchdog timers.

SLE : Optimizing the Original Program. **8 Hours**

MODULE 2:

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**

MODULE 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. **8 Hours**

MODULE 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. **8 Hours**

MODULE 5:

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

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

SLE: Saving Power. **8 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)

OPERATION RESEARCH (3:0:0)

Sub Code : CS7E204   **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. Understand the need for Operation Research for problem solving and apply the same for linear programming model
2. Analyze and apply Simplex Method for problem solving
3. Apply Simplex Method to other Model forms
4. Translate primal to dual form and solve the problem
5. Formulate the use of assignment, transportation and game theory methods, to solve real world application.

MODULE 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.   **8 Hours**

MODULE 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   **7 Hours**

MODULE 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   **8 Hours**

MODULE 4:

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

SLE: SOB Method   **8 Hours**

MODULE 5:

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

Game Theory: The formulation of two persons, zero sum games; Solving simple games- a prototype example; Games with mixed strategies

SLE: Travelling Salesmen Problem   **8 Hours**

TEXT BOOK:

1. Frederick S. Hiller and Gerald J. Lieberman: Introduction 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
2. Hamdy A.Taha : Operations Research An Introduction, 10th Edition, Pearson

ADVANCED ALGORITHMS (3:0:0)

Sub Code:	**CS7E205**	**CIE:**	**50%**
Hrs/ Week:	**03**	**SEE:**	**50%**
SEE Hrs:	**03 Hours**	**Max. Marks: 100**	

Prerequisite: Analysis and Design of Algorithms.

Course Outcomes:

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

1. Describe Hashing Technique and Red Black Trees
2. Design algorithm using Dynamic programming and Greedy
3. Compare different algorithms fusing Amortized Analysis
4. Describe B trees and Fibonacci heaps
5. Interpret max flow and multi-threaded algorithm

MODULE 1:

Hash tables: Direct-address tables, Hash tables, Hash functions, Open addressing, Perfect hashing Red Black **Trees:** Properties, Rotations

SLE: Hash Search and Deletion of Red Black Trees.   **9 Hours**

MODULE 2:

Dynamic Programming: Rod Cutting, Travelling Sales person Problem, Optimal binary search trees Greedy Algorithms: Activity selection problem, Huffman codes

SLE: A task scheduling problem as a matroid.   **10 Hours**

MODULE 3:

Amortized Analysis: Aggregate analysis, The Accounting method, Potential Method.

Single Source Shortest paths: The Bellman-Ford algorithm, Single source shortest paths in a DAG.

SLE: Floyd-Warshall algorithm.   **7 Hours**

MODULE 4:

B-trees: Introduction, Definition of B-trees, Basic operations of B-trees.

Fibonacci Heaps: Introduction, Structure of Fibonacci heaps, Mergeable-heap operations.

SLE: Deleting a key from a B-tree.   **7 Hours**

MODULE 5:

Maximum Flow: Introduction, Flow networks, the Ford-Fulkerson method, Maximum bipartite matching, push reliable algorithms: basic operations, push operation reliable operation, the generic algorithm.

SLE: The Relabel-to-front algorithm.   **6 Hours**

TEXT BOOK:

1. Introduction to Algorithms –Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein PHI, 3rd Edition.

REFERENCE BOOKS:

1. Computer Algorithms - Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Science Press, 1998
2. The Design and Analysis of Computer Algorithms- Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Addison Wesley, 1974

SOFTWARE PROJECT MANAGEMENT (3:0:0)

Sub code: CS7E305	**CIE**	**: 50%**
Hrs/ week: 03	**SEE**	**: 50%**
SEE Hrs: 3 Hours	**Max Marks**	**: 100**

Prerequisites:

Knowledge of Software Engineering and basic Programming.

Course Outcomes:

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

1. Describe the roles and responsibilities by PM process group (initiating, planning, and executing controlling, closing).
2. Articulate the purpose and benefits of project management (PM).
3. Explain quality management and process improvement in the context of software development projects.
4. Acquire knowledge to work with a team to analyze a project and implement a solution.
5. Understand how projects are managed and implemented in real time scenario.

MODULE 1:

Introduction to Software Project Management : Introduction, Why is Software Project Management Important? What is a Project? Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Project Evaluation and Programme Management, Overview of Project Planning.

SLE: Some ways of categorizing Software Projects   **8 Hours**

MODULE 2:

Software Development Methodologies: The old way and the new: The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process. Life cycle phases. Software Effort Estimation, introduction, Where are the Estimates Done? Problems with Over- and Under-Estimates, the Basis for Software Estimating, Software Effort Estimation Techniques.

SLE: The problems with over and Under-Estimates   **8 Hours**

MODULE 3:

Activity Planning: Introduction, Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Risk Assessment - Introduction, Risk, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Resource Allocation - Nature of Resources, Identifying Resource Requirements, Scheduling Resources

SLE: Categories of Risk   **8 Hours**

MODULE 4:

Flows of the process: Software process workflows, Inter-trans workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. Interactive process Planning: Work breakdown structures, planning guidelines, Interaction planning process, Pragmatic planning. Managing People.

SLE: The Oldham-Hackman job Characteristics Model   **8 Hours**

MODULE 5:

Managing Teams : Introduction, Becoming a Team, Decision Making, Organization and Team Structures; Software Quality: Introduction, The Place of Software Quality in Project Planning, Importance of Software Quality, Defining Software Quality, Software Quality Models, ISO 9126, Product and Process Metrics, Closure of Projects - Introduction, Reasons for Project Closure, Project Closure Process; Process Automation: Automation Building Block

SLE: Defining Software Quality.   **7 Hours**

TEXT BOOKS:

1. Bob Hughes, Mike Cotterel, Rajib Mall: Software Project Management, Sixth Edition; McGraw Hill, 2016.

REFERENCE BOOKS:

1. Walker Royce: Software Project Management, Pearson Education, 2015.

INTRODUCTION TO BLOCKCHAIN TECHNOLOGY (3:0:0)

Sub Code:	CS7E306	**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. Describe the functional/operational aspects of the Blockchain ecosystem.
2. Identify the cryptographic primitives behind Blockchain.
3. Compare the consensus algorithm used in Blockchain technology.
4. Analyze bitcoin mining and forking.
5. Describe the functional/operational aspects of Ethereum and Hyperledger Blockchain platforms.

MODULE 1:

Introduction To Blockchain: History of Bitcoin and Blockchain, Digital Ledger Technology (DLT), Peer-to-Peer (P2P) Network, Centralized, Decentralized and Distributed Networks, Public Blockchain, Private Blockchain.

SLE: Tiers of Blockchain Technology **7 Hours**

MODULE 2:

Blockchain Security: Cryptographic Hash Functions – Cryptographic Nonce, Transactions, Asymmetric Key Cryptography, Address and Address Derivation – Private Key Storage, Ledgers, Blocks, Chaining Blocks, Zero Knowledge System, Attacks – 51% attack, Sybill attack.

SLE: Distributed Hash Tables **8 Hours**

MODULE 3:

Consensus Algorithms: Proof of Work Consensus Algorithm, Proof of Stake Consensus

Algorithm, Delegated Proof of Stake (DPoS), Proof of Burn, Practical Byzantine Fault tolerance.

SLE: Proof of Elapsed Time Consensus Algorithm **8 Hours**

MODULE 4:

Blockchain Mining And Forking: Permission, Permission less, Forking – Soft forking, Hard Forking, Cryptographic changes forking, Merkle Tree, Bitcoin Mining, Mining Incentives Strategies. Bitcoin Cryptocurrencies - Double Spending problem and its avoidance in Blockchain.

SLE: Patricia tree

8 Hours

MODULE 5:

Blockchain Platforms: Ethereum Platform – Transactions in Ethereum – Ether wallet, Ether Accounts, Ether Gas, Gas Price, Gas Limit, Ether Tokens – ERC20 ethereum stands for Tokens, Mining in Ethereum and Awards, Smart Contract. Hyperledger Platform – Hyperledger Fabric Architecture, Membership services, Blockchain services.

SLE: ERC721 tokens   **8 Hours**

TEXT BOOK:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. 19th ,July 2016

2. Imran Bashir, Mastering Blockchain: Distributed ledgers, Decentralization and Smart Contracts explained. 2nd Edition, March 2018.

REFERENCE BOOKS:

1. Malcolm Campbell-Verduyn, Bitcoin And Beyond Cryptocurrencies, Blockchains, And Global Governance.

2. S. Shuka, M. Dhawan, S. Sharma. S. Venkatesan, Blockchain Technology: Cryptocurrency and Applications

3. Josh Thompson, Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming

4. Antonopoulos, Mastering Bitcoin

5. Antonopoulos and G. Wood, Mastering Ethereum

INTRODUCTION TO DATA MINING (3:0:0)

Sub code : CS7E303   **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. 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 and Classification and prediction

MODULE 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.   **8 Hours**

MODULE 2:

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

SLE: Concept Hierarchy Generation   **8 Hours**

MODULE 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**

MODULE 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

8 Hours

MODULE 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

Classification and Prediction: What Is Classification? What Is Prediction? Issues Regarding Classification and Prediction

SLE: Metarule-Guided Mining of Association Rules

8 Hours

TEXT BOOK :

1. Data Mining Concepts and Techniques, Jiawei Han and MichelineKamber, Morgan Kaufman Publications. 3rd Edition, July 2011.

REFERENCE BOOKS:

1. Introduction to Data Mining, Adriaan, Addison Wesley Publication
2. Data Mining Techniques, A.K.Pujari, University Press

ADVANCED JAVA (3:0:0)

Sub Code: CS7E304   **CIE:50%Marks**

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

SEE Hours: 03 Hours   **MarksMax.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 and JDBC connectivity to Databases

MODULE 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 the Console.

SLE: The Audio Clip Interface,The Applet Stub Interface   **8 Hours**

MODULE 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 AFrame 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 Font Metric   **8 Hours**

MODULE 3:

Using AWT Controls, Layout Manager and Menus: Control Fundamentals, Labels, Using Buttons, Check boxes, 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**

MODULE 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, crollpane,Jlist,Jcombobox,.

SLE: trees, Jtable **7 Hours**

MODULE 5:

JavaBeans: What Is JavaBeans, Advantages Of Java Beans, 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.

JDBC-connectivity to Database: Java Database Connectivity, Database Servers, Database Clients,JDBC(Java Database Connectivity),Working With Oracle Database,Working With Mysql Database,S tagesina 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 Mysql Database, retrieving Data From MS Access Database, Improving The Performance of a JDBC Program, Affect of Driver, Affect of Set fetchsize(),AffectOf Prepared statement.

SLE: Beans example, Session Tracking Result set metadata, Database metadata, Types of JDBC Drivers

10 Hours

TEXT BOOKS:

1. JavaThe Complete Reference, HerbertSchildt,9th Edition,Tata-McGraw-Hill,2014

2. Core JAVA An Integrated Approach, by Dr.R.NageswaraRao, Dreamtech Press,2008

DEPARTMENT ELECTIVE 4 (2 CREDITS) (CS7E4XX)

SOFTWARE TESTING (2:0:0)

Sub Code : CS7E405	**CIE** : 50%
Hrs/Week : 02	**SEE** : 50%
SEE Hours : 2 Hrs	**Max Marks:** 50

Course outcomes

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

1. Identify various test Cases and levels of testing.
2. Understand various MODULE testing techniques such as Boundary value testing, Equivalence class testing, Decision table based testing, Path Testing, Data flow testing, Life Cycle based Testing.
3. Analyze Integration Testing, System Testing and Requirements Specification.

MODULE 1:

Basics of software testing - Basic Definitions, Test Cases, Preparing a Test Plan, Insights from a Venn Diagram, Identifying Test Cases, Fault Taxonomies.

 Examples: The Triangle Problem, The NextDate Function, The Commission Problem;

SLE: Levels of Testing

7 Hours

MODULE 2:

Boundary value testing, Equivalence class testing, Decision table based testing-Normal, Robust Boundary value testing, Examples, Traditional and Improved Equivalence class testing, Equivalence class test cases examples-triangle problem, NextDate function, Decision Table Techniques, Decision Table Test cases for triangle problem

Path Testing, Data flow testing, Life Cycle–Based Testing-Program Graphs, DD Paths, Basis path testing, Define/Use Testing, Slice-Based Testing, Traditional Waterfall Testing, Testing in Iterative Life Cycles, Agile Testing

SLE: Random testing   **12 Hours**

MODULE 3:

Integration Testing, System Testing- Decomposition-Based Integration, Path-Based Integration ,Example: integration NextDate; Threads, Basis Concepts for Requirements Specification, Model-Based Threads, Use

Case–Based Threads, Non-functional System Testing

SLE: *Coverage Metrics for System Testing*   **7 Hours**

TEXT BOOKS:

1. Software Testing, A Craftsman's Approach, Paul C. Jorgensen, 4th Edition, First Indian Reprint, 2014, Auerbach Publications.

2. Software Testing Principles and Practices, Srinivasan Desikan Gopalaswamy, 5th Edition, 2008, Pearson Education.

REFERENCE BOOK:

1. Software Testing Technique, Beizer Boris, 2nd Edition, 2008, Wiley India

UI & UX (2:0:0)

Sub code: CS7E406   **CIE**   **: 50 Marks**

Hrs/week: 02   **SEE**   **: 50% Marks**

SEE Hrs: 02   **Max. Marks : 50**

Course Outcomes:

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

1. Describe the concepts of User interface patterns

2. Illustrate different features, approach and pattern of User Interface / User Experience

3. Discuss the effects of Wearable devices on health and environment.

MODULE 1:

What Users Do: A Means to an End, the Basics of User Research, Users' Motivation to Learn, The Patterns – Safe Exploration, Instant Gratification, Satisfying, Changes in Midstream, Deferred Choices, Incremental Construction, Habituation, Micro breaks, Spatial Memory, Prospective Memory, Streamlined Repetition, Keyboard Only.

SLE: Other People's Advice, Personal Recommendations.

8 Hours

MODULE 2:

Information Architecture and Application Structure : The Big Picture, The Patterns – Feature, Search and browse, News Stream, Picture Manager, Dashboard, Canvas Plus Palette, Wizard, Setting Editor, Alternative Views, Many Workspaces, Multi-Level Help.

Making it Look Good: Visual Style and Aesthetics: Same content, Different styles, The Basics of Visual Design, What This Means for Desktop Applications, The Patterns: Deep Background, Few Hues, Many Values, Corner Treatments, Borders That Echo Fonts, Hairlines.

SLE: Contrasting Font Weights, Skins and Themes   **9 Hours**

MODULE 3:

Design and UX: Users Vs Life Cycles, Visual Design, Web standards, Potential Barriers to sustainable UX, Designing for Emerging Technologies: Design for Disruption, Eight Design Tenets for Emerging Technology, Changing Design and Designing Change,

Fashion with Function: Designing for wearable devices, The next big wave in Technology, The wearable market segments.

SLE: UX (and Human) Factors to consider   **9 Hours**

TEXT BOOKS:

1. Jenifer Tidwell, "Designing Interfaces", 2nd Edition, Oreilly, 2015.
2. Jonathan Follet, "Designing for Emerging Technologies- UX for Genomics, Robotics and The Internet of Things", 1st Edition, Oreilly, 2014.
3. Tim Frick, "Designing for Sustainability", 1st Edition, Oreilly 2016.

REFERENCE BOOKS:

1. Ben Shneiderman, Plaisant, Cohen, "Jacobs: Designing the User Interface", 5th Edition, Pearson Education, 2010
2. Unger and Chandler, "A Project Guide to UX Design", 2nd Edition, New Riders, 2012
3. Michal Levin, "Designing Multi-Device Experiences", 1st Edition, Oreilly, 2014.

RESEARCH METHODOLOGY (2:0:0)

Sub Code	: CS7E407	**CIE**	: 50%
Hrs/Week	: 02	**SEE**	: 50%
SEE Hours	: 2 Hrs	**Max Marks**	: 50

Course outcomes:

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

1. Discuss the basic framework of research process, research design and techniques

2. Acquire the processes of quantitative data collection, analysis, interpretation and presentation

3. Analyze the components of scholarly writing and ethical issues in research

MODULE 1:

OVERVIEW OF RESEARCH:

Introduction to research, Objectives and motivations for research, Significance of research, Research Methods v/s Methodology, Types of research, Quantitative Research Methods, Variables, Conjecture, Hypothesis. Research Process, Criteria of good Research,

Importance of literature review in defining a problem - Survey of literature - Primary and secondary sources - Reviews, Identifying gap areas from literature review - Development of working hypothesis.

Research problem-definition, selection and formulation of a research problem selection, criteria of a good research problem. Introduction to research design, Characteristics of good research design.

SLE: Developing a research plan, Department/program specific research problem discussions.

8 Hours

MODULE 2:

DATA COLLECTION, PROCESSING AND ANALYSIS:

Sources of data, collection of data, Primary and secondary Data, Collection of Data through various methods, Measurement and scaling (brief introduction only), Sources of error in measurement. Modeling, Mathematical Models for research (brief introduction only)

Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Probability and Non Probability sampling- types and criteria for selection, Hypothesis Testing, Level of Significance and Confidence Interval, Type I and Type II errors, t-test, z-test, Regression Analysis (brief introduction only).

SLE: Tools for data processing, Graphical representation of Data.   **10 Hours**

MODULE 3:

REPORT WRITING AND ETHICS IN RESEARCH:

Writing Research Report: Format and style. Review of related literature its implications at various stages of research. (Formulation of research problem, hypothesis, interpretation and discussion of results. Major findings, Conclusions and suggestions.) Layout of a Research Paper, Research proposal, Software for paper formatting like LaTeX/MS Office, effective technical presentation in seminars/workshops/symposiums (oral/paper/poster),

Significance of ethical conduct in research, Ethical issues related to publishing, Plagiarism & latest regulations. Software for detection of Plagiarism.

SLE: Intellectual property rights, importance and protection, copyrights, patents, Impact factor of Journals

                                                                                      8 Hours

TEXT BOOKS:

1. Chawla, Deepak & Sondhi, Neena (2011). Research methodology: Concepts and Cases, Vikas Publishing House Pvt. Ltd. Delhi.

2. Kothari, C.R., (2014), Research Methodology, New Age International second revised edition

3. Ranjit Kumar, (2011). Research Methodology a step by step guide for beginners, Sage Publications

REFERENCE BOOKS:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., (2002). An Introduction to Research Methodology, RBSA Publishers.

2. Sinha S.C. and Dhiman AK, (2002). Research Methodology, Ess, Ess Publications

3. Fink A, (2009). Conducting Research Literature Reviews: From the Internet to Paper, Sage Publications

4. Donald R. Cooper and Pamela S. Schindler, (2013). Business Research Methods, TMH, New Delhi, 12th Edition.

5. John W. Creswell, (2003). Research Design, Qualitative, Quantitative and Mixed Approaches, 2ndEdition, Sage Publication.

6. William G. Zikmund, Jon C. Carr, Barry Babin, Mitch Griffin, (2013). Business Research Methods, Cengage Learning.

WEB-COMMERCE (2:0:0)

Sub Code : CS7E408 **CIE** : 50%

Hrs/Week : 02 **SEE** : 50%

SEE Hours : 2 Hrs **Max Marks:** :50

Course outcomes:

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

1. Interpret the challenges of e-commerce in the Indian business context and analyze the various business models of e-commerce.
2. Identifying the various web presence goals and E-market opportunities using E-commerce.
3. Analyze the different New E-payment systems.

MODULE 1:

E-commerce in Indian business context and Business models:

Definition of e-commerce, advantages of e-commerce, disadvantages of e-commerce, E-business models based on relationship of transaction parties– B2C: Working procedure, B2B:Advantages- Tools and Techniques, C2C and C2B; E-business models based on relationship of transaction types.

Brokerage model: characteristics –advantages- price discovery mechanisms, Aggregator model.

Self learning components:- E-commerce opportunities for industries, advertising model, subscription model.

9 Hours

MODULE 2:

Enabling Technologies of www and E-marketing : Search Engines, identifying web-presence goals,

Traditional marketing, Browsing behavior model, online marketing, e-advertising, Marketing strategies.

Self learning component :- ISP, Internet standards and specifications **9 Hours**

MODULE 3:

E-payment Systems: Main concerns in Internet banking, Digital payment requirements, classification of new payment systems, Risk and e-payment systems, Designing e-payment systems.

Self learning component :- digital signatures. **8 Hours**

TEXT BOOK:

1. P.T. Joseph, S.J. "E Commerce – and Indian perspective" – Fifth edition, PHI 2015. Ch.1, 2, 3, 4, 6.

REFERENCE BOOK:

1. Daniel Minoli and Emma Minoli"Web commerce Technology", Tata McGraw Hill –2000.

2. Introduction to E-Commerce: Combining Business and Information Technology, 1st Edition, 2016 Martin Kutz.

INTRODUCTION TO BIG DATA ANALYTICS (2:0:0)

Sub code : CS7O01		**CIE** : 50 %
Hours / week : 02		**SEE** : 50 %
SEE Hours : 2 Hours		**Max. Marks** : 50

Course Outcomes:

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

1. Overview of Big Data and Related Technologies for Handling Big Data and Hadoop Ecosystem
2. Acquire clear understanding of MapReduce Fundamentals and HBase
3. Acquire clear understanding of Virtualizing and Processing Data using MapReduce

MODULE 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.

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,

SLE: Sqoop,Flume   **10 Hours**

MODULE 2:

Understanding MapReduce Fundamentals and HBase

MapReduce, Features of MapReduce, HadoopYARN,IntroducingHBase, Combining HBase and HDFS, 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   **9 Hours**

MODULE 3:

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   **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, Vignesh Prajapati, -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 OpportMODULEies 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

INTRODUCTION TO DATA MINING (2:0:0)

Sub code : CS7O02   **CIE : 50% Marks**

Hrs/week : 02   **SEE : 50% Marks**

SEE Hrs : 02 Hours   **Max. Marks : 50**

Course Outcomes:

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. Acquire knowledge about Data Warehouse Implementation.

MODULE 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.   **8 Hours**

MODULE 2:

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

SLE: Concept Hierarchy Generation   **9 Hours**

MODULE 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   **9 Hours**

TEXT BOOK :

1. Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber, Morgan Kaufman Publications-2011

REFERENCE BOOKS :

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

2. Data Mining Techniques, A.K.Pujari, University Press - 3rd Edition, 2013

INTRODUCTION TO PYTHON PROGRAMMING (2:0:0)

Sub Code: CS7O03   CIE   : 50%

Hrs./Week :02   SEE   : 50%

SEE Hours : 02 Hrs.   Max Marks : 50

Prerequisite:

Basic understanding of computers and programming.

Course Outcomes:

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

1. Develop simple Python programs using basic data types, expressions and functions
2. Implement moderately complex python programs that involve branching and looping constructs of Python.
3. Apply file operations for medium scale unstructured text data processing.

MODULE 1:

Introduction to Programming & Python: Why should everyone learn to write programs, Creativity and motivation, Computer hardware architecture, Understanding programming, Terminology: Interpreter and compiler, the building blocks of programs, Variables, expressions, and statements: Values and types, Variable names and keywords, Statements, Operators and operands, Expressions, Order of operations, Modulus operator, String operations, Asking the user for input, Comments.

Functions: Function calls, Built-in functions, Type conversion functions, Math functions, Adding new functions, Parameters and arguments.

SLE: What could possibly go wrong ? The types of programming errors.   **8 Hours**

MODULE 2:

Conditional Execution: Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Catching exceptions using try and except.

Iteration: The while statement, Infinite loops, Finishing iterations with continue, Definite loops using for.

Strings : A string is a sequence, Length of a string, String traversal, String slicing, Looping over strings, The in operator, String comparison, String methods, Format operator.

SLE: Loop patterns, Parsing string   **9 Hours**

MODULE 3:

Files: Persistence, Opening files, Reading files, Searching through a file, Writing files.

Lists : Basics, Traversing a list, List operations, List slicing, List methods, Deleting elements, Lists and functions. Dictionaries: Basics, Dictionary as a set of counters, Dictionaries and files, Looping and dictionaries.Tuples: Tuples are immutable, Comparing tuples, Tuple assignment, Dictionaries and tuples.

SLE: Lists and strings, Parsing lines, Using try, except, and open with file.　　　　　　　**9 Hours**

 TEXT BOOK:

1. Python for Everybody: Exploring Data Using Python 3, Dr. Charles R. Severance, Shroff Publishers; First edition, ISBN-13 : 978-1530051120, https://www.py4e.com/

REFERENCE BOOKS:

1. Starting out with Python, Tony Gaddis, 5th edition, Pearson
2. Learning Python, Mark Lutz , O′Reilly; 5th edition

Web Links:

1. Coursera Course: Python for Everybody : https://www.coursera.org/specializations/python
2. GeeksforGeeks: https://www.geeksforgeeks.org/python-programming-language/
3. Python tutorials: https://realpython.com/
4. Official Python Documentation: https://docs.python.org

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