FACULTY OF ENGINEERING

Scheme of Instruction & Examination

And
Syllabi

B.E.V and VI Semester

of
Four Year Degree Programme
In

B.E. (Information Technology)

w.e.f. 2022-2023

BATCH 2020-2024

Dean, Faculty of Engineering
Osmania University, Hyderabad – 500 007

2022

Chairperson, BoS **Dean, FoE OU**

PROFESSIONAL ELECTIVES THREAD

THREAD NAME	PE-1	PE-2	PE-3	PE-4	PE-5
SUBJECT CODE	PE 51Z IT	PE 62Z IT	PE 73Z IT	PE 74Z IT	PE 85Z IT
Software Engineering	Object Oriented Analysis and Design	Software Testing and Quality Assurance	Software Reuse Techniques	Software Project Management	Agile Software Development
Networks and security	Mobile Computing	Adhoc Sensor Networks	Cyber Security	Digital Forensics	Information Security
Cloud Engineering	Distributed Systems	Cloud Computing	Scalable Architectures or Large Applications	Blockchain Technologies	DevOp sand Kubernetes
Data Engineering	Data Mining	Data Science	Natural Language Processing	Deep Learning	Computational Intelligence
Miscellaneous	Computer Graphics	Information Storage and Management	Real Time Systems	Augmented and virtual Reality	Quantum Computing

SCHEME OF INSTRUCTION & EXAMINATION
B.E (INFORMATION TECHNOLOGY)

V Semester

S. No.	CourseCode	Course Title	Scheme of Instruction Periods Per week			Contact Hrs / Week	Scheme of Examination MaximumMarks		Duration in Hrs	Credits
			L	T	D/P		CIE	SEE		
Theory Course										
1.	PC501IT	Automata Theory	3	1	-	4	30	70	3	3
2.	PC502IT	Operating Systems	3	1	-	4	30	70	3	3
3.	PC503IT	Artificial Intelligence	3	1	-	4	30	70	3	3
4.	PC504IT	Computer Networks	3	1	-	4	30	70	3	3
5.	PC505IT	Software Engineering	3	-	-	3	30	70	3	3
6.	PE-1	Professional Elective–I	3	-	-	3	30	70	3	3
Practical/Laboratory Courses										
7.	PC551IT	Computer Networks and Operating System Lab	-	-	3	3	25	50	3	1.5
8.	PC552IT	Artificial Intelligence Lab	-	-	2	2	25	50	3	1
9.	PC553IT	Web Application Development Lab	-	-	2	2	25	50	3	1
Total			18	04	07	32	255	570	-	21.5

PC: Professional Core; **PE**: Professional Elective; **HS**: Humanities and social Science ;
MC: Mandatory ; **L**:Lecture; **T**:Tutorial ; **P**:Practical
CIE: Continuous Internal Evaluation ; **SEE**: Semester End Examination(Univ.Exam)

Note:

1. Each contact hour is one clock hour.
2. The duration of practical class is two hours , however it can be extended whenever necessary to enable the students to complete the program.

Profession Elective – I	
Course Code	**Course Title**
PE 511 IT	Object oriented Analysis and Design
PE 512 IT	Mobile Computing
PE 513 IT	Distributed Systems
PE 514 IT	Data Mining
PE 515 IT	Computer Graphics

SCHEME OF INSTRUCTION & EXAMINATION
B.E (INFORMATION TECHNOLOGY)
VI Semester

S.No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1.	PC601IT	Embedded Systems	3	1	-	4	30	70	3	3
2.	PC602IT	Design and Analysis of Algorithms	3	1	-	4	30	70	3	3
3.	PC603IT	Machine Learning	3	1	-	4	30	70	3	3
4.	PC604IT	Network Security and cryptography	3	-	-	3	30	70	3	3
5	OE-1	Open Elective-1	3	-	-	3	30	70	3	3
6.	PE-II	Professional Elective-II	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7.	PC651IT	Embedded Systems Lab	-	-	2	2	25	50	3	1
8.	PC652IT	Machine Learning Lab	-	-	2	2	25	50	3	1
9.	PC653IT	Mobile Application Development Lab	-	-	2	2	25	50	3	1
8.	PW654IT	Mini Project-I	-	-	2	2	25	50	3	1
Total			18	03	8	29	280	620	-	22

PC: Professional Core; **PE**: Professional Elective;

HS: Humanities and social Science ;

MC: Mandatory ; **L**:Lecture; **T**:Tutorial ; **P**:Practical

CIE: Continuous Internal Evaluation ; **SEE**: Semester End Examination (Univ.Exam)

Note:

1. Each contact hour is one clock hour.

2. The duration of practical class is two hours , however it can be extended whenever necessary to enable the students to complete the program.

Profession Elective – II	
Course Code	**Course Title**
PE 621 IT	Software Testing and Quality Assurance
PE 622 IT	Adhoc Sensor Networks
PE 623 IT	Cloud Computing
PE 624 IT	Data Science
PE 625 IT	Information Storage and Management

Open Elective 1		
Sl.No	**Code**	**Name of Subject**
1	**OE601 EE**	Electrical Energy Conservation and Safety (Not for EEE & EIE Students)
2	**OE602 EE**	Reliability Engineering (Not for EEE & EIE Students)
3	**OE611 AE**	Basics of Automobile Engineering (Not for Mech./Prod./Automobile Engg. students)
4	**OE611 ME**	Industrial Robotics (Not for Mech./Prod./Automobile Engg. students)
5	**OE601 EG**	Soft Skills & Interpersonal Skills
6	**OE602 MB**	Human Resource Development and Organizational Behaviour
7	**OE601 LW**	Cyber Law and Ethics
8	**OE601 CS**	OOP using Java (Not for CSE, IT, AD, AM, DS and CB Students)
9	**OE602 CS**	Data Structures & Algorithms (Not for CSE, IT, AD, AM, DS and CB Students)
10	**OE601 IT**	Operating Systems (Not for CSE, IT, AD, AM, DS and CB Students)
11	**OE601 AD**	Principles of Artificial Intelligence (Not for CSE, IT, AD, AM, DS and CB Students)
12	**OE601 AM**	Principles of Machine Learning (Not for CSE, IT, AD, AM, DS and CB Students)
13	**OE601 DS**	Data Science (Not for CSE, IT, AD, AM, DS and CB Students)
14	**OE601 CB**	Principles of IOT (Not for CSE, IT, AD, AM, DS and CB Students)
15	**OE601 CE**	Disaster Mitigation (Not for Civil Engg. Students)
16	**OE601 EC**	Principles of Electronic Communication (Not for ECE students)
17	**OE602 EC**	Digital system design using verilog HDL (Not for ECE students)

AD- *Artificial Intelligence & Data Science*

AE- *Automobile Engineering*

AM-*Artificial Intelligence & Machine Learning*

CB- *IoT, Cyber Security & Block Chain*

CE-*Civil Engineering*

CS-*Computer Science*

DS- *Data Science*

EC-*Electronics and Communication Engg.*

EE- *Electrical Engineering*

EG-*English*

IT-*Information Technology*

LW-*Law*

MB-*Business Management*

ME-*Mechanical Engineering*

SCHEME OF INSTRUCTION & EXAMINATION
B.E (INFORMATION TECHNOLOGY)
V Semester
AUTOMATA THEORY

PC501IT

Instruction	: 3 +1 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives:

1. Provides basic properties of formal languages and formal grammars, deterministic and non-deterministic finite automata, relation between types of languages and types off inite automata.
2. Provides basic properties of Pushdown Automata and Turing machines and computing with Turing machines and PDA.
3. Understand the challenges for Theoretical Computer Science and its contribution to other sciences

Course Outcomes

Student will able to

1. Design and use deterministic, non-deterministic, and epsilon transition finite state automata and illustrate state transition on symbols of input words and establish the corresponding language of automata.
2. Analyze Regular Expressions and use Laws and establish the corresponding Regular Language. Prove a given language is regular or otherwise. Use Closure and Decision Properties of Regular Language.
3. Analyze ambiguity. Develop Context Free Grammars, Parse Trees and establish Context Free Language. Use Closure and Decision Properties of Regular Language.
4. Design Pushdown Automata and illustrate the working. Develop deterministic Pushdown Automata and establish equivalence of language of PDA and CFG.
5. Design Turing Machine and illustrate its working, implement programming techniques for Turing Machines, analyze extended and restricted Turing Machines for computational abilities, and establish the Recursively Enumerable language of Turing Machine and analyze the Un decidable problems.

UNIT I

Automata: Introduction to Finite Automata, Central Concepts of Automata Theory.

Finite Automata: An informal picture of Finite Automata, Deterministic Finite Automata, non-deterministic Finite Automata, An Application, Finite Automata with Epsilon Transitions.

UNIT II

Regular Expression And languages: Regular Expressions, Finite Automata and Regular Expression, Applications of Regular Expressions, Algebraic Laws for Regular Expression.

Properties of Regular Languages: Proving Languages not to be Regular, Closure Properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT III

Context Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications, Ambiguity in Grammars and Language Properties of Context Free Languages: Normal Forms for Context-Free Grammars, Pumping Lemma, Closure Properties, Decision Properties of CFL‘s.

UNIT IV

Push down Automata: Definition, Language of PDA, Equivalence of PDA‘s and; CFG‘s, Deterministic Pushdown Automata.

UNIT V

Turning Machines: Problems that Computer Cannot Solve, The Turning Machine, Programming Techniques for Turning Machines, Extensions to the Turning Machines, Restricted Turning Machines, Turning Machine and Computers. Undecidable Problems about Turning Machines, Post‘s Correspondence Problem, Other Undecidable Problems.

Suggested Reading

1. John E.Hopcroft, Rajeev Motwani, Jeffery D Ulman. Introduction to Automata Theory Languages and Computation, third edition, Pearson Education,2009.
2. John C. Martin, Introduction to Languages and the Theory of computation, third Edition,TataMcGrawHill,2003.

OPERATING SYSTEMS

PC502IT

Instruction	: 3 +1 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives

1. To understand the working of computer system and the basic concepts of operating system and the services provided by it.
2. To understand the functions and management of different resources of the operating system (Processor, I/O, and Memory etc.)
3. To understand process management concepts including scheduling, synchronization, deadlocks
4. To learn the mechanisms involved in memory management and I/O sub systems of an operating system.
5. To understand issues of protection and security

Course Outcomes

Student will able to

1. Explain the fundamental concepts and functions of operating System.
2. Understand process scheduling in a multi-programming environment and implementing process scheduling algorithms.
3. Write application and system calls related programs for managing processes, memory, I/O and inter-process Communication related system calls.
4. Understand memory management, disk management techniques, including virtual memory and file system structure.
5. Explain protection and security related issues of the computer system.

UNIT-I

Introduction: Computer System organization & Architecture, Operating System Structure & Operations, Process, Memory and Storage Managements, Protection and Security, Distributed and Special-Purpose Systems, Computing Environments.

System Structures: Operating-System Services, User Operating System Interface, System calls, Types of System Calls, System Programs, Operating-System Structure, Virtual Machines, Operating–System Generation, System Boot.

Process Concept: Overview, Process Scheduling, Operations on Processes, Inter process communication, Examples of IPC Systems, Communication in Client/ Server Systems.

Multithreaded Programming: Overview, Multithreading Models, Thread Libraries, Threading Issues, Operating-System Examples.

UNIT II

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multi-Processor Scheduling, Thread Scheduling: Pthreads, Operating System Examples, Algorithm Evaluation Process Coordination and Synchronization: Background, The Critical-Section Problem, Peterson 's Solution, Synchronization, Monitors, Synchronization Examples.

Deadlocks: System Model, Deadlock characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT III

Memory-Management Strategies: Background, Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Example: The Intel Pentium.

Virtual Memory Management: Background, Demand paging, Copy-on-write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Other Considerations,

Storage Management: File System, File Concept, Access Methods, Directory Structure, File-System Mounting, Filesharing, Protection.

UNIT IV

Implementing File Systems: File System-Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery, Log-Structured File Systems, NFS.

Secondary –Storage Structure: Overview of Mass-Storage

Structure, Disk Structure, Disk Attachment, RAID Structure, Stable-Storage Implementation, Tertiary-Storage Structure.
I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystems, Transforming I/O Request to Hardware Operations, STREAMS, Performance.

UNIT V

Protection and Security: Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of access rights, Capability-based Systems, Language-based protection.
System Security: The security problem, program Threats, System and System Network Threats, Cryptography as a Security tool, User Authentication, Implementing Security Defenses, firewalling to protect Systems and Networks, Computer Security Classification, Case Studies-Linux System.

Suggested Reading

1. Abraham Silber Schatz, Peter Galvin, Greg Gagne, Operating System principles, seventh Edition, John Wiley & sons' publication,2006.
2. A.Tanenbaum – Modern Operation Systems. Third edition,PearsonEducation,2008.
3. William Stallings-Operating Systems, Fifth Edition, Pearson Education,2005.
4. IdaM. Flynn, Understanding Operating Systems, Sixth Edition, Cengage,2011

ARTIFICIAL INTELLIGENCE

PC503IT

Instruction	: 3 +1 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives:

1. To understand foundations and Applications of AI
2. To learn Probabilistic Reasoning and other search algorithms.
3. To design Bayesian Networks and Markov model
4. To learn aspects of Reinforcement Learning

Course Outcomes:

Student will able to

1. Identify problems that are amenable to solution using State space search algorithms.
2. Understand and analyze working of an AI technique using Heuristic search.
3. Understand and design the Bayesian Networks.
4. Understand and apply the concepts of Markov Decision process.
5. Apply the program and apply Reinforcement Learning

UNIT-I:

Introduction- What is intelligence? Intelligent Systems, Foundations of artificial intelligence (AI). History of AI, Subareas of AI, Applications, Structure of Agents.

Problem Solving - State-Space Search and state space representation.

UNIT-II:

Search strategies. - Uninformed Search strategies-BFS,DFS, Iterative deepening DFS, Informed Search Strategies- Best first search, A* algorithm, heuristic functions, Iterative deepening A*.

UNIT-III:

Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

UNIT-IV:

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Applications.
Markov Decision process: MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

UNIT-V:

Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

Suggested Readings:

1. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Third edition, Pearson Education Press,.
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 3 rd ed, 2009.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, 2009
4. David Poole and Alan Mackworth, ―Artificial Intelligence: Foundations for Computational Agents‖, Cambridge University Press 2010.
5. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011
6. K.R.Chowdhary, Fundamentals of AI, Springer, 2020

COMPUTER NETWORKS

PC504IT

Instruction	: 3 +1 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives:

1.To study the design issues in network layer and various routing algorithms

2. To introduce internet routing architecture and protocols

3.To learn the flow control and congestion control algorithms in Transport Layer

4. To introduce the TCP/IP suite of protocols and the networked application supported by it

5. To learn basic and advanced socket system calls

Course Outcomes:

Student will able to

1. Explain the function of each layer of OSI and trace the flow of information from one

2. Node to another node in the network

3. Understand the principles of IP addressing and internet routing

4. Describe the working of various networked applications such as DNS, mail, file transfer and World Wide Web.

5. Implement client-server socket-based networked applications

UNIT–I

Introduction: Uses of Computer Networks, Network Hardware, Network Software: Reference Models (ISO-OSI,TCP/IP).Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms

UNIT–II

Internet working: Concatenated virtual circuits, Connectionless internet working, Tunneling, Fragmentation. Network layer in the

Internet: IP protocol, IP addresses, Internet control protocols, OSPF, BGP, Mobile IP, IPv6.

UNIT–III

Network Programming: Socket Interface: Sockets, Socket Address, Elementary Sockets, Advanced Sockets, Socket Options, Remote Procedure Calls: Introduction, Transparency Issues and SunRPC.

UNIT-IV

THE TRANSPORT LAYER: Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.

UNIT–V

Application Layer: Domain Name System: DNS Name Space, Resource Records, Name Servers. Electronic Mail: Architecture and Services, User Agent, Message Formats, Message transfer and Final Delivery. World Wide Web: Architectural Overview, Static Web Documents, Dynamic Web Documents, HTTP.

Suggested Reading:

1. Andrew S.Tanenbaurn, Computer Networks, Fourth Edition, Pearson Education.
2. W. Richard stevens, Unix NetworkProgramming||
3. JamesF.Kurose,KeithW,Ross,ComputerNetworking,Atop-Down Approach Featuring the Internet, Third Edition,PearsonEducation,2005.
4. William Stallings, Computer Networking with Internet Protocols and Technology, Pearson Education,2009

SOFTWARE ENGINEERING

PC504IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives

1. To introduce the basic concepts of software development- processes from defining a product to shipping and maintaining that product
2. To impart knowledge on various phases, methodologies and practices of software development
3. To understand the importance of testing in software development and study various testing strategies and software equality metrics.

Course Outcomes

Students will be able to:

1. Define different software development processes and their usability in different problem domains.
2. Explain the process of requirements collection,
3. Design and Develop the architecture of real world problems towards developing a blue print for implementation.
4. Understand the concepts of software equality, testing and maintenance.
5. Discuss the concepts related to Risk management and Software project Estimation

UNIT-I

Introduction to Software Engineering: Ageneric view of process, Software Engineering process framework, The Nature of Software, Software Engineering, Software Myths.

Process Models: AGeneric ProcessModel, An Agile View of Process: Introduction to Agility and Agile Process.

UNIT-II

Understanding Requirements: Requirements Engineering, Establishing the Ground work, Eliciting Requirements, Building the Requirement Model, Negotiating Requirements, Validating Requirements.

Design Concepts: Design with in the Context of Software Engineering, the Design Process, Design Concepts.

Architectural Design: Software Architecture, Architecture Genres, Architecture Styles, Architecture Design, Assessing Alternative Architecture Designs, Architecture Mapping Using Data Flow.

UNIT-III

Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, SQA Tasks, Goals and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, The ISO 9000 Quality Standards, The SQA Plan.

Risk Management: Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.

UNIT-IV

Testing Conventional Applications: Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing, Control Structure Testing, Black–Box Testing.

Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging.

UNIT-V

Product Metrics: A Frame work for Product Metrics, Metrics for the Requirements Model, Metrics for the Design Model, Metrics for Testing, Metrics for Maintenance. Estimation: Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Specialized Estimation Techniques.

Software Configuration Management: Software Configuration Management. Software Process Improvement: The SPI Process, The CMMI.

Suggested Reading:

1. Roger S. Pressman, Software Engineering: A Practitioners Approach, Seventh Edition,McGrawHill,2009.
2. AliBehforoz and Frederic J.Hadson, Software Engineering Fundamentals, Oxford University Press,1996.
3. PankajJalote—An Integrated Approach to Software Engineering,Third Edition,NarosaPublishinghouse,2008.

COMPUTER NETWORKS & OPERATING SYSTEM LAB

PC 551 IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 25 marks
SEE	: 50 marks
Credits	**: 1.5**

Course Objectives:

1. To understand the use of client/server architecture in application development.
2. To understand and use elementary socket system calls, advanced socket system calls and TCP and UDP based sockets
3. To implement network routing algorithms, application layer protocols and encryption algorithms.

Course Outcomes:

Student will able to

1. Understand the usage of basic commands ipconig, ifconfig, netstat, ping, arp, telnet, ftp, finger, trace route, who is of LINUX platform.
2. Develop and Implement Client-Server Socket based programs using TCP, and UDP sockets and Distance Vector Routing Algorithm.
3. Demonstrate how threads can be created and simultaneously handled in LINUX POSIX environment.
4. Understand possible Inter-Process Communication implementations using LINUX IPC Constructs. Develop and Implement RSA Public Key algorithm.
5. Constructs implement network by using any modern Open-Source Network Simulation Tool

List of Programs

1. Familiarization of Network Environment, Understanding and using network utilities: ipconig, ifconfig, netstat, ping,arp,telnet, ftp,finger, traceroute,whois.

2. Write a program to implement connection oriented and connection less client for well-known servicesi. estandard ports
3. Implementation of concurrent server service using connection-oriented socket system calls(Service: Daytime, Time)
4. Implementation of concurrent server using connection less socket system calls.(Service: Echo server, String Concatenation)
5. Implementation of Iterative server using connection-oriented socket system calls.(Service: Calculate Employee Salary)
6. ImplementationofIterativeserverusingconnectionlesssocketsystem calls.(Service: StudentGrade)
7. Program to demonstrate the use of advanced socket system calls:readv(),writev(),getsockname(),setsockname(),getpeername( ),gethostbyname(),gethostbyaddr(),getnetbyname(),getnetbyaddr() ,getprotobyname(),getservbyname(),getprotobynumber(),getserby port().
8. Implementation Familiarity and usage of Linux System calls:

- Process management:fork(),exec(),wait(),sleep()...,
- File management:open(),read(),write(),seek(),close()...,

9. Write a program to Implement two process communication using IPC constructs. a)pipes b)shared memory c)message queues
10. Demonstrate the use of threads under LINUX platform using appropriate thread API
11. Write a program to Implement Producer Consumer Problem solution.
12. Write a program to Implement Dining philosopher‘s problem solution.
13. Write a program to implement Processor Scheduling Algorithms

a) FCFSb)SJF c)RoundRobin.

14. Write a program to simulate Bankers Algorithm for Dead Lock Avoidance.

Suggested Reading:

1. W.RichardStevens,―UnixNetworkProgramming‖,PrenticeHall, PearsonEducation,2009.
2. Douglas E.Comer,―Handson Networking with Internet Technologies ,Pearson Education

ARTIFICIAL INTELLIGENCE LAB

PC 552 IT

Instruction	:2 periods per week
Duration of SEE	: 3 hours
CIE	: 25 marks
SEE	:50 marks
Credits	**: 1**

Course Objectives :

1. To apply programming skills to formulate the solutions for computational problems.
2. To study implementation first order predicate calculus using Prolog
3. To familiarize with basic implementation of NLP with the help of Python libraries NLTK
4. To understand python library scikit-learn for building machine learning models
5. To enrich knowledge to select and apply relevant AI tools for the given problem

Course Outcomes

1. Design and develop solutions for informed and uninformed search problems in AI.
2. Demonstrate reasoning in first order logic using Prolog
3. Utilize advanced package like NLTK for implementing natural language processing.
4. Demonstrate and enrich knowledge to select and apply python libraries to synthesize information and develop supervised learning models
5. Develop a case study in multidisciplinary areas to demonstrate use of AI.

1. Write a program to implement Un informed search techniques:
   a. BFS
   b. DFS
2. Write a program to implement Informed search techniques
   a. Greedy Best first search
   b. A* algorithm
3. Study of Prolog, its facts, and rules.

a. Write simple facts for the statements and querying it.

b. Write a program for Family-tree.

4. Write a program to train and validate the following classifiers for given data (scikit-learn):

a. Decision Tree

b. Multi-layer Feed Forward neural network

1. Case Studies: a. Smart Inventory Management System

b. AI in Healthcare Digital Assistant

WEB APPLICATION DEVELOPMENT LAB

PC 553 IT

Instruction	:2 periods per week
Duration of SEE	: 3 hours
CIE	: 25 marks
SEE	:50 marks
Credits	**: 1**

Course Objective:

1. To develop web pages using HTML tags and perform validation using scripting
2. To implement various types of styling using CSS and transform data into various forms
3. To implement applications using JQuery and AngularJS
4. To understand and implement the concepts of MEAN Stack and SMACK stack

Course Outcomes:

Student will able to

1. Design Web pages and perform form validation using HTML5.0 in built functions.
2. Apply Styles to the web content using CSS.
3. Create and process web publishing content using XML and JSON.
4. Use JQuery to perform client-side Dynamics.
5. Create single page applications(Front End)using AngularJS. And design Big data applications using Mean stackor SMACK stack Frameworks.

a. Implement Basic HTML Tags

b. Implement Table Tag

i. Implement FRAMES

c. Designa forming HTML(CV/Photos/DataStorage/Publish)

i. Validation of form Using Java Script.

d. Implement various types of CSS.

e. Display the various forms of XML document

i. RawXML ii.XMLusingCSS

f. Using JQuery implement the following:

   i) Selecting Elements, Getting Values,and Setting Values.

   ii) Events

g. Using angular JSimplement the following

   i) Input Validation

   ii) Back-end building

h. Case study on i)MEAN Stack

OBJECT ORIENTED ANALYSIS AND DESIGN

PE511IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives:

1. To introduce the basic concepts of Unified Modeling Language from defining Unified process and Core workflows
2. To impart knowledge on various UML diagrams for the software development
3. To understand the importance of each diagram in software development and understand rules to develop each diagram

Course Outcomes

Student will able to

1. Understand the activities in the different phases of the object-oriented development life cycle.
2. Model a real-world application by using a UML diagram.
3. Provide a snapshot of the detailed state of a system at appoint in time using object diagram.
4. Recognize when to use generalization, aggregation, and composition relationships. Specify different types of business rules in a class diagram.
5. Understand the Unified Software Development Process

UNIT-I

UML Introduction: Why we Model, Introducing the UML, Elements of UML Basic Structural Modeling: Classes, Relationships, Common Mechanisms, Diagrams, Class Diagrams.

Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Types and Roles, Packages, Instances, Object Diagrams, Components

UNIT-II

Basic Behavioral Modeling: Interactions, Use Cases, Use Case Diagrams, Interaction diagrams, Activity diagrams.
Advanced Behavioral Modeling: Events and Signals, State Machines, Processes and Threads, Time and space, State Chart Diagrams.

UNIT-III

Architectural Modeling: Artifacts, Deployment Collaborations, Patterns and Frame-works, Artifact Diagrams, Deployment Diagrams, Systems and Models

UNIT-IV

Unified Software Development Process: The Unified Process, The Four Ps, A Use-Case-Driven Process, An Architecture-Centric Processes, An Iterative and Incremental Process.

UNIT-V

Core Work flows: Requirements Capture, Capturing requirements as use cases, Analysis, Design, Implementation, Test

Suggested Reading:

1. The Unified Modeling Language User Guide, Pearson Education-GradyBooch, James Rumbaugh, Ivar Jacobson
2. Object-Oriented Analysis And Design With Applications, PearsonEducation, 3rdEdition-Booch, Jacobson, Rumbaugh

MOBILE COMPUTING

PE512IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives:

Student should be able to understand

1. Basic concepts of mobile computing.
2. Basics of mobile telecommunication system.
3. Basics of network, transport and application layer protocols.
4. Gain knowledge about different mobile platforms and application development.

Course Outcomes:

Student will be able to

1. Explain the basics of mobile telecommunication systems
2. Illustrate the generations of telecommunication systems in wireless networks
3. Determine the functionality of MAC, Network layer and Identify a routing protocol for a given Adhoc network
4. Explain the functionality of Transport and Application layers
5. Develop a mobile application using android/blackberry/Ios/Windows SDK

UNIT I - INTRODUCTION

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies-Multiplexing – Spread spectrum -MAC Protocols –SDMA-TDMA-FDMA-CDMA

UNIT II – MOBILE TELECOMMUNICATION SYSTEM

Introduction to Cellular Systems- GSM– Services & Architecture–Protocols–Connection Establishment– Frequency Allocation–Routing– Mobility Management–Security–GPRS-UMTS–Architecture–Handover-Security

UNIT III – MOBILE NETWORK LAYER
MobileIP–DHCP–AdHoc–Proactiveprotocol-DSDV, Reactive RoutingProtocols–DSR, AODV, Hybridrouting–ZRP, MulticastRouting-ODMRP,VehicularAdHocnetworks(VANET)–MANETVsVANET–Security.

UNIT IV – MOBILE TRANSPORT AND APPLICATION LAYER
Mobile TCP – WAP – Architecture - WDP – WTLS – WTP – WSP – WAE – WTA Architecture -WML

UNIT V – MOBILE PLATFORMS AND APPLICATIONS
Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, Windows Phone – M- Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

Suggested Reading:

1. Jochen Schiller, ―Mobile Communications ‖, PHI, Second Edition,2003.
2. Prasant Kumar Pattnaik, RajibMall, ―Fundamentals of Mobile Computing ‖, PHI Learning Pvt.Ltd, NewDelhi–2012

REFERENCE BOOKS:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobilesystems",ThomsonAsiaPvtLtd,2005.
2. UweHansmann,LotharMerk,MartinS.NicklonsandThomasStober,―Principlesof Mobile Computing‖, Springer, 2003.
3. William.C.Y.Lee,―MobileCellularTelecommunications-AnalogandDigitalSystems‖,SecondEdition,TataMcGraw HillEdition,2006.
4. C.K.Toh,―AdHocMobileWirelessNetworks‖,FirstEdition,PearsonEducation,2002.
5. Android Developers:http://developer.android.com/index.html
6. Apple Developer : https://developer.apple.com/
7. Windows Phone Dev Center:http://developer.windowsphone.com

DISTRIBUTED DATABASES

PE513IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives:

1. To learn the concept and issues of distributed systems in detail.
2. To study architectures and working of distributed file systems.
3. To understand the processes in distributed system and communication.
4. To make students understand how names are assigned in distributed systems.
5. To learn examples of distributed file systems.

Course Outcomes:

Student will able to

1. Understand the problems and issues associated with distributed systems.
2. Understand how coordination occurs in distributed systems.
3. How replicas are handled in distributed systems and consistency is maintained.
4. How security is implemented in distributed systems.
5. Understand design trade-offs in large-scale distributed systems

UNIT – I

Introduction: What is Distributed Systems?, Design Goals, Types of Distributed System.

Architectures: Architectural Styles, Middleware Organization, System Architectures, Example Architectures..

UNIT – II

Processes: Threads, Virtualization, Clients,Servers, Code migration.

Communication: Foundations, Remote Procedure Call, Message-Oriented Communication, Multicast Communication.

UNIT – III

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming, and AttributeBased Naming.

Coordination: Clock Synchronization, Logical Clocks, Mutual Exclusion, Election Algorithms, Location System, Distributed event matching, Gossip-based coordination.

UNIT – IV

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols.

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, and Recovery.

Security: Introduction to security, Secure channels, Access control, Secure naming, Security management.

UNIT – V

Distributed File Systems: Introduction, File service architecture, Case study: Sun Network File System, Case study: The Andrew File System, Enhancements and further developments.

Distributed Multimedia Systems: Introduction, Characteristics of multimedia data, Quality of service management, Resource management, Stream adaptation, Case studies: Tiger, BitTorrent and End System Multicast.

Designing Distributed Systems: GOOGLE CASE STUDY Introduction, Overall architecture and design philosophy, Underlying communication paradigms,Data storage and coordination services, Distributed computation services.

Suggested Readings:

1 Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems, PHI 2nd Edition, 2009.

2 R. Hill, L. Hirsch, P. Lake, S. Moshiri, Guide to Cloud Computing, Principles and Practice,Springer, 2013.

3 R. Buyya, J. Borberg, A. Goscinski, Cloud Computing-Principles and Paradigms, Wiley, 2013.

DATA MINING

PE514IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	: 3

Course Objectives

1. To understand data classification, data preprocessing and data mining applications.
2. To understand how patterns, associations and correlations can be obtained on data.
3. To understand how classification and clustering techniques can be implemented and perform its evaluation.
4. To learn how complex data mining can be performed.

Course outcomes

Student will able to

1. Classify types of data, perform preprocessing of data and appreciate applications of data mining.
2. Analyze data for mining frequent patterns, Associations and Correlations.
3. Perform the classification by using decision tree induction, Bayes classification methods etc. and evaluate the classifier.
4. Select and perform clustering, outlier analysis detection methods.
5. Perform Text mining, Spatial Mining, Web mining and Multimedia mining.

UNIT-I

Introduction: Fundamentals of Data Mining, Kinds of Patterns can be mined, Technologies used, Applications and issues in Data Mining. Types of Data: Attribute types, Basic Statistical Descriptions of Data, Measuring data similarity and Dissimilarity. Data Pre-Processing: Need of Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation.

UNIT-II

Mining Frequent Patterns, Associations and Correlations: Market Basket Analysis, Association rule mining, frequent item set mining methods, mining various kinds of association rule, Constraint based frequent pattern mining.

UNIT–III

Classification: General approach to classification, Classification by Decision tree induction, Classification by back Propagation, Lazy learners, other classification methods, Prediction, Evaluating the accuracy of classifier, increasing the accuracy of classifier.

UNIT—IV

Cluster Analysis: Basic Clustering methods, Partitioning methods, Density-based methods, Grid-based methods, and Evaluation of clustering, Outlier Analysis and detection methods.

UNIT—V

Mining Complex Data, Applications and Trends: Mining complex data: Spatial mining, Text Mining, Multimedia Mining,Web Mining,Data Mining Applications and Data MiningTrends.

Suggested Reading:

1. HanJ&KamberM, ―Data Mining: Concepts and Techniques‖, Harcourt India,Elsevier India, Second Edition.
2. Pang-Ning Tan. Michael Steinback, Vipin Kumar,―Introduction to Data Mining‖,Pearson Education,2008.
3. MargaretHDunham,S.Sridhar,―Datamining:IntroductoryandAdvancedTopics‖,Pearson Education,2008.
4. Humphires,hawkins,Dy,―DataWarehousing:ArchitectureandImplementation‖,Pearson Education,2009.
5. Anahory,Murray,―DataWarehousingintheRealWorld‖,PearsonEducation,2008.

COMPUTER GRAPHICS

PE515IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives:

1. Acquire knowledge about device level algorithms for displaying two dimensional output primitives for raster graphics system.
2. Acquire knowledge about the basic concepts of representing 3D objects in 2D.
3. To introduce computer graphics techniques transformations, clipping, curves.

Course Outcomes

Student will able to

1. Describe the steps in graphics programming pipeline
2. Apply affine transformations for viewing and projections
3. Create a listed images of geometrical objects in 2-D and modeling implementation
4. Describe the mathematical principles to represent curves and surfaces.
5. Three dimensional object representation and transformation.

UNIT – I

Overview of Graphics Systems-Video display devices, raster-scan systems, Random-scan system, graphics monitors and workstations, Input Devices, hard copy devices, Graphics Software. Output Primitives, Line driving, algorithms, Circle generating algorithms, ellipse generating algorithms, pixel addressing, Filled-area primitives, Fill area functions, cell array, character generation.

UNIT – II

Attributes of output primitives: Line attributes, curve attributes, color and Gray scale level, Area fill attributes, character attributes, Bundled attributes, Enquiry function. Two dimensional Geometric transformations: Basic transformations, Homogeneous coordinates, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations.

UNIT – III

Two dimensional viewing: Viewing pipeline, viewing transformation, viewing functions, line clipping-Cohen Sutherland line clipping Liang Bar skyline clipping. Sutherland-Hodgman polygon clipping, Weller Atherton polygon clipping.

UNIT – IV

Structures and Hierarchical Modeling: Structure concepts, editing structures, Basic modeling concepts, hierarchical modeling with structures. Graphical user interfaces and Interactive input methods: The user Dialogue, logical classification of input devices, input functions and Models, Interactive picture construction techniques.

UNIT – V

Three dimensional object representations: Polygon surface, curved lines and surfaces, splinere presentations, Bezeir curves and surfaces, B-spline curves and surfaces, CSG methods: Octress, BSP Trees. Three Dimensional Transformation Three dimensional viewing: Viewing coordinates, projections, visible surface detection methods: Back- face Detections, Depth-buffer methods, depth sorting methods, Gour and shading, Phong shading.

Suggested Reading:

1. HeamDonald, PaulineBakerM.,“Computer Graphics“,2nd edition, PHI,1995. 2.HaningtonS.,“ComputerGraphicsAProgramming Approach“,2nd edition,McGraw Hill.
3. David F. Rogers.,“Procedural ElementsforComputerGraphics”,2nd edition,TataMcGraw Hill, 2001.

SCHEME OF INSTRUCTION & EXAMINATION
B.E (INFORMATION TECHNOLOGY)

VI Semester

S.No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1.	PC601IT	Embedded Systems	3	1	-	4	30	70	3	3
2.	PC602IT	Design and Analysis of Algorithms	3	1	-	4	30	70	3	3
3.	PC603IT	Machine Learning	3	1	-	4	30	70	3	3
4.	PC604IT	Network Security and cryptography	3	-	-	3	30	70	3	3
5	OE-1	Open Elective-1	3	-	-	3	30	70	3	3
6.	PE-II	Professional Elective-II	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7.	PC651IT	Embedded Systems Lab	-	-	2	2	25	50	3	1
8.	PC652IT	Machine Learning Lab	-	-	2	2	25	50	3	1
9.	PC653IT	Mobile Application Development Lab	-	-	2	2	25	50	3	1
8.	PW654IT	Mini Project-I	-	-	2	2	25	50	3	1
Total			18	03	8	29	280	620	-	22

PC: Professional Core; **PE**: Professional Elective; **HS**: Humanities and social Science ;
MC: Mandatory ; **L**:Lecture; **T**:Tutorial ; **P**:Practical
CIE: Continuous Internal Evaluation ; **SEE**: Semester End Examination(Univ.Exam)

Note:

1. Each contact hour is one clock hour.
2. The duration of practical class is two hours , however it can be extended whenever necessary to enable the students to complete the program.

Profession Elective – II

Course Code	Course Title
PE 621 IT	Software Testing and Quality Assurance
PE 622 IT	Adhoc Sensor Networks
PE 623 IT	Cloud Computing
PE 624 IT	Data Science
PE 625 IT	Information Storage and Management

Open Elective 1

Sl.No	Code	Name of Subject
1	**OE601 EE**	Electrical Energy Conservation and Safety (Not for EEE & EIE Students)
2	**OE602 EE**	Reliability Engineering (Not for EEE & EIE Students)
3	**OE611 AE**	Basics of Automobile Engineering (Not for Mech./Prod./Automobile Engg. students)
4	**OE611 ME**	Industrial Robotics (Not for Mech./Prod./Automobile Engg. students)
5	**OE601 EG**	Soft Skills & Interpersonal Skills
6	**OE602 MB**	Human Resource Development and Organizational Behaviour
7	**OE601 LW**	Cyber Law and Ethics
8	**OE601 CS**	OOP using Java (Not for CSE, IT, AD, AM, DS and CB Students)
9	**OE602 CS**	Data Structures & Algorithms (Not for CSE, IT, AD, AM, DS and CB Students)
10	**OE601 IT**	Operating Systems (Not for CSE, IT, AD, AM, DS and CB Students)
11	**OE601 AD**	Principles of Artificial Intelligence (Not for CSE, IT, AD, AM, DS and CB Students)
12	**OE601 AM**	Principles of Machine Learning (Not for CSE, IT, AD, AM, DS and CB Students)
13	**OE601 DS**	Data Science (Not for CSE, IT, AD, AM, DS and CB Students)
14	**OE601 CB**	Principles of IOT (Not for CSE, IT, AD, AM, DS and CB Students)
15	**OE601 CE**	Disaster Mitigation (Not for Civil Engg. Students)
16	**OE601 EC**	Principles of Electronic Communication (Not for ECE students)
17	**OE602 EC**	Digital system design using verilog HDL (Not for ECE students)

AD- *Artificial Intelligence & Data Science*
AE- *Automobile Engineering*
AM-*Artificial Intelligence & Machine Learning*
CB- *IoT, Cyber Security & Block Chain*
CE-*Civil Engineering*
CS-*Computer Science*
DS- *Data Science*
EC-*Electronics and Communication Engg.*
EE- *Electrical Engineering*
EG-*English*
IT-*Information Technology*
LW-*Law*
MB-*Business Management*
ME-*Mechanical Engineering*

EMBEDDED SYSTEM

PC601IT

Instruction	: 3 +1 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	: 3

Course Objectives:

1. To understand the architecture of 8051 microcontrollers.
2. To understand the various applications of Embedded Systems using the concepts of Interfacing.
3. To familiarize with smart sensors and understand various sensor applications.
4. To learn the concepts of RTOS and the design process using RTOS.
5. To familiarize with the design principles of SOC.

Course Outcomes:

Student will be able to

1. Study and analysis of embedded systems.
2. Design and develop embedded systems (hardware, software and firmware)
3. Analyze, real time systems using RTOS and develop applications.
4. Apply knowledge to interface various sensors and its applications in embedded systems.
5. Understand principles of SOC design.

UNIT – I

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

UNIT – II

Programming using 8051. Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, Applications: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication. Bus protocols: I^{2}Cbus and CAN bus.

UNIT – III

Smart Sensors Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters –Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface–The Automation.

Sensors–Applications Introduction–On-board Automobile Sensors(Automotivem Sensors)–Home Appliance Sensors–Aerospace Sensors—Sensors form Manufacturing–Sensors for environmental Monitoring

UNIT – IV

Introduction to Real-Time Operating Systems: Tasks and task states, tasks and data, semaphores, and shared data; message queues, mail boxes and pipes, timer functions, events, memory management, interrupt routines in an RTOS environment.BasicDesignUsingaReal-TimeOperatingSystem:Principles,semaphoresandqueues,hardreal-timeschedulingconsiderations,savingmemoryandpower.

UNIT – V

Introduction to the System Approach System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level inter connection, An approach for SOC Design, System Architecture and Complexity.

Suggested Readings:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay,―The 8051 Microcontroller and Embedded Systems using Assembly and C ||, Prentice HallIndia, 2nd Edition.
2. D.Patranabis–―Sensors and Transducers||– PHI Learning Private Limited.

3. Wayne Wolf,"Computers and Components",Elsevier,Second Edition.
4. KennethJ.Ayala,"The8051Microcontroller",Third Edition,,Thomson.
5. DavidE.Simon," An Embedded Software Primer", PearsonEducation

DESIGN AND ANALYSIS OF ALGORITHMS

PC602IT

Instruction	: 3 +1 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives

1. To review elementary data structures, order notation and algorithm analysis.
2. To learn algorithm design strategies such as Divide-and-Conquer, greedy method, dynamic programming, back tracking and branch & bound technique.
3. To understand the concepts of NP-hard and NP-complete.

Course Outcomes:

Students will be able:

1. Compute and analyse complexity of algorithms using a symptotic notations.
2. Write algorithms to solve various computing problems and analyse their time and space complexity.
3. Understand and apply differential algorithm design techniques to solve real world problems and analyse their complexities.
4. To describe algorithmic complexities of various well known computing problems.
5. Understand NP Hard and NP Completeness.

UNIT-I

Introduction: Algorithm Specification, Performance analysis, Space Complexity, Time Complexity, Asymptotic Notation (O,Omega, Theta), Practical Complexities, Performance Measurement, Review of elementary data structures, Heap and Heap Sort,Set representation, UNION,FIND.

UNIT-II

Divide-and Conquer: The general method, finding maximum minimum. Merge sort quick sort and selection.

Greedy Method: Knap sack problem, Optimal Storage on tapes, Job sequencing with deadlines, Optimal merge patterns, Minimum

Spanning Trees.

UNIT-III

Dynamic Programming and Traversal Technique: Multistage graph, All Pair Shortest Path, Optimal Binary Search trees, 0/1 Knapsack, Reliability Traveling Salesman Problem, Biconnected Components and Depth First Search.

UNIT-IV

Back tracking and Branch and Bounds: 8-Queens Problem, Graph Coloring Hamilton cycle, Knapsack Problem, 0/1Knapsack Problem, Traveling salesperson problem.

UNIT-V

NP-Hard and NP-Completeness: Basic concepts, cook‘stheorem, NP-hard graph problems and scheduling problem, NP-hard generation problems, Decision problem, No decovering problem.

Suggested Reading

1. Horowitz E.SahaniS: Fundamentals of Computer Algorithm, Second edition, University Press,2007.
2. Anany Levitin, Introduction to the Design & Analysis,of Algorithms, Pearson Education,2003.
3. Aho, Hopcroft, Ulman, The Design and Analysis of Computer Algorithm, Pearson Education,2000.
4. Parag H.Dave, Himanshu B.Dave, Design and Analysis of Algorithms, Pearson Education,2008.

MACHINE LEARNING

PE603IT

Instruction	: 3+1 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	: 3

Course Objectives

1. To learn the concepts of machine learning and types of learning along with evaluation metrics.
2. To study various supervised learning algorithms.
3. To learn ensemble techniques and various unsupervised learning algorithms.
4. To explore Neural Networks.
5. To learn reinforcement learning and study applications of machine learning.

Course Outcomes

Student will able to:

1. Extract features that can be used for a particular machine learning approach in various applications.
2. Compare and contrast pros and cons of various machine learning techniques and to get an insight when to apply particular machine learning approach.
3. Apply ensemble techniques for improvement of classifiers.
4. Understand machine learning process along with algorithms.
5. Understand how to apply machine learning in various applications.

Unit-I

Introduction: Learning, Machine Learning, Types of Machine Learning, the Machine Learning Process, Weight Space, curse of dimensionality, Overfitting, Training, Testing, and Validation Sets, The Confusion Matrix, Accuracy Metrics, The Receiver Operator Characteristic (ROC) Curve, Unbalanced Datasets. Some basic statistics: Averages, Variance and Covariance, The Gaussian, the bias-variance trade-off.

Unit-II

Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.

Supervised Learning :Classification Learning with Trees**:** Using Decision Trees**,** Constructing Decision Trees, CART, Classification Example Support vector machines: optimal separation, kernels Multilayer Perceptron (MLP): The Perceptron, Going Forwards, Backwards, MLP in practices, Deriving back Propagation**,** Linear Separability, K-Nearest Neighbours, Naïve Bayes Classifier **Regression:** Regression Model, Goals of Regression Analysis, Statistical Computing in Regression Analysis.

Unit-III

Unsupervised Learning: Clustering The K-Means Algorithm: Dealing With Noise, the K-Means Neural Network Normalisation, a Better Weight Update Rule Using Competitive Learning for Clustering, Vector Quantisation, the Self-Organising Feature Map: The Som Algorithm Neighbourhood Connections Self-Organisation Network Dimensionality and Boundary Conditions, Examples of Using the Som.

Unit-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming. **Ensemble Algorithms**: Bagging, Boosting. **Dimensionality Reduction:** Linear Discriminant Analysis (LDA), Principal Component Analysis (PCA).

Unit –V

Reinforcement learning Overview, Example, Markov Decision Processes, Values, The Q-Learning Algorithm, The Sarsa Algorithm, Using Reinforcement Learning, The Difference Between Sarsa And Q-Learning.

Suggested Reading

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Second Edition (Chapman & Hall/Crc Machine Learning & Pattern Recognition)
2. Machine Learning, Tom Mitchell, McGraw-Hill Science/Engineering/Math; (1997).
3. Linear regression analysis: theory and computing. Yan, Xin, and Xiaogang Su. World Scientific, 2009.
4. Deep Learning by Ian Goodfellow, YoshuaBengio and Aaron Courville, MIT Press(2017)

NETWORK SECURITY AND CRYPTOGRAPHY

PC604IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives

1. Familiarize students with basics of Network Security and cryptography.
2. To understand the network security, services, attacks, mechanisms, types of attacks on TCP/IP protocol suite.
3. To comprehend and apply network layer security protocols, Transport layer security protocols, Web security protocols.
4. To comprehend and apply authentication services, authentication algorithms.
5. Provide a solid understanding of main issues related to network security

Course Outcomes

Student will able to

1. Understand the most common type of information and network threat sources.
2. Be able to determine appropriate mechanisms for protecting the network.
3. Design a security solution for a given application system with respect to security of the system.
4. Understand the information and network security issues and apply the related concepts for protection and communication privacy.
5. Comprehend various network security threats.

UNIT – I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques:

Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography.

UNIT – II

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange.

UNIT – III

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service.

UNIT – IV

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security

UNIT – V

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations.

Suggested reading:

- Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition
- Cryptography and Network Security: AtulKahate, McGraw Hill, 3rd Edition

EMBEDDED SYSTEM LAB

PC 651 IT

Instruction	:2 periods per week
Duration of SEE	: 3 hours
CIE	: 25 marks
SEE	:50 marks
Credits	**: 1**

Course Objective

1. To understand basic concepts and structure of embedded systems.
2. To design and develop real time applications of embedded systems

Course Outcomes

Student will able to

1. Apply the basic concepts to develop an Interface for 8051 and ARM processors.
2. How to interface input and output units.
3. Develop control applications
4. Demonstrate the RTOS Concepts by designing real time applications.
5. Demonstrate multi-tasking, scheduling, priority inversion and Interrupt service routines in RTOS.

A. Use of 8-bit and 32-bit Microcontrollers, (such as 8051 Microcontroller, ARM2148 / ARM2378, LPC 2141/42/44/46/48) Microcontroller and C compiler (Keil, Ride etc.)to:

1. Interface Input-Output and other units such as: Relays, LEDs, LCDs, Switches, Keypads, Stepper Motors, Sensors, ADCs, Timers
2. Demonstrate Communications: RS232, IIC and CAN protocols
3. Develop Control Applications such as: Temperature Controller, Elevator Controller, Traffic Controller

B. Development and Porting of Real Time Applications on to Target machines such as Intel or other Computers using any RTOS

Understanding Real Time Concepts using any RTOS through Demonstration of:

1. Multi-Tasking
2. Semaphores
3. Message Queues
4. Round-Robin Task Scheduling
5. Preemptive Priority based Task Scheduling
6. Priority Inversion
7. Signals
8. Interrupt Service Routines

MACHINE LEARNING LAB

PC 652 IT

Instruction	:2 periods per week
Duration of SEE	: 3 hours
CIE	: 25 marks
SEE	:50 marks
Credits	**: 1**

Course Objectives:

The main objectives of this course are:

1. Demonstration of different classifiers on different data.
2. Demonstrate unsupervised learning algorithms.
3. To demonstrate dimensionality reduction techniques.
4. Make use of real world data to implement machine learning models.

Course Outcome:

Student will able to:

1. Apply machine learning algorithms: dataset preparation, model selection, model building etc.
2. Evaluate various Machine Learning approaches.
3. Use scikit-learn, Keras and Tensorflow to apply ML techniques.
4. Design and develop solutions to real world problems using ML techniques.
5. Apply unsupervised learning and interpret the results.

1. Basic Data Preprocessing
   a) Installation of python environment/Anaconda IDE for machine learning: installing python modules/Packages like scikit-learn, Keras and Tensorflow etc.
   b) Programs involving pandas, Numpy and Scipy libraries.

2. Programs for classification
   1. Build models using linear regression and logistic regression and apply it to classify a new instance
   2. Write a program to demonstrate the following classifiers. Use an appropriate data set for building the model. Apply the model to classify a new instance.

a) Decision tree
b) K nearest neighbour
c) Naïve bayes
d) Support vector machine

3. Demonstration of Clustering algorithms using
   a. k-means,
   b. Competitive learning
   Interpret the clusters obtained.

4. Implement Self-Organising Feature Map.

5. Write a program to implement
   a) Linear Discriminant Analysis
   b) Principal Component Analysis in Python

MOBILE APPLICATION DEVELOPMENT LAB

PC 653 IT

Instruction	:2 periods per week
Duration of SEE	: 3 hours
CIE	: 25 marks
SEE	:50 marks
Credits	**: 1**

Course Objectives

1. To facilitate students to understand android SDK
2. To help students to gain a basic understanding of Android application development
3. To inculcate working knowledge of Android Studio development tool

Course Outcomes

Student will able to

1. Identify various concepts of mobile programming that make it unique from programming for other platforms.
2. Critique mobile applications on their design pros and cons,
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
4. Program mobile applications for the Android operating system that use basic and advanced phone features, and
5. Deploy applications to the Android marketplace for distribution.

1. To develop a Simple Android/iOS Application that uses GUI components, Font and Colors.
2. To develop a Simple Android/iOS Application that uses Layout Managers and Event Listeners.
3. To develop a Simple Android//iOS Application that draws basic Graphical Primitives on the screen.
4. To develop a Simple Android//iOS Application that makes use of Database.
5. To develop an Android//iOS Application that makes use of Notification Manager.
6. To develop an Android/iOS Application that implements Multi threading.
7. To develop an Android//iOS Application that uses GPS

location information.

8. To develop an Android//iOS Application that writes data to the SD Card.
9. To develop an Android//iOS Application that creates an alert upon receiving a message.
10. To develop an Android//iOS Application that makes use of RSS Feed.
11. To develop an Android//iOS Application to send an Email.
12. To develop a Simple Android/iOS Application for Native Calculator.
13. To develop a Android/iOS Application that creates Alarm Clock.

MINI PROJECT–I

PW 654 IT

Instruction	:2 periods per week
Duration of SEE	: 3 hours
CIE	: 25 marks
Credits	**: 1**

Course Objectives

1. To develop capability to analyse and solve real world problems with an emphasis on applying/integrating knowledge acquired.
2. To take responsibility of the end product.

Course Outcomes

Student will able to

1. Implement the system using SQL, data structures/C++,JAVA, Python and
   a. Different software engineering models

The Students are required to take one of larger projects listed in the suggested readings or assigned by the teacher, implement and submit the report. The workbooks and project reports should be evaluated.

SOFTWARE TESTING AND QUALITY ASSURANCE

PE621IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives:

1. Study importance of Software Testing in Software Development
2. Explore appropriate Software Testing Techniques for finding bugs in Software.
3. Study various Software Testing Tools and Quality Assurance Methods

Course Outcomes:

Students will able to:

1. Solve the problems using Software Testing techniques and Approaches.
2. Apply various Software testing Techniques to find bugs in software.
3. Use open source software Testing Tools.
4. Apply various Software Quality Assurance Techniques to ensure the quality in software.
5. Apply several software measurements and metrics.

Unit-I

Basics of Software Testing: Testing in the Software Life Cycle & Test Levels: The General V-Model, W-Model, Component Test, Integration Test, System Test, Acceptance Test, Generic types of Testing Functional, Non Functional, Testing software structure, Regression Testing.

Unit-II

Static Testing, Dynamic Analysis: Structured Group Examinations – Reviews, Static Analysis -Control Flow Analysis & Data Flow Analysis, Tools for Static Testing

Unit-III

Test Management: Test Planning, Test Management, Test Process, Test Reporting, Incident Management – Test Log, Incident Reporting, Classification, Status 08

Unit-IV

Test Automation, Software Quality: Design and Architecture for Automation, Test Automation, Design and Architecture for Automation, Generic Requirements for test Tool/Framework, Criteria for selecting test tools, Testing of Object Oriented Systems 08

Unit-V

Software Measurement & Metrics: Measurement during Software Life Cycle Context, Defect Metrics, Metrics for software Maintenance & Requirements, Measurement Principles, Case study for Identifying Appropriate Measures & Metrics for Projects.

Text Books:

- Software Testing Foundations, Andreas Spillner, Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors
- Foundations of Software Testing, by Aditya P. Mathur – Pearson Education custom edition 2000.
  Reference Books:
- Software Testing: Principles and Practices, by Srinivasan D and Gopalswamy R, PearsonEd, 2006.
- Software Testing & Quality Assurance Theory & Practice By Kshirasagar Naik & Priyadarshi Tripathi, Wiley Student Edition.
- Software Quality Assurance Principles & Practice, by Nina S. Godbole, Narosa.
- Stephan H.Kan, Metric and Model in Software Quality Engineering, Addison Wesley, 1995.
- Roger S. Pressman, Software Engineering – A Practitioners Approach, Fifth Edition,McGraw Hill, 2001
- Advanced Software Testing, Vol. 2, Rex Black, SPD.

ADHOC SENSOR NETWORKS

PE622IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives:

1. Fundamentals of Ad hoc network and Sensor network
2. Different routing protocols
3. In-depth knowledge on sensor network architecture and design issues
4. Security issues possible in Adhoc and Sensor networks
5. Programming platforms and tools

Course Outcomes:

Student will be able to

1. Know the basics of Adhoc networks and Wireless Sensor Networks
2. Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
3. Apply the knowledge to identify appropriate physical and MAC layer protocols
4. Understand the transport layer and security issues possible in Adhoc and sensor networks.
5. Be familiar with the OS used in Wireless Sensor Networks and build basic modules

UNIT I – ADHOC NETWORKS–INTRODUCTION AND ROUTING PROTOCOLS

Elements of Adhoc Wireless Networks, Issues in Adhoc wireless networks, Example commercial applications of Adhoc networking, Adhoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On–DemandRoutingprotocols–AdhocOn–DemandDistanceVectorRouting(AODV)

UNIT II – SENSOR NETWORKS–INTRODUCTION & ARCHITECTURES

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

UNIT III – WSN NETWORKING CONCEPTS AND PROTOCOLS

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols– LEACH,IEEE802.15.4MACprotocol,RoutingProtocols-Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

UNIT IV – SENSOR NETWORK SECURITY

Network Security Requirements, Issues and Challenges in Security Provisioning, NetworkSecurity Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management,SecureRouting–SPINS,reliability requirements in sensor networks.

UNIT V – SENSOR NETWORK PLATFORMS ANDTOOLS

Sensor Node Hardware – Berkely Motes, Programming Challenges, Node =level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators–NS2anditsextensionto sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centricprogramming.

Text Books:

1.C.SivaRamMurthyandB.S.Manoj,―AdHocWirelessNetworksArchitecturesandProtocols‖,Prentice Hall,PTR,2004.(UNITI)

2.HolgerKarl,Andreaswillig,―ProtocolandArchitectureforWirelessSensorNetworks‖,Johnwileypublication,Jan2006.(UNITII-V)

REFERENCE BOOKS

1. FengZhao,LeonidasGuibas,―WirelessSensorNetworks:aninformationprocessingapproach‖,Elsevierpublication,2004.
2. CharlesE.Perkins,―AdHocNetworking‖,AddisonWesley,2000.
3. I.F.Akyildiz,W.Su,Sankarasubramaniam,E.Cayirci,―Wirelesssensornetworks:asurvey‖,computer networks,Elsevier,2002,394-422.

CLOUD COMPUTING

PE623IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	: 3

Course Objectives:

1. To introduce basic concepts cloud computing and enabling technologies
2. To learn about Auto-Scaling, capacity planning and load balancing in cloud
3. To introduce security, privacy and compliance issues in clouds
4. To introduce cloud management standards and programming models

Course Outcomes

Student will be able to

1. Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
2. Create virtual machine images and deploy them on cloud
3. Identify security and compliance issues in clouds.
4. Solve Portability and Interoperability issues in cloud
5. Understand Enterprise architecture and SOA.

UNIT – I

Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning

UNIT – II

Scaling in the Cloud, Capacity Planning , Load Balancing, File System and Storage

UNIT – III

Multi-tenant Software, Data in Cloud , Database Technology, Content Delivery Network, Security

Reference Model , Security Issues, Privacy and Compliance Issues

UNIT – IV

Portability and Interoperability Issues, Cloud Management and a Programming Model Case Study, Popular Cloud Services

UNIT – V

Enterprise architecture and SOA, Enterprise Software , Enterprise Custom Applications, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem.

Suggested Readings:

1. Cloud Computing - Sandeep Bhowmik, Cambridge University Press, 2017
2. Enterprise Cloud Computing - Technology, Architecture, Applications by Gautam
   Shroff, Cambridge University Press, 2016.
3. Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, ―Distributed and Cloud Computing

From Parallel Processing to the Internet of Things‖, Elsevier, 2012.

DATA SCIENCE

PE624IT

Instruction:	3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives

1. Introduce the mathematical foundations of data science.
2. Introduce data science algorithms.
3. Introduce data analytics problem solving framework.
4. Introduce R as a programming language.

Course Outcomes

Student will be able to

1. Understand flow process for data science problems ¬ Classify data science problems
2. Use various data structures and packages in R for data visualization and summarization
3. Use linear, non-linear regression models and techniques for data analysis
4. Use clustering methods ,time series forecasting and text mining
5. Understand Statistical Modeling

UNIT-I Introduction: Introduction to data science , Linear Algebra for data science , Solving Linear equations, Linear Algebra - Distance, Hyperplanes, Halfspaces, Eigenvalues, Eigenvectors

UNIT-II Statistical Modeling: Random variables, Probability mass/density functions, sample statistics, Hypothesis testing Predictive Modeling: Linear Regression, Simple Linear Regression Model Building, Multiple Linear Regression, Logistic Regression

UNIT-III Introduction to R: Downloading and Installing R, IDE and Text Editors, Handling Packages in R. Getting Started with R: Working with Directory, Data Types in R, Few Commands for Data Exploration. Loading and Handling Data in R: Expression, Variables, Functions, Missing Values Treatment in R, Vectors, Matrices, Factors, List, Aggregation and Group Processing of a Variable, Simple Analysis Using R, Methods for Reading Data.

UNIT-IV Exploring Data in R: Introduction, Data Frames, R Functions for Understanding Data I Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values and Outliers, Descriptive Statistics, Spotting Problems in Data with Visualization. Linear Regression and Logistic Regression Implementation in R, K - Nearest Neighbours (kNN), K-Nearest Neighbours implementation in R, K - means Clustering, K - means Implementation in R.

UNIT-V Text Mining: Definition, Challenges, Text Mining in R,General Architecture of Text Mining Systems, Preprocessing of Documents in R. Time Series in R: Introduction, What is Time Series Data, Reading Time Series Data, Decomposing Time Series Data,Forecasts Using Exponential Smoothing, ARIMAModels Social Network Analysis, Reading data from relational databases- MySQL,Reading data from NoSQL databases- MongoDB.

Suggested Readings:

1. Data Science for Engineers by Prof.RagunathanRengasamy, Prof. Shankar Narasimham, IIT Madras.
2. Data Analytics using R by Seema Acharya ,McGraw Hill, 2018
3. R-Viswa Viswanathan, Shanthi Viswanathan - R Data Analysis Cookbook -Packt Publishers.
4. Introduction to Linear Algebra by Gilbert Strang
5. Applied Statistics and Probability for Engineers by Douglas Montgomery
6. Nina Zumel, Practical Data Science with R,ManningPublications,2014.
7. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists,O‘Reilly,2017. 8. Hadley Wickham and Garrett Grolemund, Rfor DataScience,O‘Reilly,2017

INFORMATION STORAGE AND MANAGEMENT

PE625IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives

1. To introduce the concept of storage, emphasize the significance of storage technologies in IT infrastructure.
2. To provides a comprehensive understanding of the various storage infrastructure components in data center environments.
3. To learn about the architectures, features, and benefits of Intelligent Storage Systems.
4. To understand various storage networking technologies such as FC-SAN, NAS, and IP-SAN; long-term archiving solution– CAS.
5. To know about various business continuity solutions such as backup and replication.
6. To understand information security role in storage networks and the emerging field of storage virtualization including storage resource management

Course Outcomes

After completing this course, the student will be able to

1. Evaluate storage architecture; understand logical and physical components of a storage infrastructure including storage subsystems.
2. Describe storage networking technologies such as FC-SAN,NAS,IP-SAN and data archival solution–CAS.
3. Identify different storage virtualization technologies and their benefits.
4. Understand and articulate business continuity solutions including, backup and recovery technologies, and local and remote replication solutions.
5. Identify parameter so managing and monitoring storage infrastructure and describe common Storage

UNIT – I

Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data CenterInfrastructure, Virtualizationand CloudComputing. Data Center Environment: Application, Database Management System (DBMS), Host, Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application, Disk Native Command Queuing, Introduction to Flash Drives.

UNIT – II

Data Protection: RAID, Implementation Methods, Array Components, Techniques, Levels, RAID Impacton Disk Performance, RAID Comparison, Hot Spares. Intelligent Storage Systems: Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems.

UNIT – III

Fibre Channel Storage Area Networks: Overview, The SAN and Its Evolution, Components of FCSAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, I/O Operation, Implementations, File-Sharing Protocols, Factors Affecting NAS Performance, File Level Virtualization.Object-BasedandUnifiedStorage:Object-BasedStorageDevices,ContentAddressedStorage,CASUseCases.

UNIT – IV

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments. Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies.

Remote Replication: Modes of Remote Replication, Remote Replication Technologies, Three-Site Replication.

UNIT – V

Cloud Computing: Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges. Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Storage Security Domains. Managing the Storage Infrastructure: Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution, Information Lifecycle Management.

Suggested Readings:

1. EMC Corporation, Information Storage and Management, WileyIndia,2ndEdition,2011.
2. Robert Spalding, Storage Networks: The Complete Reference,TataMcGrawHill,Osborne,2003.
3. MarcFarley, Building Storage Networks,TataMcGrawHill,Osborne,2ndEdition,2001.
4. MeetaGupta, Storage Area Network Fundamentals, Pearson EducationLimited,2002.

OPERATING SYSTEMS

OE601IT

Instruction	: 3 periods per week
Duration of SEE	: 3 hours
CIE	: 30 marks
SEE	: 70 marks
Credits	**: 3**

Course Objectives

1. To understand the working of computer system and the basic concepts of operating system and the services provided by it.
2. To understand the functions and management of different resources of the operating system(Processor, I/O,and Memory etc)
3. To understand process management concepts including scheduling, synchronization
4. To learn the mechanisms involved in memory management and I/O sub systems of an operating system.

Course Outcomes

Student will able to

1. Explain the fundamental concepts and functions of operating System.
2. Understand process scheduling in a multi-programming environment and implementing process scheduling algorithms.
3. Write application and system calls related programs for managing processes, memory, I/O and inter-process Communication related system calls.
4. Understand memory management, disk management techniques, including virtual memory and file system structure.
5. Understand protection and security mechanism in operating systems.

UNIT-I

Introduction: Computer System organization & Architecture, Operating System Structure & Operations, Process, Memory and Storage Managements, Protection and Security, Distributed and

Special-Purpose Systems, Computing Environments.

System Structures: Operating-System Services, User Operating System Interface, System calls, Types of System Calls, System Programs, Operating-System Structure, Virtual Machines, Operating–System Generation, System Boot.

Process Concept: Overview, Process Scheduling, Operations on Processes, Inter process communication, Examples of IPC Systems, Communication in Client/ Server Systems.

UNIT II

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multi-Processor Scheduling, Thread Scheduling: Pthreads, Operating System Examples, Algorithm Evaluation Process Coordination and Synchronization: Background, The Critical-Section Problem, Peterson ‘s Solution, Synchronization, Monitors, Synchronization Examples.

UNIT III

Memory-Management Strategies: Background, Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Example: The Intel Pentium. Virtual Memory Management: Background, Demand paging, Copy-on-write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Other Considerations,

UNIT IV

Implementing File Systems: File System-Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery, Log-Structured File Systems, NFS. Secondary –Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, RAID Structure, Stable-Storage Implementation, Tertiary-Storage Structure.

UNIT V

Protection and Security: Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of access rights, Capability-based Systems, Language-based protection.

System Security: The security problem, program Threats, System and System

Suggested Reading

1. Abraham Silber Schatz, Peter Galvin, Greg Gagne, Operating System principles, seventh Edition, John Wiley & sons' publication,2006.
2. A.Tanenbaum – Modern Operation Systems. Third edition, Pearson Education, 2008.
3. William Stallings-Operating Systems, Fifth Edition, Pearson Education, 2005.
4. IdaM. Flynn, Understanding Operating Systems, Sixth Edition, Cengage,2011