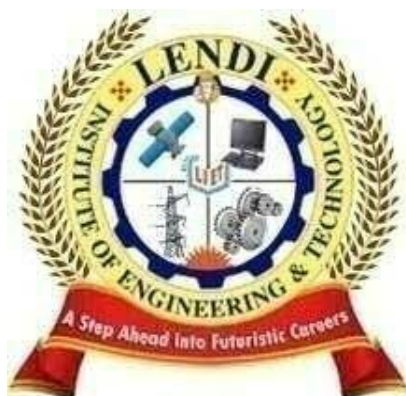# COURSE STRUCTURE (R20)
&
DETAILED SYLLABUS
(IV YEAR)

COMPUTER SCIENCE & ENGINEERING

For
B.Tech., Four-Year Degree Course
(Applicable for the batches admitted from 2020-21)

LENDI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institution
Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with "A" Grade and NBA (CSE, ECE, EEE & ME)
Jonnada (Village), Denkada (Mandal), Vizianagaram Dist – 535 005
Phone No. 08922-241111, 241112
E-Mail: lendi_2008@yahoo.com
Website: www.lendi.org

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CSE)
B. Tech IV-Year Course Structure and Syllabus –R20

S. No	Course Code	Course Title	Category	L	T	P	Credits
		IV Year - I Semester					
1	R20CSE-PE4101.1 R20CSE-PE4101.2 R20CSE-PE4101.3	**Professional Elective Course-3** 1. Software Architecture& Design Patterns 2. Advanced computer Networks 3. Machine Learning	PE	3	0	0	3
2	R20CSE-PE4102.1 R20CSE-PE4102.2 R20CSE-PE4102.3	**Professional Elective Course-4** 1. Big Data Analytics 2. Advanced Computer Architecture 3.Mobile Computing	PE	3	0	0	3
3	R20CSE-PE4103.1 R20CSE-PE4103.2 R20CSE-PE4103.3	**Professional Elective Courses-5** 1.Cloud Computing 2.Cryptography & Network Security 3. Software Project Management	PE	3	0	0	3
4	R20ECE-OE4101 R20ECE-OE4102 R20CSE-OE4103	**Open Elective Courses/ Job Oriented Elective -3** 1. Fundamentals of Digital Image Processing 2. Basics of Embedded Systems 3. Software Testing Methodologies	OE	3	0	0	3
5	R20CSE-OE4102 R20MEC-OE4101 R20BSH-OE4101	**Open Elective Courses/ Job Oriented Elective-4** 1. Scripting Languages 2. Robotics 3. Operations Research	OE	3	0	0	3
6	R20BSH-HM4101	**Universal Human Values -2: Understanding Harmony**	HM	3	0	0	3
7	R20CSE-SC4101	React JS (Skill Oriented Course-5)	SC	0	1	2	2
8	R20CSE-SI4101	**Summer Internship-2 (Evaluation)**	SI	0	0	0	3
			Total	**19**	1	1	**23**

Track No.	Course Code	Course Title	Category	L	T	P	Credits
		Honors Course -4					
1	R20CSE-HN4101	Mobile Adhoc Networks (MANETs) (Track-1)	HC	**3**	**1**	0	4
2	R20CSE-HN4102	Vulnerability Assessment & Penetration Testing (Track -2)	HC	**3**	**1**	0	4
3	R20CSE-HN4103	Java Enterprise Framework (Track-3)	HC	**3**	**1**	0	4
4	R20CSE-HN4104	Deep Learning (Track-4)	HC	**3**	**1**	0	4
		Minor Course-4					

S. No	Course Code	Course Title	Category	L	T	P	Credits
		IV Year - II Semester					
1	R20CS-PJ4201	Project work	**PJ**	**0**	**0**	**0**	**12**
			Total	**0**	**0**	**0**	**12**

HONOR DEGREE IN COMPUTER SCIENCE AND ENGINEERING

Track-I (Networks)

S.No	Year & Semester	Course Code	Subject title	Category	L	T	P	C
1	II-II	R20CSE-HN2201	Data Communication	HN	3	0	2	4
2	III-I	R20CSE-HN3101	TCP/IP Protocol Suite	HN	3	0	2	4
3	III-II	R20CSE-HN3201	Wireless Sensor Networks	HN	3	0	2	4
4	IV-I	R20CSE-HN4101	Mobile Adhoc Networks	HN	3	0	2	4
5	II Year to IV Year	R20CSE-HNMS01.1	Honors MOOCS-1	HN	0	0	0	2
6	II Year to IV Year	R20CSE-HNMS01.2	Honors MOOCS-2	HN	0	0	0	2
							Total	20

Track- II (Cyber Security)

S.No	Year & Semester	Course Code	Subject title	Category	L	T	P	C
1	II-II	R20CSE-HN2202	Information Security	HN	3	0	2	4
2	III-I	R20CSE-HN3102	Secure Coding	HN	3	0	2	4
3	III-II	R20CSE-HN3202	Blockchain Technologies	HN	3	0	2	4
4	IV-I	R20CSE-HN4102	Vulnerability Assessment & Penetration Testing	HN	3	0	2	4
5	II Year to IV Year	R20CSE-HNMS02.1	Honors MOOCS-1	HN	0	0	0	2
6	II Year to IV Year	R20CSE-HNMS02.2	Honors MOOCS-2	HN	0	0	0	2
			Total					20

Track III (Web Frameworks)

S.No	Year & Semester	Course Code	Subject title	Category	L	T	P	C
1	II-II	R20CSE-HN2203	Web UI Framework	HN	3	0	2	4
2	III-I	R20CSE-HN3103	Angular Framework	HN	3	0	2	4
3	III-II	R20CSE-HN3203	.Net Framework	HN	3	0	2	4
4	IV-I	R20CSE-HN4103	J2EE Framework	HN	3	0	2	4
5	II Year to IV Year	R20CSE-HNMS03.1	Honors MOOCS-1	HN	0	0	0	2
6	II Year to IV Year	R20CSE-HNMS03.2	Honors MOOCS-2	HN	0	0	0	2
							Total	20

Track IV (Data Science)

S.No	Year & Semester	Course Code	Subject title	Category	L	T	P	C
1	II-II	R20CSE-HN2204	Advanced Python Programming	HN	3	0	2	4
2	III-I	R20CSE-HN3104	Mathematical Essential For Data Science	HN	3	1	0	4
3	III-II	R20CSE-HN3204	Natural Language Processing	HN	3	0	2	4
4	IV-I	R20CSE-HN4104	Deep Learning	HN	3	0	2	4
5	II Year to IV Year	R20CSE-HNMS03.1	Honors MOOCS-1	HN	0	0	0	2
6	II Year to IV Year	R20CSE-HNMS03.2	Honors MOOCS-2	HN	0	0	0	2
							Total	20

Subject Code	Subject Name	L	T	P	C
R20CSE-PE4101.1	Software Architecture & Design Patterns (**Professional Elective Courses-3**)	3	0	0	3

Course Objectives:

The course should enable the student to:

- To understand interrelationships, principles, and guidelines governing architecture and evolution over time.
- To understand various architectural styles of software systems.
- To understand design patterns and their underlying object-oriented concepts.
- To understand the implementation of design patterns and provide solutions to real-world software design problems.
- To understand patterns with each other and understand the consequences of combining patterns on the overall quality of a system.

Course Outcomes:

1. Analyze various architectural patterns and reference models used in software engineering
2. Analyze various architectural designs for real time applications
3. Analyze patterns and creational patterns for solving problems
4. Apply various structural design patterns for real time applications.
5. Apply behavioral Design Patterns to Incremental/Iterative Development.

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UNIT-I

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Envisioning Architecture: The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures, and views.

Creating and Architecture: Quality Attributes, Achieving qualities, Architectural styles and Patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

Learning Outcomes: Students will be able to

- Understand the necessity of the Architecture Business Cycle and the importance of Software Architecture.
- Understand software architecture with various reference models.
- Understand documenting software architectures.
- Analyze the Quality Attributes.

Applications:

- Architectures are influenced by
- System stakeholders
- Developing organization
- Experience of the architect

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UNIT-II

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Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM

Moving from One System to Many: Software Product Lines, Building systems from the shelf components, Software architecture in the future.

Learning Outcomes: Students will be able to

- Understand Architecture Evaluation.
- Understand different analysis models.
- Analyze Architecture design decision-making.
- Analyze how software architectures can be used in different software applications.

Applications:
- Analyzing Architecture is influenced by MVC architecture etc.,

UNIT-III

Patterns: Pattern Description, Organizing catalogs, role in solving design problems, Selection, and usage.

Creational Patterns: Abstract factory, Builder, Factory method, Prototype, &Singleton.

Learning Outcomes: Students will be able to
- Understand what the use of design patterns is.
- Analyze how problems can be solved using design patterns.
- Analyze how to use creational design patterns for different problems.
- Evaluate whether the product design can be independent or not.

Applications:
- Selection & Usage of Design patterns can be solved by
- Usage of MVC architecture for developing web applications.

UNIT-IV

Structural Patterns: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, &PROXY.

Learning Outcomes: Students will be able to
- Understand the structure of design patterns.
- Analyze how classes and objects are composed to form large structures.
- Understands the logic of design patterns.

Applications:
- The result is a class that combines the properties of its parent classes. This pattern is particularly useful for making independently developed class librarieswork together.

UNIT-V

Behavioral Patterns: Chain Of Responsibility, Command, Interpreter, State, Strategy, Template Method, &Visitor. The World Wide Web - a case study in Interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in Product line development.

Learning Outcomes: Students will be able to
- Analyze responsibilities between objects of classes.
- Apply complex control flow in applications.
- Analyze various dependencies between objects with respect to classes.

Applications:
- The implementation of various Case Studies can be done by
- Quality of application (for various Real – Time Examples) can be observed in weband desktop applications.

Text Books

1. Software Architecture in Practice, 4th edition, Len Bass , Paul Clements, Rick Kazman , Published by Addison-Wesley Professional (December 15th 2021) - Copyright © 2022.
2. Design Patterns, Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides , Published by Pearson Education, 1January 2008..

Reference Books

1. Beyond Software architecture, Luke Hohmann, Addison Wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.

Subject Code	Subject Name	L	T	P	C
R20CSE-PE4101.2	Advanced Computer Networks (**Professional Elective Courses-3**)	3	0	0	3

Course Objectives:
- To make the addressing mechanisms and address translation familiar to the student.
- To identify the fields in the Packet and their importance.
- Understand the Routing Protocols and their importance.
- Analyze the difference between connection-oriented and connection-less protocols.
- Understand the data transfer applications.

Course Outcomes:
1. Analyze Internet Protocol mechanisms in Mobile IP technology
2. Analyze the Address transition mechanisms for IPv4 to IPv6.
3. Apply routing algorithms on OSPF, RIP, BGP Etc. protocols to effectively manage network routing in both intra-domain and inter-domain contexts.
4. Analyze the functionalities and features Transport Layer Protocols in managing data transmission across networks.
5. Analyze the Various Protocols and their Architecture in the Application Layer

.

Unit 1:

IP Addressing: Address Space, Notations, Class full addressing, Classless addressing, Network Address Translation (NAT). Internet Protocol (IP): Datagram Format, Fragmentation, Options.
ICMPv4: Messages, Debugging Tools, ICMP Checksum,
MobileIP: Addressing, Agents, Three Phases. Inefficiency in MobileIP. Virtual Private Network Technology.
Learning Outcomes: Students will be able to
- Understand the addressing mechanisms. (L2).
- Understand the calculation of CheckSum.(L2)
- Analyze packet format.(L4).

Applications: Conceptual Framework of a Network, ATM, Online reservation systems, and reservation systems.

Unit-2:

IPv6Addressing: Representation, address space, address space allocation, Auto configuration, Renumbering. The transition from IPv4 to IPv6: Dual Stack, Tunneling, Header Translation. IPv6 Protocol: Packet format, Extension Header.
Learning Outcomes: Students will be able to
- Understand the IPV6 addressing. (L2).
- Analyze IPV6 Header fields. (L4).
- Understand the IPV6 format. (L2).

Applications: Addressing mechanisms in real time will be learned.

Unit 3:

Introduction: Inter-domain, Intra-domain Routing. **Routing Algorithms:** Distance Vector Routing, Bellman—Ford algorithm, Link State Routing, Path Vector Routing. Unicast Routing Protocols: Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4(BGP4). Protocols: Multicast Distance Vector (DVMRP), Multicast Link State (MOSPF), Protocol Independent Multicast (PIM).
Learning Outcomes: Students will be able to
- Understand the Network Layer concepts. (L2)
- Understand the types of routing algorithms. (L2)

Applications: Routing techniques in real world.

Unit4:

User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options. SCTP: SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control.

Learning Outcomes: Students will be able to
- Understand the Transport Layer protocols. (L2)
- Understand which protocols are used for Flow Control and Error Control. (L2)

Applications: Used to implement data transfer and collision detection mechanisms.

Unit 5:

World Wide Web and HTTP, FTP, TFTP, e-mail: Architecture, SMTP, POP, email security, MIME, Remote Login: Telnet and SSH.

Learning Outcomes: Students will be able to
- Understand E-mail architecture(L2)
- Understand security in Email.(L2)

Applications: mail transfer and real-time data transfer.

Text Books:
1. TCP/IP Protocol Suite, 4th Edition, Behrouz A. Forouzan, Published By Behrouz A. Forouzan,2010.
2. Inter-Networking with TCP/IP, Volume-1, Sixth Edition, Douglas E.Commer, Published by Pearson publishers,1 Jan 2015.

Reference Books:
1. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education, 2015.
2. Advanced Computer. Network. DT Editorial. B.M.Harwani and. Dreamtech New Delhi- 2014.

Subject Code	Subject Name	L	T	P	C
R20CSE-PE4101.3	Machine Learning (**Professional Elective Courses-3**)	3	0	0	3

Course Objectives:
- To familiarize with a set of well-known supervised unsupervised and semi-supervised learning algorithms.
- The ability to implement some basic machine learning algorithms
- Understanding of how machine learning algorithms are evaluated
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.

Course Outcomes:
1. Understand the characteristics of machine learning, that make it useful to solve real-world Problems.
2. Apply decision tree learning algorithm, to construct decision tree for the given data set.
3. Apply Bayes optimal classifiers, to make decisions that minimize expected loss.
4. Apply Computational learning theory, to generate correct hypothesis.
5. Apply the concept of Computational and instance-based Learning on given data set

<div align="center">UNIT - I:</div>

Introduction: Well- posed learning problems, designing a learning system, Perspectives and issues in machine learning. Applications of machine learning
Concept Learning: Concept learning and the general to specific ordering. Introduction, A concept learning task, Concept learning as search, Find-s: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.
Learning Outcomes: Student will be able to
- Summarize the process of machine learning.(L2)
- Recognize various machine learning Applications.(L1)
- Recognize various steps in machine learning.(L1)
- Understand various candidate elimination algorithms (L2)

<div align="center">UNIT – II</div>

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning
Learning Outcomes: Student will be able to
- Summarize the process of classification.(L2)
- Construct a decision tree for any sample data.(L3)

<div align="center">UNIT – III</div>

Bayesian learning: Bayes theorem, Byes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Bayes optimal classifier, An example learning to classify text, Bayesian belief networks
Learning Outcomes: Student will be able to
- Calculate Bayes probability for any given data(L4)
- Calculate Naïve Bayes probability.((L4)
- Distinguish the process of Bayes and Naïve Bayes probability calculation (L4)

<div align="center">UNIT - IV:</div>

Computational learning theory – 1: Probability learning an approximately correct hypothesis, Sample complexity for infinite Hypothesis spaces, The mistake bound model of learning- Instance- Based learning- Introduction.

Learning Outcomes: Student will be able to

- Understand Probability learning and Instance- Based learning(L2)

UNIT - V

Computational learning theory – 2: K- Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning

Learning Outcomes: Student will be able to

- Understand the concept of classification (L2)
- Distinguish lazy Lazy and Eager Learning.(L4)

Text Books:

1. Tom M. Mitchell, Machine Learning, MGH

Reference Books:

1. Ethem Alpaydin, Introduction to machine learning, 2nd edition, PHI.
2. Kevin P. Murphy, "Machine Learning," A Probabilistic Perspective, MIT Press, 2012

Subject Code	Subject Name	L	T	P	C
R20CSE-PE4102.1	Big Data Analytics (**Professional Elective Courses-4**)	3	0	0	3

Course Objectives:
- Optimize business decisions and create a competitive advantage with Big Data analytics
- Introducing Java concepts required for developing map reduce programs
- Derive business benefits from unstructured data
- Imparting the architectural concepts of Hadoop and introducing map-reduce paradigm
- To introduce programming tools PIG & HIVE in the Hadoop ecosystem.

Course Outcomes:
1. Understands the basic concept of Big Data and challenges in the industry.
2. Apply data modeling techniques on huge data sets.
3. Analyze the concepts of Hadoop components.
4. Implement the business models for Data Streams.
5. Analyze various Bigdata Tools for Predictive Analytics and Visualizations

UNIT-I

Introduction: Introduction to Big data, Introduction to Big Data platform, Characteristics & Classification of Data, Challenges of conventional systems, Intelligent data analysis, The Lifecycle Phases of Big Data Analytics, Types of Big Data Analytics, Analytic processes, and tools, Big Data Industry Applications, Analysis vs. Reporting.

Learning Outcomes: Students will be able to
- Understands the Basic concept of Big Data.
- Understands their challenges in the industry

UNIT-II

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Name node, Data node, Secondary Name node, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), What is NoSQL, Why NoSQL, Use of NoSQL in Industry, Comparison of SQL, NoSQL, and NewSQL, NoSQL Business Drivers, NoSQL Case Studies, NoSQL Data Architectural Patterns.

Learning Outcomes: Students will be able to
- Understand HDFS and its basic building blocks
- Understand NoSQL, Hadoop cluster, and XML files

UNIT III

Introduction to Hadoop: why Hadoop, RDBMS versus Hadoop, History of Hadoop, Components of Hadoop, Hadoop Distributed File System (HDFS), Processing Data with Hadoop, How Map Reduce Works, Anatomy of a Map Reduce Job run, Map Reduce Types and Formats, Map Reduce Features Hadoop environment. Interacting with Hadoop Ecosystem, HDFS Limitations.

Learning Outcomes: Students will be able to
- Understand and implement Hadoop Components.
- Understand the Concept of Interacting with the Hadoop Ecosystem.

UNIT IV

Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Examples of Data stream applications, Stream Computing, stream queries, issues in data stream query processing, Sampling Data in a Stream, Real-time

Analytics Platform (RTAP) Applications, Case Studies – Real-Time Sentiment Analysis - Stock Market Predictions.

Learning Outcomes: student will be able to
- Understand Hadoop for Stream Processing Framework.
- Apply Real time Analytics Platform.

UNIT-V

Frameworks and Applications: Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive Architecture of Hive, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and Zookeeper. Predictive Analytics and Visualizations.

Learning Outcomes: Students will be able to
- Understand programming tools PIG & HIVE in the Hadoop echo system.
- Creating a complete business data analytic solution.

Text Books:

1. Big Data Analytics 2nd Edition, Seema Acharya, Subhashini Chellappan, Wiley IndiaPvt. Ltd, Second Edition,1Jan 2019.
2. Big Java 4th Edition, Cay Horstman, Wiley John Wiley & Sons,INC, by Wiley
3. India Pvt. Ltd, 2008.
4. Hadoop: The Definitive Guide by Tom White, 3rd Edition,O'Reilly,12 June 2012.

Reference Books:

1. Hadoop in Practice by Alex Holmes, MANNING Publ, Second Edition,5 Feb 2015.
2. Hadoop Map Reduce Cookbook, Srinath Perera, Thilina Gunarathne, Ingram short title, 1 Jan 2013.
3. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,BruceBrown, Rafael Coss, by For Dummies, First Edition,7 May 2014.

Software Links:
1. Hadoop:http://hadoop.apache.org/
2. Hive:https://cwiki.apache.org/confluence/display/Hive/Home
3. Piglatin:http://pig.apache.org/docs/r0.7.0/tutorial.html

Subject Code	Subject Name	L	T	P	C
R20CSE-PE4102.2	Advanced Computer Architecture (**Professional Elective Courses-4**)	3	0	0	3

Course Objective:
- Understand the Concept of Parallel Processing and its applications.
- Implement the Hardware for Arithmetic Operations.
- Analyze the performance of different scalar Computers.
- Develop the Pipelining Concept for a given set of Instructions.
- Distinguish the performance of pipelining and non-pipelining environments in a processor.

Course Outcomes:
1. After the completion of the course, the students will be able to know the types of computer, and new trends and developments in computerarchitecture.
2. Understand pipelining, instruction set architectures, and memory addressing.
3. Understand exploiting ILP using dynamic scheduling, multiple issue, and speculation.
4. Understand the various techniques to enhance a processor's ability to exploit Instruction-level parallelism (ILP) and its challenges.
5. Understand multithreading by using ILP and supporting thread-level parallelism (TLP).

UNIT I:

Fundamentals of Computer Design- Fundamentals of Computer design, Changing faces of computing and the task of computer designer, Technology trends, Cost price, and their trends, Measuring and reporting performance, Quantitative principles of computer design, Amdahl's law, Instruction set principles and examples- Introduction, Classifying instruction set- Memory addressing- type and size of operands, Operations in the instruction set.

Learning Outcomes: student will be able to
- To understand the structure, function and characteristics of computer systems.

UNIT II:

Pipelines- Introduction, Basic RISC instruction set, Simple implementation of RISC instruction set, Classic five-stage pipelined RISC processor, Basic performance issues in pipelining, Pipeline hazards, Reducing pipeline branch penalties,
Memory Hierarchy Design- Introduction, Review of ABC of cache, Cache performance, Reducing cache miss penalty, Virtual memory.

Learning Outcomes: student will be able to
- To understand the design of the various functional units and components of computers.

UNIT III:

Instruction Level Parallelism the Hardware Approach: Instruction-Level parallelism, dynamic scheduling, dynamic scheduling using Tomasulo's approach, Branch prediction, high-performance instruction delivery- hardware-based speculation.

Learning Outcomes: student will be able to
- To identify the elements of modern instructions sets and their impact on processor design.

UNIT IV:

ILP Software: Approach Basic compiler level techniques, Static branch prediction, VLIW approach, Exploiting ILP, and Parallelism at compile time, Cross-cutting issues - Hardware versus Software.

Learning Outcomes: student will be able to

- To explain the function of each element of a memory hierarchy,

UNIT V:

Multi Processors and Thread Level Parallelism: Multi Processors and Thread level Parallelism- Introduction, Characteristics of the Application domain, Systematic shared memory architecture, Distributed shared – memory architecture, Synchronization,

Interconnection and Networks- Introduction, Interconnection network media, Practical issues in Interconnecting networks, Examples of interconnection, Cluster, Designing of clusters,

Intel Architecture- Intel IA-64 ILP in embedded and mobile markets Fallacies and pitfalls.

Learning Outcomes: Students will be able to

- To identify and compare different methods for computer I/O.

Text Books:

1. John L. Hennessy, David A. Patterson – Computer Architecture: A Quantitative Approach, 5rd Edition, An Imprint of Elsevier,23 Nov 2017.

References:

2. John P. Shen and Miikko H. Lipasti – Modern Processor Design , Waveland Press, Inc., 1st edition ,July 30, 2013.
3. Fundamentals of Super Scalar Processors,Jhon paul shen, Waveland Pr Inc; Reprint Edition, 12 Aug 2013.
4. Computer Architecture and Parallel Processing – Kai Hwang, Faye A.Brigs.,MC Graw Hill, McGraw-Hill Inc.US ,1 Dec 1984.
5. Advanced Computer Architecture – A Design Space Approach – Dezso Sima,Terence Fountain, Peter Kacsuk , Addison-Wesley; 1st Edition,10 June 1997.

Subject Code	Subject Name	L	T	P	C
R20CSE-PE4102	Mobile Computing (**Professional Elective Courses-4**)	3	0	0	3

Course Objectives:
- To make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
- To understand the typical mobile networking infrastructure through a popular GSM protocol
- To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer
- To understand the database issues in mobile environments & data delivery models.
- To understand the ad hoc networks and related concepts and platforms and protocols used in mobile environment.

Course Outcomes:
1. Understand the basic knowledge of mobile communication concepts.
2. Understand network layers in mobile computing and each layer description.
3. Understand the Mobile IP role in the mobile communications.
4. Understand the role of mobile TCP in mobile communications
5. . Identify a suitable protocol for corresponding mobile network scenario implementation in network layer or transport layer.

UNIT I

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.

GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization and Calling, Handover, Security, New Data Services, GPRS.

Learning Outcome:
- Student able to understand the basic concepts of mobile communications and GSM

UNIT –II

(Wireless) Medium Access Control (MAC) : Motivation for a specialized MAC (Hidden and exposed Terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)

Learning Outcome:
- Student able to differentiate the SDMA, FDMA, TDMA and CDMA.

UNIT –III

Mobile Network Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunnelling and Encapsulation, Route Optimization, DHCP.

Learning Outcome:
- Student able to explain the Mobile IP in mobile networks.

UNIT –IV

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, and Other Transport Layer Protocols for Mobile Networks.

Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process & QoS Issues.

Learning Outcome:
- Student able to understand the issues of databases and Mobile TCP/IP in mobile networks.

UNIT V

Mobile Ad hoc Networks (MANETs) : Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery.

Protocols and Platforms for Mobile Computing: WAP, Bluetooth, XML, J2ME, Java Card, PalmOS, Windows CE, Symbian OS, Linux for Mobile Devices, Android.

Learning Outcomes:
- Student able to identify the best routing protocol for mobile networks for data transmission.

Text Books:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition,by Pearson Publishers, 2009.
2. Raj Kamal, "Mobile Computing", Oxford University Press,First Edition, 29 March 2007.

Reference Books:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing,Technology
2. Applications and Service Creation" Second Edition, Mc Graw Hill,1 July 2017.
3. UWE Hansmann, Lother Merk, Martin S. Nocklous, Thomas Stober, "Principles ofMobile Computing," Second Edition,Published by Dreamtech Press; 1 Jan 2006.

Subject Code	Subject Name	L	T	P	C
R20CSE-PE4103.1	Cloud Computing (Professional Elective Courses-5)	3	0	0	3

Course Objectives:
- Cloud Computing is a large-scale distributed computing paradigm which has become a driving force for information technology over the past several years.
- This course introduces cloud computing technology to undergraduate engineering students, so they can learn, apply and use this technology in their future careers.

Course Outcomes: Upon completion of the course, it is expected that student will be able to:
1. Understand Possible threats and attacks on data in network security.
2. Analyze various symmetric key cryptographic algorithms.
3. Analyze various Asymmetric key cryptographic algorithms.
4. Understand various hashing, key management, and digital signature techniques.
5. Analyze various security protocols in different OSI layers..

UNIT-I:
Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.
Learning Outcomes: Student should be able to
- Memorize the various paradigms of computing models.
- Tabulate the various computing models with other models.
- Memorize the need of other computing models for cloud computing.

UNIT-II:
Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud Computing, Cloud Computing is a Service, Cloud Computing is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models
Learning Outcomes: Student should be able to
- Understand the cloud fundamentals.
- Understand the motivation behind the cloud computing

UNIT-III:
Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud Application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.
Learning Outcomes: Student should be able to
- Understand the Architecture of cloud computing
- Understand the Migration of cloud.
- Understand the cloud applications with respect to the migration of cloud.

UNIT-IV:
Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.
Learning Outcomes: Student should be able to
- Understand the cloud service models.

- Gather the cloud service providers in the market

UNIT-V:

Cloud Providers and Applications: EMC, EMC IT, Captiva Cloud Toolkit, Google Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rackspace, VMware, Manjra soft, Aneka Platform**.**

Learning Outcomes: Student should be able to
- Summarize the cloud service providers and its services.
- Summarize the services of each cloud service provider.

Text Book:

1. Essentials of Cloud Computing, K. Chandra sekharan, CRC press, First Edition, 5 Dec 2014

Reference Books:

1. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Published by Wiley,1st Edition, 1 Jan 2013.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, Published by Morgan Kaufmann; 1st Edition, 18 Dec 2013.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, Published by O'Reilly Media; 1st Edition ,4 Sept 2009.

Subject Code	Subject Name	L	T	P	C
R20CSE-PE4103.2	Cryptography & Network Security (**Professional Elective Courses-5**)	3	0	0	3

Course Objectives:
- Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers) are Introduced.
- Introduction to Public-key cryptography (RSA, discrete logarithms) is provided.
- Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, key management, key exchange, signature schemes are learnt.
- An overview of e-mail and web security is provided.
- An overview of viruses, firewalls and system security is provided.

Course Outcomes:
1. Understand Possible threats and attacks on data in network security.
2. Analyze various symmetric key cryptographic algorithms.
3. Analyze various Asymmetric key cryptographic algorithms.
4. Understand various hashing, key management, and digital signature techniques.
5.Analyze various security protocols in different OSI layers..
1. .

UNIT- I:
Basic Principles Security   Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography

Learning Outcomes:
After Completion of this unit, student will be able to
- Understand what is meant by Cryptography
- Understand the goals, mechanisms and services of Cryptography.

UNIT- II:
Symmetric Encryption Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard. **Learning Outcomes:**
After Completion of this unit, student will be able to
- Understand symmetric key Cryptography
- Analyze the various algorithms of Symmetric key Cryptography

UNIT- III:
Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography

Learning Outcomes:
After Completion of this unit, student will be able to
- Understand symmetric key Cryptography
- Analyse the various algorithms of Asymmetric key Cryptography

UNIT- IV:
Data Integrity, Digital Signature Schemes & Key Management Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signature, Key Management.

Learning Outcomes:
After Completion of this unit, student will be able to
- Understand about Digital Signature and the security schemes.
- Understand the Hash functions and its importance

UNIT -V:

Network Security: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, IPSec, System Security.

Learning Outcomes:

After Completion of this unit, student will be able to

- Understand email-security.
- Understand the mechanisms of Transport Layer Security.
- Understand about system security.

Text Books:

1. Cryptography and Network Security, Behrouz A Forouzan, DebdeepMukhopadhyay, 3rd Edition, Mc Graw Hill,11 Feb 2007.
2. Cryptography and Network Security, William Stallings, 6th Edition,Published by Pearson, 2014 april.
3. Everyday Cryptography, Keith M.Martin, Oxford,2nd Edition,Aug 2017.

Reference Books:

1. Network Security and Cryptography, Bernard Meneges, Cengage Learning,2010

Subject Code	Subject Name	L	T	P	C
R20CSE-PE4103.3	Software Project Management **(Professional Elective Courses-5)**	3	0	0	3

Course Objectives:
- Plan and manage projects at each stage of the software development life cycle (SDLC)
- Train software project managers and other individuals involved in software project planning and tracking.
- Understand successful software projects that support organization's strategic goals
- Provides an oversight in the implementation of the software project management process.

Course Outcomes:
1. Identify the theoretical and methodological issues involved in modern software project management.
2. Identify the project goals, constraints, deliverables, performance criteria, control needs and requirements in consultation with stakeholders for choosing the proper project
3. Analyze cost-benefit among projects, by estimating project cost and duration.
4. Analyze outcomes of risk management plans
5. Categorize and use project management frameworks that ensure successful outcomes.

Unit I:

Introduction Project Management: Software Project Management activities, Challenges in software projects, Stakeholders, Objectives & goals. Project Planning: Step-wise planning, Project Scope, Project Products & deliverables, Project activities, Effort estimation, Infrastructure.

Learning Outcomes:
Student will be able to
- Plan software projects, including risk and quality management.(L2)
- Recognize the importance of aligning the strategic direction of an organization with project selection.(L1)

Unit II:

Project Approach Lifecycle models, Choosing Technology, Prototyping Iterative &incremental Process Framework: Lifecycle phases, Process Artifacts, Process workflows **Learning Outcomes:**
Student will be able to
- Analyze the software estimate using various technologies
- Applying process models in required fields of project
- documenting software development project plans

Unit III:

Effort estimation & activity Planning Estimation techniques, Function Point analysis, SLOC, COCOMO, Use case-based estimation , Activity Identification Approaches, Network planning models, Critical path analysis

Learning Outcomes:
Student will be able to
- Estimate software development size, effort, and schedule for new program proposals or enhancements to existing programs (L3)
- Analyze the software estimate (L4)
- Develop metrics on a software development program (L3)

<div align="center">**Unit IV:**</div>

Risk Management Risk categories, Identification, Assessment, Planning and management, PERT technique, Monte Carlo approach

Learning Outcomes:

Student will be able to

- Assess and control risk engineering.(L3)
- Evaluate performance using PERT technique.(L4)

<div align="center">**Unit V:**</div>

Project Monitoring & Control , Resource Allocation Creating a framework for monitoring & control, Progress monitoring, Cost monitoring, Earned value Analysis, Defects Tracking, Issues Tracking, Status reports, Types of Resources, Identifying resource requirements, Resource scheduling

Learning Outcomes: Student will be able to

- Manage cost and schedules.(L3)
- Manage both the technical and socio-cultural aspects of the project.(L3)

Applications: For all software's.

<div align="center">**Text Books**</div>

1. Software Project Management, Bob Hughes & Mike Cotterell, TATA Mcgraw-Hill
2. Software Project Management, Walker Royce: Pearson Education, 2005.
3. Software Project Management in practice, Pankaj Jalote, Pearson.

<div align="center">**Reference Book:**</div>

1. Software Project Management, Joel Henry, Pearson Education.

Subject Code	Subject Name	L	T	P	C
R20ECE-OE4101	Fundamentals of Digital Image Processing (**Open Elective Courses/ Job Oriented Elective-3**)	3	0	0	3

Course Objectives:
- The objective of this course is to
- Comprehend the relation between human visual system and machine perception and processing of digital images.
- Provide a detailed approach towards image processing applications like enhancement, segmentation, and compression.

Course Outcomes:
1. Describe the fundamental concepts of digital image processing.
2. Apply the spatial domain and frequency domain image enhancement techniques on images.
3. Analyze the image degradation models and employ various restoration techniques on images.
4. Analyze the image segmentation and morphological image processing techniques on images.
5. Understand and apply various image compression techniques

UNIT - I

Digital Image Fundamentals: Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.

Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

Learning outcomes: Student should be able to
- understand the basic concepts of digital image.
- compare various types of image transform.

UNIT - II

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighbourhood criterion, Median Filter, Spatial Domain High-Pass Filtering.

Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) And High Pass (Sharpening) Filters in Frequency Domain.

Learning outcomes: Student should be able to
- Understand the various process of image enhancement properties.
- Analyze spatial &frequency domain image filtering techniques

UNIT - III

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

Learning outcomes: Student should be able to
- Explain the image restoration model.
- Apply the restoration techniques on degraded image.

UNIT – IV

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, thresholding, Region Oriented Segmentation.

Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss transformation.

Learning outcomes: Student should be able to

- Understand various edge linking techniques.
- Explain the basic morphological operation techniques.

UNIT - V

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000Standards.

Learning outcomes: Student should be able to
- Define the compression ratio, redundancies.
- Compare the various types of compression coding techniques.

Text Books:

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson.
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- MC GRAW HILL EDUCATION.

References:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIPTools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L.Eddings, 2nd Edition, MC GRAW HILL EDUCATION, 2010.
3. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indianedition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, 2008,2 nd Edition.

Subject Code	Subject Name	L	T	P	C
R20ECE-OE4102	Basics of Embedded Systems (Open Elective Courses/ Job Oriented Elective-3)	3	0	0	3

Course Objectives:
- To introduce major components of an embedded system
- To introduce 8-bit micro controller architecture
- Understand OS basics and process scheduling.
- Learn task communication and synchronization
- Understand Embedded Product Development life cycle

Course Outcomes:
1. Understandthe basic knowledgeof embedded systems. (L2)
2. Analyzearchitectureofmicrocontroller.(L4)
3. Apply various preemptive and non-preemptive task scheduling algorithms in the development of embedded system's OS.
4. Apply various communication mechanisms for inter process communication and various task synchronization techniques for inter process communication in real time operating systems.
5. Understands knowledge on Embedded Product Development life cycle and embedded systems development tools.

<div align="center">Unit-I:</div>

What is an embedded system Vs. General computing system, history, classification, major application areas, and purpose of embedded systems. Core of embedded system, memory, sensors and actuators, communication interface, embedded firmware, other system components.

Learning Outcomes: Student should be able to.
- Differentiate embedded system and general computing system (L3)
- Classify embedded systems based on performance, complexity and era in which they are evolved. (L3)
- Discuss basic hardware and software units used in embedded systems. (L2)

<div align="center">Unit -II:</div>

8-bit microcontrollers architecture: Characteristics, quality attributes application specific. Factors to be considered in selecting a controller, 8051 architecture, memory organization, registers, oscillator unit, ports, source current, sinking current, design examples.

Learning outcomes: Student should be able to
- Analyse processor architectures (L4)
- Select a processor for embedded system development (L5)

<div align="center">Unit –III:</div>

RTOS and Scheduling, Operating basics, types, RTOS, tasks, process and threads, multiprocessing and multitasking, types of multitasking, non pre-emptive, pre-emptive scheduling.

Learning Outcomes: Student should be able to.
- Differentiate multitasking and multiprocessing.(L3)
- Analyze process scheduling (L4)

<div align="center">Unit -IV:</div>

Task communication of RTOS, Shared memory, pipes, memory mapped objects, message passing, message queue, mailbox, signalling, RPC and sockets, task communication/synchronization issues, racing, deadlock, live lock, the dining philosopher's problem. The producer-consumer problem, Priority Inversion, Priority ceiling, Task Synchronization techniques, busy waiting, sleep and wakery, semaphore, mutex, critical section objects.

Learning Outcomes: Student should be able to.
- Acquire knowledge on task communication techniques (L2)
- Analyze task synchronization. (L4)

Unit -V:
Simulators, emulators, Debuggers, Embedded Product Development life cycle (EDLC), Trends in embedded Industry.

Learning Outcomes: Student should be able to.
- Use tools for Embedded Software development(L3)
- Acquire knowledge on EDLC (L2)

Text Books:
1. Introduction to embedded systems Shibu.K.V, TMH, 2009.
2. Embedded Software Primer, David Simon, Pearson.

References:
1. Ayala & Gadre: The 8051 Microcontroller & Embedded Systems using Assembly and C,CENGAGE.
2. Embedded Systems, Rajkamal, TMH, 2009.
3. The 8051 Microcontroller and Embedded Systems, Mazidi, Pearson.

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Subject Code	Subject Name	L	T	P	C
R20CSE-OE4101	Software Testing Methodologies (**Open Elective Courses/ Job Oriented Elective-3**)	3	0	0	3

Course Objectives:

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
- To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
- To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.
- To gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects.

Course Outcomes:

Understand and apply Software Testing Knowledge.

1. Analyze and design to conduct a software test process.
2. Understanding of various software testing problems and able to design the solutions.
3. Apply knowledge to design the test cases effectively and ensure the quality of the product.
4. Apply knowledge to use modern software testing tools

Unit I:

Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, Definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, relating test life cycle to development life cycle Software Testing Methodology

Verification and Validation: Verification & Validation Activities, Verification of Requirements, High level and low level designs, How to verify code, Validation **Learning Outcomes:**

By the end of the unit student can be able to

- Understand the purpose of Testing (L2)
- Apply software testing knowledge and engineering methods.(L3)
- Verify and validate the test process (L5

Unit II:

Dynamic Testing I: Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing

Dynamic Testing II: White-Box Testing: need, Logic coverage criteria, Basis path testing, Graph matrices, Loop testing, data flow testing, mutation testing

Static Testing: inspections, Structured Walk throughs, Technical reviews

Learning Outcomes:

By the end of the unit student can be able to

- Design test cases using black box testing techniques (L6)
- Design test cases using white box testing techniques (L6

Unit III:

Validation activities: Unit testing, Integration Testing. Function testing, system testing, acceptance testing Regression testing: Progressives Vs regressive testing, Objectives of

regression testing, When regression testing done?, Regression testing types.

Learning Outcomes:

By the end of the unit student can be able to

- Design the test cases for regression testing. (L6)
- Perform system testing. (L5)

Unit IV:

Efficient Test Suite Management: Test case deisgn Why does a test suite grow, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuringthe effectiveness of a prioritized test suite.

Software Quality Management: Software Quality metrics, SQA models

Debugging: process, techniques, correcting bugs, Basics of testing management tools, test link and Jira

Learning Outcomes:

By the end of the unit student can be able to

- Design the test suite effectively (L6)
- Define the quality metrics for the testing process (L1)

Unit V:

Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools, selenium tool.

Testing Web based Systems: Challenges in testing for web based software, quality aspects, web engineering, testing of web based systems, Testing mobile systems

Learning Outcomes:

By the end of the unit student can be able to

- Automate the testing process. (L3)
- Perform testing for web based systems. (L5)

Text Books:

1. Software Testing, Principles and Practices, Naresh Chauhan, Oxford
2. Foundations of Software testing, Aditya P Mathur, 2nd, Pearson
3. Software Testing- Yogesh Singh, CAMBRIDGE

Reference books:

1. Software testing techniques – Baris Beizer, International Thomson computer press, second edition.
2. Software Testing, Principles, techniques and Tools, M G Limaye, TMH
3. Effective Methods for Software testing, Willian E Perry, 3ed, Wiley

Subject Code	Subject Name	L	T	P	C
R20CSE-OE4102	Scripting Languages (**Open Elective Courses/ Job Oriented Elective-4**)	3	0	0	3

Course Objectives:
- Understanding Linux Shell Scripting functionalities.
- Implementing TCL/TK scripting for network simulation.
- Understanding basic operations of perl programming.
- Working with Server side scripting through PHP Programming.
- Writing ruby scripts for building objects.

Course Outcomes:
1. Implementing Linux Shell Scripts for handling processes.
2. Implement TCL/TK Scripts for writing complex network simulations.
3. Understand basics of perl for running scripts dynamically.
4. Implementing server-side scripts for handling client requests.
5. Create simple ruby scripts for developing model objects.

Unit -I:

Shell Scripting: What is Scripting, Determining the shell, She-bang, Comment,Variables, Sourcing a File, Troubleshooting a Script, Prevent setuid root Spoofing, Executing Shell Script, Shell Script Parameters, Shell Shift Parameters, Shell Sourcing Config File, Shell Getopts Options, Loops, if then else,if then elif, for loop,while loop, until loop, Advance Shell, Function, case, eval, Let

Learning Outcomes: student will be able to
- Understand basics of Shell Scripting.(L2)
- Write Configuration file for running processes. (L4)
- Create advanced shell operations for controlling complex processes. (L4)

Unit -II:

TCL/Tk Scripting: Introduction to TCL/Tk, Execution of command, Arguments, Command & Backslash substitution, Expressions (expr), Flow control, Lists, Arrays, String manipulation, Regular expressions, Generating & parsing strings, Procedures - extending Tcl, eval, package, File I/O in Tcl, Treating errors, Script files.Tk Library: Tk widget commands, Tk widget set, Resource (options) management, Geometry managers, Bindings, Send command and Hypertools

Learning Outcomes: Student will be able to
- Understand the basic functionalities of TCL/TK Scripting. (L2).
- Implement Regular expressions for parsing different data formats.(L4).
- Implement TK Widget set for script files. (L4)

Unit -III:

Perl Scripting: Introduction to Perl Scripting, working with simple values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting, References & Subroutines, Running and Debugging Perl, Modules, Object – Oriented Perl.

Learning Outcomes: Student will be able to
- Understand the basics of perl programming.(L2)
- Implement Data Processing using Perl regular expressions. L4)
- Understand Object oriented approach using perl classes. (L2)

Unit-IV:

Server Side Scripting: PHP introduction. Basic PHP Syntax, Comments in PHP, Variables, PHP Operators, Control Structures(If else, switch, all loops), Arrays, For Each Loop, Functions, Form Handling, PHP $_GET, PHP $_POST, PHP $_REQUEST, PHP date

Function, PHP include File, File Handling, File Uploading, PHP Sessions, Sending Emails, PHP Cookies, Working with databases.

Learning Outcomes: Student will be able to
- Understand the advantages of server-side scripting for handling requests. (L2)
- Create request-response scripting using sessions and cookies. (L4)
- Create database operations with PHP for secure data storage. (L4)

Unit -V:

Ruby Scripting: Data Types & Variables, String, Integer, Float, Boolean and Nil values, Properties of Ruby data types, Instance variables, Local & Global variables, Functions & Control Flow, Built-in functions, Creating your own functions, Passing arguments and returning values If/Else and Unless Statements, While/Until Loops, Ruby Data Structures Arrays, Hashes, Enumerators, Iterators, Classes, Creating classes, Inheritance, Class Methods, Overriding Methods

Learning Outcomes: Student will be able to
- Understand the fundamentals of Ruby scripts. (L2)
- Write functions for handling complex data structures. (L4)
- Create classes for introspecting real time objects. (L4)

Applications:
- Multimedia applications.
- Gaming and Monetisation.
- Web and Enterprise Applications.
- Web Scraping
- Data Science and Visualization.

Text Books:

1. Learning Perl – 8th Ed. Randal Schwartz, Tom Phoenix and Brain D Foy. 2021.
2. "Beginning PHP", Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi, Wiley Publishing, In feb 2005
3. The Ruby Programming Language: Everything You Need to Know by David Flanagan and Yukihiro Matsumoto .19 feb2008
4. Classic Shell Scripting by Arnold Robbins and Nelson H.F. Beebe .1st edition
5. Tcl and Tk Programming for the Absolute Beginner by Kurt Wall 2007 1st edition.

Reference Books:

1. Teach Yorself Perl in 21 days by David Till.
2. Perl in 24 Hours – 3rd Ed., Clinton Pierce, 2005, Sams Publishing.
3. PowerShell Cookbook: Your Complete Guide to Scripting the Ubiquitous Object-Based Shell by Lee Holmes.
4. Programming Perl: Unmatched power for text processing and scripting by Tom Christiansen, brian d foy, et al.

Subject Code	Subject Name	L	T	P	C
R20MEC-OE4101	Robotics **(Open Elective Courses/ Job Oriented Elective-4)**	3	0	0	3

Course Objectives:
- To provide an understanding of the history, classifications, and applications of robots
- To introduce the kinematics and position analysis of robots as mechanisms
- To explore different types of actuators and sensors used in robotics
- To introduce the control systems and control actions used in robotics
- To provide knowledge on the selection of robots based on different factors

Course Outcomes:

After completion of the course, the student will be able to:

1. **Understand** classification of Robots (L1)
2. **Identify** and use different types of actuators in robotics (L3)
3. **Analyze** the different sensors and their use in Robotics (L3)
4. **Explain** the control systems for robots (L2)
5. **Evaluate** robot performance testing methodologies. (L4)

UNIT 1:

Introduction to Robotics: Historical Perspective-Specifications of Robots- Classifications of robots, Applications of Robots. Robotics Kinematics, Position Analysis, Robotic Mechanisms

Learning Outcomes:
- **Define** key terms in robotics, such as specifications, classifications, and applications of robots. (L1)
- **Explain** the historical perspective of robotics, key milestones (L2)
- **Identify** different types of robotic mechanisms (L3)

UNIT 2:

Actuators: Characteristics of Actuating Systems, Actuating Devices and Control, Use of Reduction Gears, Comparison of Hydraulic, Electric, Pneumatic Actuators, Hydraulic Actuators.

Learning Outcomes:
- **List** examples of applications where hydraulic actuators are commonly used (L1)
- **Summarize** the key factors to consider when selecting an actuator for a particular application (L2)
- **Design** a system that uses a specific type of actuator to achieve a desired motion or force output (L3)

UNIT 3:

Sensors: Sensor Characteristics, Description of Different Sensors, Vision Sensors, Force Sensors, Proximity Sensors, Tilt Sensors

Learning Outcomes:
- **Identify** the different types of sensors based on their applications (L1)
- **Illustrate** the impact of sensor accuracy on system performance (L2)
- **Solve** problems related to calibration and sensitivity of sensors (L3)

UNIT 4:

Robot Controls: Point to Point Control, Continuous Path Control, Intelligent Robot, Control System for Robot Joint, Control Actions, Feedback Devices

Learning Outcomes:

- **Recall** the different types of feedback devices used in robot control. (L1)
- **Explain** the concept of joint control in robot motion. (L2)
- **Analyze** the advantages and disadvantages of point-to-point control versus continuous path control for a given robotic application. (L4)

UNIT 5:

Selection of Robot: Factors influencing the choice of a robot, robot performance testing, economics of robotization, Impact of robot on industry and society

Learning Outcomes:
- **Discuss** the potential benefits and drawbacks of using robots in different fields (L2)
- **Select** appropriate robots for different applications (L3)
- **Evaluate** the effectiveness of different robot performance testing methods (L4)

Textbooks:
1. Saeed B. Niku, Introduction to Robotics Analysis, Application, Pearson Education Asia, 1st Edition, 2001.
2. Vijay Madisetti and Arshdeep Bahga, Internet of Things - A Hands-on Approach, First Edition, University Press,1st Edition, 2015.

References:
1. "Robotics: Modelling, Planning and Control" by Bruno Siciliano and Lorenzo Sciavicco, 2nd Edition, 2001.
2. "Introduction to Autonomous Robots" by Nikolaus Correll, Bradley Hayes, and Adam Klaptocz, 2020.
3. "Robotics and Control" by M.V. Subramanyam, 2nd Edition, 2018.
4. "Robot Mechanisms and Mechanical Devices Illustrated" by Paul E. Sandin, 2003.
5. "Industrial Robotics: Technology, Programming, and Applications" by Mikell P. Groover and Mitchell Weiss, 1st Edition, 1986.

Subject Code	Subject Name	L	T	P	C
R20BSH-OE4101	Operations Research (**Open Elective Courses/ Job Oriented Elective-4**)	3	0	0	3

Course Objectives:
- To impart the basic concepts of the operations research to solve the real world problems.
- To solve the data science problems using Non-linear programming
- To apply the dynamic programming methods in the field of computer science and allied subjects.
- Apply Queuing theory to solve problem of the real world problems like traffic congestion, counters in banks, railway bookings,etc..
- To enlighten the learners with project management techniques that help in planning and scheduling a project.

Course Outcomes:
At the end of the course, the student will be able to
1. develop mathematical models for practical problems. (L3)
2. understand the basics of Non-linear programming. (L2)
3. apply the dynamic programming methods to real world situations (L3)
4. apply queuing theory to solve problems of traffic congestion, counters in banks, railway bookings. (L3)
    5. Apply CPM, PERT techniques to solve the problems of networks and graphs

UNIT I (9 hours)

Introduction to Operations Research (Review only): Operation Research (OR) definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models

Linear Programming(LP): Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two–Phase Simplex Method, LPP- Degeneracy, Concept of duality, Dual and simplex method.

Learning Outcomes:
At the end of this unit, the student will be able to
- formulate practical problems given in words into a mathematical model. (L2)
- quantify OR models to solve optimization problems. (L3)
- formulate linear programming problems and appreciate their limitations.(L2)

UNIT II (9 hours)

Non-linear Programming: Jacobian, hessian, convex sets, convex functions and its properties (Review only), Unconstrained and Constrained optimization, Lagrangean Method, Kuhn-Tucker Conditions, Quadratic programming.

Learning Outcomes:
At the end of the this unit, the student will be able to
- solve problems using Non-linear programming. (L3)
- apply optimality conditions for single- and multiple-variable constrained and unconstrained nonlinear optimization problems. (L3)

UNIT III (12 hours)

Dynamic programming: Characteristics of dynamic programming, Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.

Learning Outcomes:
At the end of this unit, the student will be able to
•   identify the characteristics of dynamic progamming. (L2)

- solve problems using dynamic programming. (L3)

UNIT IV (9 hours)

Queuing Theory: Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non finite queue length.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of queuing theory
- model a dynamic system as a queuing model to compute performance measures. (L3)

UNIT V (9 hours)

Network Models: Introduction, Phases of Project Management, Guidelines for Network Construction, Critical Path Method (CPM), Project Evaluation and Review Technique (PERT).

Learning Outcomes:

At the end of this unit, the student will be able to

- understand phases of project management (L3)
- develop the skills how to construct network by CPM&PERT (L3)

Text books:

1. Sharma S.D., Operations Research: Theory, Methods and Applications, 15th Edition, KedarNath Ram Nath, 2010.

Reference books:

1. Taha H.A., Operations Research, 9th Edition, Prentice Hall of India, New Delhi, 2010.
2. Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7th Edition, Tata McGraw Hill, 2010.
3. Sharma J.K., Operations Research: Theory and Applications, 4th Edition, Laxmi Publications, 2009.
4. Premkumar Gupta and Hira, Operations Research, 3rd Edition, S Chand Company Ltd., New Delhi, 2003.
5. Pannerselvam R., Operations Research, 2nd Edition, Pentice Hall of India, New Delhi, 2006.
6. Sundaresan.V, and Ganapathy Subramanian. K. S, Resource Management Techniques: Operations Research, A.R Publications, 2015.
7. S.S.Rao, Engineering Optimization-Theory and Practice, Wiley publications,
8. B.S Grewal, Higher Engineering Mathematics, 42nd edition, khanna publications, 2012.
9. Hiller F S and Lieberman G J, Introduction to operations research, 7th edition, McGraw-Hill (2001).
10. Srinivasan G., Operations research: Principles and applications, 1st edition, Prentice (2010).

Subject Code	Subject Name	L	T	P	C
R20BSH-HM4101	Universal Human Values-2:Understanding Harmony	3	0	0	3

Course Objectives:
- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.(L3)
- Relate the harmony in the human being, family, society and nature/existence(L4)
- Outline and strengthening of self-reflection.(L2)
- Improvement of commitment and courage to act.(L5)
- Integrate the humanistic constitution and humanistic universal order.(L2)

Course Outcomes: At the end of the course, student will able to
1. Apply elements and process of value education to live happy life
2. Develop thoughts, emotions, physical sensations of the self & body and harmonizing their Inter and Intra relations.
3. Analyze human relations and their role in ensuring harmonious family and society
4. Analyze the holistic perceptions of harmony in existence with reference to nature
5. .Develop professional ethics with universal human values and holistic technologies

UNIT-I :

Introduction to Value Education: Understanding Value Education- Self-exploration as the Process for Value Education- Continuous Happiness and Prosperity – Basic Human Aspirations- Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario.

Learning Outcomes:
- Apply Human values to balance their life and profession (L3)
- Identify and incorporate the levels of human values(L2)

Application:
- Natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

UNIT-II:

Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body- Distinguishing between the Needs of the Self and the Body-The Body as an Instrument of the Self -Understanding Harmony in the Self - Harmony of the Self with the Body.

Learning Outcomes:
- Distinguish physical facilities the self and body (L4)
- Related to proper upkeep of the body and practice them in their daily routine. (L2)

Application:
- Differentiate between prosperity and accumulation.
- Discuss program for ensuring health vs dealing with disease

UNIT-III:

Harmony in the Family and Society: Harmony in the Family –Basic Unit of Human Interaction - Values in Human-to-Human Relationship - 'Trust' – Foundational Value in Relationship-'Respect'–Right Evaluation -Understanding Harmony in the Society -Vision for the Universal Human Order.

Learning Outcomes:
- Interpreting Natural acceptance is always for living in harmony(L2)
- Exemplifying Right evaluation leads to fulfillment in relationship(L3)

Application:
- Reflect on relationships in family, hostel and institute as extended family, real life

examples, teacher-student relationship, goal of education etc., Gratitude as a universalvalue in relationships.

UNIT-IV:

Harmony in the Nature/Existence: Understanding Harmony in the Nature - Inter connectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature - Realizing Existence as Co-existence at All Levels - The Holistic Perception of Harmony in Existence.

Learning Outcomes:
- Organizing Confident that they can understand the whole existence made appropriate and holistic.(L2)
- Differentiate between the characteristics and activities of different orders able to see the interconnectedness in the nature(L3)

Application:
- Human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT-V:

Implications of the Holistic Understanding – a Look at Professional Ethics : Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct - A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics - Holistic Technologies, Production Systems and Management Models.

Learning Outcomes:
- Present sustainable solutions to the problems in society and nature. (L2)
- Able to grasp the right utilization of their knowledge in their streams of Technologyto ensure mutual fulfilment.(L3)

Application:
- Discuss Exercises and Case Studies will be taken up in Practice

Text Book

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978- 93- 87034- 47-1

Reference Books

1. JeevanVidya:EkP arichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999.
2. Human Values, A.N. Tripathi, NewAge Intl.Publishers, NewDelhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
5. Small is Beautiful -E. FSchumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence-J C Kumarappa
8. Bharat Mein Angreji Raj -Pandit Sunderlal
9. Rediscovering India- by Dharampal
10. Hind Swaraj o rIndian Home Rule-by Mohandas K.Gandhi
11. India Wins Freedom-Maulana Abdul Kalam Azad
12. Vivekananda-Romain Rolland (English)
13. Gandhi-Romain Rolland(English)

E-Resources:

1. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SAIC4003.pdf
2. https://gyansanchay.csjmu.ac.in/wp-content/uploads/2022/09/UHVE-2.0-Class-Notes-Part-1-of-4-1.pdf

Subject Code	Subject Name	L	T	P	C
R20CSE-SC4101	React JS (Skill Oriented Course-5)	0	1	1	2

Course Objectives:
- Understand the anatomy of react java script framework.
- Understand the life cycle of React applications.
- Implement React components for interactive user interfaces.
- Create react hooks for component independence and reusability.
- Apply rendering methods on react components for encapsulating behaviour

Course Outcomes:
1. Understand the anatomy of React Java Script.
2. Understand the life cycle hooks of React JS.
3. Create React components for building applications.
4. Create React hooks for component reusability and monitoring.
5. Implement react rendering for interactive applications..

Unit -I:
React JS – Introduction to React JS, React vs Angular, React Version History, Anatomy of React Project, Creating and Running React App.
Templating using JSX: Expressions, Operators, Attributes, Fragments.
Learning Outcomes: student will be able to
- Understand react framework for building applications.(L2)
- Understand the installations of react packages.(L2)
- Create templates in react applications. (L4)

Unit-II:
React Core: Props, State, Event Handling, Lists and Keys, Styling, React Life Cycle, Life cycle methods, Mounting Life Cycle,
Learning Outcomes: Student will be able to
- Understand event handling in React. (L2).
- Implement life cycle methods in react.(L4).
- Create props and states in building react apps.(L4)

Unit- III:
React Components: Pure Components, memo, Refs, Portals, Higher Order Components(HOC), Context, HTTP requests(POST & GET).
Learning Outcomes: Student will be able to
- Understand http request methods in handling end points. (L2)
- Create components to handle react requests. (L4)
- Create higher order components and refs in react .(L4)

Unit -IV:
React Hooks: Introduction to Hooks, useState, useEffect, Run Effects, Fetching Data, useContext, useReducer, useCallBack, useMemo, useRef, Custom Hooks
Learning Outcomes: Student will be able to
- Understand react hooks. (L2)
- Create hooks and custom methods for handling components. (L4)
- Implement context and callback methods in hooks. (L4)

Unit -V:
React Render: Introduction to Rendering, useState, useReducer, State Immutability, Parent & Child, Memo, Context, useCallBack.
Learning Outcomes: Student will be able to

- Understand the working react rendering. (L2)
- Implement userReducer and context for rendering react apps.. (L4)

Applications:
- Online web applications
- Financial, banking applications and gateways etc
- Online and Social media applications

<p style="text-align:center">Text Books:</p>

1. React.js Book: Learning React JavaScript Library From Scratch by Greg Sidelnikov, Learning Curve.
2. React: Quickstart Step-By-Step Guide To Learning React Javascript Library (React.js, Reactjs, Learning React JS, React Javascript, React Programming) by Lionel Lopez, Publisher: Create space Independent Publishing Platform, United States, 2017

<p style="text-align:center">Reference Books:</p>

1. Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js, 2nd Edition by Shama Hoque, Packt

Subject Code	Subject Name	L	T	P	C
R20CSE-HN4101	Mobile Adhoc Networks (MANETs) (Track-1)	3	1	0	4

Course Objectives:
- To understand the concepts of Ad Hoc Wireless Networks
- To understand the Data Transmission in MANETS
- To understand the MAC protocols for ad-hoc networks
- To understand and analyze the various routing protocols and model link cost
- Understanding security in Adhoc Networks

Course Outcomes:
1. Evaluate the principles and characteristics of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks
2. Discuss the challenges in designing MAC, routing, and transport protocols for wireless ad-hoc sensor networks
3. Understand the MAC Protocols for Ad Hoc Wireless Networks
4. Illustrate the various Routing Protocols And Transport Layer In Ad Hoc Wireless Networks
5. Demonstrate the issues and challenges in security provisioning and also familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs

UNIT- I

Introduction to Ad Hoc Wireless Networks: Characteristics of MANETs, Applications of MANETs, Challenges.
Routing in MANETs: Topology-based versus Position-based approaches, Topology-based routing protocols, Position-based routing, and Other Routing Protocols.
Learning Outcomes: Students will be able to
- Understand the characteristics & Applications of the MANETs
- Understand various routing protocols in MANETS

UNIT-II

Data Transmission In MANETs: The Broadcast Storm, Multicasting, Geo casting
TCP over Ad Hoc Networks: TCP Protocol overview, TOP and MANETs, Solutions for TOP over Ad Hoc
Learning Outcomes: Students will be able to
- Understand the Data transmission and TCP Protocols over Adhoc Networks

UNIT- III

MAC Protocols For Ad Hoc Wireless Networks: Issues in designing a MAC Protocol, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention based protocols, Contention based protocols with Reservation Mechanisms, Contention based protocols with Scheduling Mechanisms, Multi-channel MAC - IEEE 802.11.
Learning Outcomes: Students will be able to
- Understand the Issues in designing the MAC for MANETS.
- Understand the MAC Protocols

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UNIT- IV

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Routing Protocols And Transport Layer In Ad Hoc Wireless Networks: Routing Protocol: Issues in designing a routing protocol for Ad hoc networks, Classification, proactive routing, reactive routing (on demand), hybrid routing, Transport Layer protocol for Ad hoc networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer solutions-TCP over Ad hoc wireless, Network Security, Security in Ad Hoc Wireless Networks, Network Security Requirements.

Learning Outcomes: Students will be able to

- Understand various Routing protocols in Adhoc Networks.

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UNIT- V

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Security in Ad Hoc Networks: Introduction- Security Attacks, Intrusion Detection System, Intrusion Prevention System, Intrusion Response system, Wired Equivalent Privacy(WEP) - A Security Protocol for Wireless Local Area Networks (WLANs), Security in MANETs.

Learning Outcomes: Students will be able to

- Understand the Security system in Adhoc Networks

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TEXTBOOKS

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1. "Ad Hoc Wireless Networks: Architectures and Protocols ", C. Siva Ram Murthy, and B. S. Manoj, Pearson Education, 2008
2. Ad Hoc and Sensor Networks — Theory and Applications, Car/os Corderlo Dharma R Aggarwal, World Scientific Publications /Cambridge University Press, March 2006

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REFERENCE BOOKS

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1. "Ad Hoc & Sensor Networks: Theory and Applications", 2nd edition, Carlos De Morais Cordeiro, Dharma Prakash Agrawal , World Scientific Publishing Company, 2011
2. Adhoc Wireless Networks — Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education, 2004
3. Wireless Ad hoc Mobile Wireless Networks — Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
4. Ad hoc Networking, Charles E.Perkins, Pearson Education, 2001.
5. Wireless Ad hoc Networking, Shih-Liri Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007
6. Wireless Ad hoc and Sensor Networks — Protocols, Performance and Control, Jagannathan Sarangapani, CRC Press, Taylor & Francis Group, 2007, rp 2010.
7. Security in Ad hoc and Sensor Networks, Raheem Beyah, et al., World Scientific Publications / Cambridge University Press, 2010
8. Ad hoc Wireless Networks — A communication-theoretic perspective, Ozan K.Tonguz, Giatuigi Ferrari, Wiley India, 2006, rp2009.

Subject Code	Subject Name	L	T	P	C
R20CSE-HN4102	Vulnerability Assessment & Penetration Testing (Track-2)	3	1	0	4

Course Objectives:

- To Recognize various penetration testing phases and types.
- To identify security vulnerabilities and weaknesses in the target applications.
- To identify how security controls can be improved to prevent hackers gaining access to operating systems and networked environments.
- To identify various advanced hacking methods.
- To understand the impact of hacking in real time machines.

Course Outcomes:

1. Understand Penetration testing phases, types and techniques.
2. Analyze various social engineering attacks.
3. Understand System Hacking Techniques in real time applications
4. Analyze advanced system hacking methods and procedures,
5. Understand the techniques for Bypassing WLAN Authentication

UNIT-I:

Introduction-Penetration Testing phases/Testing Process, types and Techniques, Blue/Red Teaming, Strategies of Testing, Non Disclosure Agreement Checklist, Phases of hacking, Open-source/proprietary Pen test Methodologies.

Learning Outcomes: student will be able to

- Understand various testing procedures(L2).
- Analyze the steps of Testing Phases (L4).

UNIT -II –

Information Gathering and Scanning- Information gathering methodologies- Foot printing, Competitive Intelligence- DNS Enumerations- Social Engineering attacks, Port Scanning-Network Scanning- Vulnerability Scanning- NMAP scanning tool- OS Fingerprinting-Enumeration.

Learning Outcomes: student will be able to

- Analyze the information gathering methodologies.(L4)
- Understand the DNS enumerations (L2).
- Understand about various social engineering attacks (L2).
- Understand the scanning tools. (L2).

UNIT- III

System Hacking: Password cracking techniques- Key loggers- Escalating privileges- Hiding Files, Double Encoding, Steganography technologies and its Countermeasures. Active and passive sniffing- ARP Poisoning, MAC Flooding- SQL Injection - Error- based, Union- based, Time-based, Blind SQL, Out-of-band. Injection Prevention Techniques

Learning Outcomes: student will be able to

- Understand the file handling and steganographic techniques (L2).
- Analyse SQL injection prevention techniques. (L4).

UNIT- IV

Advanced System Hacking: Broken Authentication, Sensitive Data Exposure, XML External Entities, Broken Access Code, XSS - Stored, Reflected, DOM Based.

Learning Outcomes: student will be able to

- Understand the Authentication techniques. (L2).
- Understand the XSS stored and reflection methods.(L2)

UNIT -V

Wireless Pentest: Wi-Fi Authentication Modes, Bypassing WLAN Authentication, Types of Wireless Encryption, WLAN Encryption Flaws, AP Attack, Attacks on the WLAN Infrastructure, DoS-Layer1, Layer2, Layer 3, DDoS Attack, Client Misassociation, Wireless Hacking Methodology, Wireless Traffic Analysis.

Learning Outcomes: student will be able to
- Understand the WLAN Flaws and attacks.(L2)
- Analyze Wireless traffic analysis. (L4).

Text Books:

1. Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver , June 2016 PacktPublishing

Reference Books:

1. Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016 PacktPublishing.
2. SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication

Subject Code	Subject Name	L	T	P	C
R20CSE-HN4103	Java Enterprise Frame work (Track-3)	3	1	0	4

Course Objectives:
- Implement CRUD operations using Java APIs
- Understand server side environment using Servlets.
- Create server side web pages using Java Server Pages.
- Understand Object relational mapping using Hibernate.
- Write business logics using Spring MVC and AOP programming.

Course Outcomes:
1. Implement database operations from front end java APIs.
2. Write server side programs for controlling HTTP requests.
3. Create dynamic server side web pages using JSP tags.
4. Create Hibernate objects for mapping objects and database relations.
5. Create model based java objects for controlling server based applications.

Unit I:

Java Database Connectivity - JDBC Overview & Architecture, JDBC Driver Types, Types of ResultSet, Statement, PreparedStatement, CallableStatement, Executing DDL and DML Commands.

Learning Outcomes: Student will be able to
- Understand JDBC Drivers for connecting Database.(L2)
- Write complex queries for retrieving data from database.(L4)
- Create callable statements for executing database procedures. (L4)

Unit- II:

Servlets: Web Server, Container, Servlet Overview, Life cycle of Servlet, Handling Web Form Data in Servlets., Dynamically including Content in Servlets, Handling Exceptions in Web Applications, Reading and Setting Cookies, Session Tracking, Servlet Filters, Accessing Databases.

Learning Outcomes: Student will be able to
- Understand Web container for storing server side programs (L2).
- Implement Request and response handlers using Http libraries.(L4).
- Create Servlet for retrieving data from databases. (L4)

Unit III:

Java Server Pages: Overview of JSP, JSP Architecture & life cycle, Components of Java Server Pages, Implicit Objects & Standard JSP Tags, Scope of JSP objects, Dynamically including content in JSPs, Handling Form data in JSPs, Accessing Databases, Tag Libraries.

Learning Outcomes: Student will be able to
- Understand the structure of JSP and its Life Cycle(L2)
- Create dynamic web pages using JSP tag libraries. L4)
- Implement JSP scope for switching between pages.(L4)

Unit -IV:

HIBERNATE: Introduction to Hibernate, Hibernate Architecture, Understanding Object Persistence, Hibernate Basics, Types of Relations, Querying Persistent Objects, Hibernate Query Language (HQL)

Learning Outcomes: Student will be able to
- Understand Hibernate Object relational mapping (L2)
- Create Hibernate objects for implementing relations between tables. (L4)
- Implement Hibernate queries for persisting java objects. (L4)

Unit V:

Spring Framework: Spring Architecture and Container, Spring Setup in Eclispe, Spring Bean Factory, Bean factory VS Application Context, Dependency Injection (DI), Types of DI, Bean Auto wiring, Collections with Spring, Bean Scopes, Event Handling in Spring, Introduction to Aspect Oriented Programming (AOP).

Learning Outcomes: Student will be able to
- Understand architecture of spring container. (L2)
- Implement dependency injection for setting data for beans. (L4)
- Create spring beans for handling events and aspects. (L4)

Applications:
- Building enterprise level applications like IRCTC.
- Building Financial, banking applications, gateways etc
- Online and Social media applications

Text Books:
1. JDBC, Servlets and JSP Black Book, by Kogent Solutions Inc. Santosh Kumar K, Dream tech Publications. 2nd Edition, 2016.
2. Java Servlet & JSP Cookbook by Bruce W. Perry Publisher(s): O'Reilly Media, 2004
3. Spring and Hibernate-2ed, by K. Santosh Kumar , McGraw-Hill Education

Reference Books:
1. Spring in Action, 4ed (Manning), by Craig Walls (Author) , Dream tech.
2. Java Persistence with Hibernate: Revised of Hibernate in Action, Dream tech, by Christian Bauer.

Subject Code	Subject Name	L	T	P	C
R20CSE-HN4104	Deep Learning (Track-4)	3	1	0	4

Course Objectives:
- To learn the techniques and principles of Machine Learning.
- To study the different models in deep learning
- To familiarize deep learning concepts with Convolutional Neural Network.

Course Outcomes: Upon completion of the course, the student will be able to
1. Illustrate basic concepts of machine learning.
2. Demonstrate the architecture of deep learning.
3. Outline the basics of Convolution Neural Networks (CNN).
4. Inspect basics of transfer learning.
5. Illustrate applications of deep learning

Unit-I:

Machine Learning Basics : Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants stochastic gradient decent, Curse of Dimensionality.

Learning Outcomes: Student will be able to
- Outline the basics of machine learning.
- Reproduce the algorithms of machine learning.

Unit-II:

Deep Learning Architectures : Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications

Learning Outcomes: Student will be able to
- Describe the various architectures of deep learning.
- Explain the training of neural networks.

Unit-III :

Convolutional Neural Networks : Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet - Applications

Learning Outcomes: Student will be able to
- Sketch the architecture of convolutional neural networks.
- Explain the popular CNN architectures.

Unit-IV:

Transfer Learning : Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet

Learning Outcomes: Student will be able to
- Illustrate the transfer learning techniques.
- Explain the different variants of CNN.

Unit-V:

Deep Learning -Applications : Large Scale deep learning, Computer Vision, Speech Recognition, Natural Language processing, Other Applications

Learning Outcomes: Student will be able to
- Demonstrate the applications of deep learning
- Explain applications of NLP

Text Books:
1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, " Deep Learning", MIT Press,2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

Reference Books:
1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz,Shai BenDavid, Cambridge.
2. Machine Learning in Action, Peter Harington, 2012, Cengage.