RATHINAM COLLEGE OF ARTS AND SCIENCE

(AUTONOMOUS)

Rathinam Tech Zone, Eachanari, Coimbatore – 641021.

DEPARTMENT OF COMPUTER SCIENCE

Syllabus forM.Sc. COMPUTER SCIENCE

(I -IV Semester)

2024 – 2026 Batch onwards

Vision and Mission of the Institution

Vision

To emerge as a world-renowned Institution that is integrated with industry to impart Knowledge, Skills, Research Culture and Values in youngsterswhocanaccelerate the overall development of India

Mission

To provide quality education at affordable cost, build academic and research excellence, maintain eco-friendly and robust infrastructure, and to create a team of well qualified faculty who can build global competency and employability among the youth of India.

Motto

Transform the youth into National Asset

Vision and Mission of the Department

Vision

To become a globally recognized and deeply connected with the tech industry, fostering a culture of knowledge, skills, research, and values in aspiring computer scientists, empowering them to drive India's holistic technological advancement.

Mission

To empower students and cultivate academic and research brilliance and provide them to leverage Technology as a tool for innovation and fostering global competitiveness and employability in diverse field

Motto

Industry – Ready Education

Program Educational Objectives (PEO)

PEO1	Pursue a career as a globally competent and universally employable professionalin core and related fields in diverse sectors who accelerates the overall development of India.
PEO2	Pursue lifelong learning opportunities including graduate degrees to improve and expand domain specific and professional skills.
PEO3	Advance personally and professionally by accepting professional and societal responsibilities, and pursuing leadership roles.

Mapping of Institute's Mission to PEO

Institute's Mission	PEO's
To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure, and	PEO1, PEO2
To create a team of well qualified faculty who can build global competency and employability among the youth of India.	PEO2, PEO3

Mapping of Department Mission to PEO

Department Mission	PEO's
To empower students and cultivate academic and research brilliance	PE01, PE02
Provide them to leverage Technology as a tool for innovation	PEO3
Fostering global competitiveness and employability in diverse field	PE04, PE05
To empower students and cultivate academic and research brilliance	PE01, PE02

Program Outcomes (PO):

PO1	:	Demonstrate knowledge competency in core discipline
PO2	:	Apply the appropriate knowledge and suitable skills in solving the complex problems
PO3	:	Conduct investigations of complex problems through various scientific approaches
PO4	:	Design solutions for complex and open ended real-life or real-time problems
PO5	:	Use appropriate and advanced tools for a wide range of practices with an understanding on its associated limitations
PO6	:	Work effectively and responsibly as a member or a leader in a team
PO7	:	Express complex concepts within the profession and with society at large
PO8	:	Understand the professional roles and responsibilities
PO9	:	Analyze social and environmental aspects of the professional practices
PO10	:	Practice higher moral and ethical standards during the discharge of professional duties
PO11	:	Incorporate finer finance and business practices in all professional engagements
PO12	:	Identify and address their professional development through lifelong learning

Program Specific Outcomes (PSO):

PSO1	:	Graduates will be able to apply computational thinking and algorithmic problem-solving techniques to solve complex problems in various domains of computer science.
PSO2	:	Graduates will be able to design, implement, and evaluate computing systems, components, or processes to meet specified requirements, considering ethical, social, and environmental implications
PSO3	:	Graduates will demonstrate the ability to manage, store, retrieve, and analyze data effectively using appropriate data structures, databases, and information retrieval techniques.
PSO 4	:	Graduates will possess a solid understanding of computer networks, protocols, and security principles, and will be able to design, implement, and manage secure networked systems
PSO5	:	The course syllabi will provide students with a solid foundation with the necessary knowledge and skills to pursue Research Level specialized areas of computer science.

Correlation between the PO/PSO and the PEOs

Program Outcomes		PEO 1	PEO 2	PEO 3
PO1	:	3	1	3
PO2	:	3	2	3
PO3	:	1	2	3
PO4	:	3	1	3
PO5	:	3	3	2
PO6	:	2	3	3
PO7	:	2	3	1
PO8	:	3	2	1
PO 9	:	2	2	3
PO 10	:	3	2	1
PO 11	:	2	1	1
PO 12	:	3	2	2
PSO1	:	2	3	1
PSO2	:	3	2	2
PSO3	:	2	3	3
PSO4	:	3	2	2
PSO5		2	3	3

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

Components considered for Course Delivery is listed below:

a. Class room Lecture
b. Laboratory class and demo
c. Assignments
d. Mini Project
e. Project
f. Online Course
g. External Participation
h. Seminar
i. Internship

Mapping of POs with Course Delivery:

Program Outcome	Course Delivery								
	a	b	c	d	e	f	g	h	i
PO1	3	3	1	1	2	1	3	3	1
PO2	3	3	2	3	3	1	1	2	3
PO3	3	3	1	3	1	1	1	2	3
PO4	2	3	2	3	3	1	1	3	1
PO5	3	2	1	3	1	3	3	3	3
PO6	2	3	1	3	3	1	2	3	3
PO7	2	3	1	3	1	1	2	3	3
PO8	2	2	1	2	3	3	2	3	3
PO9	1	1	2	3	3	3	2	3	3
PO10	2	1	2	3	2	2	2	2	2
PO11	1	1	2	2	2	3	3	3	3
PO12	1	2	3	2	2	2	3	3	3
PSO1	2	3	1	3	2	3	1	3	3
PSO2	3	2	2	3	3	2	2	3	2
PSO3	2	3	3	2	2	3	3	2	3
PSO4	3	2	2	1	3	2	2	1	2

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

RATHINAM COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)
Scheme of Curriculum for M.Sc Computer Science for the Batch Admitted during 2024-2025 Onwards

Sem	Part	Type	Sub Code	Subject	Credit	Per Week	CIA	ESE	Exam Hours
1.1	3	C1		Advanced Python Progamming	4	5	50	50	3
1.2	3	C2		Advance Data Structures and Algorithms	4	5	50	50	3
1.3	3	C3		Advanced Computer Networks	4	5	50	50	3
1.4	3	C4		Data Science	4	5	50	50	3
1.5	3	SEC 1		Data Analytics	4	5	50	50	3
1.6	3	ELE 1		Internet of Things	4	5	50	50	3
2.1	3	C5		J2EE	4	5	50	50	3
2.2	3	C6		Advance Opertaing System	4	5	50	50	3
2.3	3	C7		Big Data	4	5	50	50	3
2.4	3	C8		Natural Language Processing	4	5	50	50	3
2.5	3	SEC 2		Quantum Computing	4	5	50	50	3
2.6	3	ELE 2		Web Technology	4	5	50	50	3
3.1	3	C9		Digital Image Processing	4	6	50	50	3
3.2	3	C10		Deep Learning	4	6	50	50	3
3.3	3	C11		Software Engineering	4	6	50	50	3
3.4	3	SEC 3		Software Testing	4	6	50	50	3
3.5	3	ELE 3		RESEARCH METHODLOGY	4	6	50	50	3
3.6	3	ITR		Internship / Industrial Training (Summer vacation at the end of II semester activity)	2		50	50	3
4.1	3	C12		Artificial Intellegence	4	6	50	50	3
4.2	3	SEC 4		Cloud Computing	4	6	50	50	3
4.3	3	ELE 4		VIRTUAL REALITY AND AUGMENTEDREALITY	4	6	50	50	3
4.4	3	PRJ		Project with Viva-Voce	8	12	100	100	3
				TOTAL	90	120	1150	1100	

Semester-I

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Python Progamming	4	5	-	-	Core Theory

Course Introduction

This course enables the student to setup to run the python programs. Explore our comprehensive Advanced Python course offerings, designed to help to enhance your programming skills, data analysis, web development, and machine learning capabilities, equipping you for the intricate demands of the rapidly progressing Python programming landscape.

Course Focus on:Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Install and Run Python Program
CO 2:	Write functions and Loops in the python program
CO 3:	Implementing OOPs concepts while writing Python Program
CO 4:	Developing web applications using Django
CO 5:	Build micro services in Python

Unit I:	Introduction to Python	[12 Periods]

Introduction to Python, Setting up the environment, Installing Python, Running python program, Python's execution model, Guidelines on how to write good, The Python culture, A note on the IDEs

Built-in Data Types: Numbers, Immutable sequences, Mutable sequences, Set types,

Mapping types – dictionaries, The collections module, Final considerations

Iterating and Making Decisions: Conditional programming, Looping, Putting this all together.

Unit II:	Advanced Concepts	[12 Periods]

Functions, the Building Blocks of Code: Use of functions, Scopes and name resolution, Input parameters, Return values, Recursive functions, Anonymous functions, Function attributes, Built-in functions, Importing objects.

Saving Time and Memory: map, zip, and filter, Comprehensions, Generators, Some performance considerations, Name localization, and Generation behavior in built-ins.

Advanced Concepts – OOP, Decorators, and Iterators: Decorators, Class and object namespaces, Attribute shadowing, Initializing an instance, Accessing a base class, Multiple inheritance, Static and class methods, Private methods and name mangling, The property decorator, Operator overloading, Polymorphism

Unit III:	Web Development	[12 Periods]

The Edges – GUIs and Scripts: Scripting-The imports, Parsing Arguments, The business logic, GUI application-The import, The layout logic, The business logic, The tkinter.tixmodule,The turtle module, wxPython, PyQt, and PyGTK, The principle of least astonishment, Threading considerations.

Web Development Done Right: Django design philosophy, The Django URL dispatcher, Setting up Django, Adding the Entry model, Customizing the admin panel, Creating the form, Writing the views, Tying up URLs and views, Writing the templates, Writing a Flask view, Building a JSON quote server in Falcon.

Unit IV:	Cloud Native Python	[12 Periods]

Building Microservices in Python: Modelingmicroservices, Building microservices, Testing the RESTful API.

Building a Web Application in Python: Getting started with applications, Working with Observables and AJAX, Binding data for the adduser template, Working on Observables with AJAX for the addtweet template, Data binding for the addtweet template, CORS - Cross-Origin Resource Sharing, Session management, Cookies.

Interacting Data Services: MongoDB terminology, Initializing the MongoDB database, Integrating microservices with MongoDB, Working with user resources, Working with the tweets resources.

Unit V:	Exception Handling	[12 Periods]

Testing, Profiling, and Dealing with Exceptions: The anatomy of a test, Testing guidelines, Unit testing, Test-driven development, Exceptions, Profiling Python.

Debugging and Troubleshooting: Debugging with print, Debugging with a custom function, Inspecting the traceback, Using the Python debugger, Inspecting log files, Other techniques, Troubleshooting guidelines.

Text Books:

1. Python for Data Science for Dummies - Luca Massaron and John Paul Mueller, John Wiley & Sons, Inc.
2. Learn Python Programming, 2nd Edition by Fabrizio Romano
3. Python Cookbook, 3rd Edition by David Beazley (Author), Brian K. Jones (Author)

Reference Books:

1. Python for Data Analysis - Wes McKinney, O'Reilly Media, Inc.
2. Data Science from Scratch - Joel Grus, O'Reilly Media, Inc.
3. Python Scripting for Computational Science - Hans PetterLangtangen
4. Python and AWS Cookbook: Managing Your Cloud with Python and Boto by Mitch Garnaat
5. Advanced Python Programming: Build high performance, concurrent, and multi-threaded apps with Python using proven design patterns by Dr. Gabriele Lanaro

Web Resources:

1. https://www.tutorialspoint.com/python_programming/
2. https://www.coursera.org/courses?query=python&productDifficultyLevel=Advanced

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Python Programming Lab	4	-	-	4	Practical

Course Introduction
- To setup the environment to run the python programs
- To understand concepts about Data Types and Looping techniques
- To understand and implement the OOP concepts, Decorators, and Iterators
- To understand and build the Web Applications
- Debugging and Troubleshooting Python Programs

Course Focus on:Skill Development/ Entrepreneurship / Employability / **Research**

	List of Programs	
	1. Write a python program to find biggest number among four numbers using if-else 2. Write a python program to find given number is prime or not 3. Write a python program to find given number is palindrome or not 4. Write a python program to print multiplication table of given number 5. Write a python program to find mean of a n numbers using list 6. Write a python program to find given number is exist or not in the list, if exists print all its places 7. Write a python program to return sum of n numbers from a function using list 8. Write a python program to manipulate student details using dictionary and lists 9. Write a python program to return student details from a function using list and sno as parameter 10. Write a python program to manipulate employee details using classes and objects 11. Write a python program to read and write student details from and to a file using IO 12. Write a python program to read content from student.csv file and find total number of students, maximum and minimum marks	

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Advance Data Structures and Algorithms	**4**	**5**	**5**	**0**	**Theory**

Advance Data Structures and Algorithms

Course Introduction
This course enables the student skills and knowledge to tackle complex database challenges, optimize database performance, and design efficient database solutions using advanced RDBMS and SQL techniques.
Course Focus on:Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Understand the basic principles and operations of data structures.
CO 2:	Apply Hashing, Disjoint sets and String Matching techniques for solving problems effectively.
CO 3:	Apply the concepts of advanced Trees and Graphs for solving problems effectively.
CO 4:	Analyze the given scenario and choose appropriate Data Structure for solving problems.
CO 5:	Implementation of Disjoint sets.

Unit I:	Hashing	[12 Periods]

General Idea, Hash Function, Separate Chaining, Hash Tableswithout linked lists: Linear Probing, Quadratic Probing, Double Hashing,Rehashing, Hash Tables in the Standard Library, Universal Hashing, Extendible Hashing.

Unit II:	Priority Queues (Heaps)	[12 Periods]

Model, Simple implementations, Binary Heap:Structure Property, Heap Order Property, Basic Heap Operations: insert, delete,Percolate down, Other Heap Operations.Binomial Queues: Binomial Queue Structure, Binomial Queue Operations,Implementation of Binomial Queue, Priority Queues in the Standard Library.

Unit III:	Trees	[12 Periods]

AVL: Single Rotation, Double Rotation, B-Trees. Multi-way Search Trees – 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree. Red-Black Trees – Properties of red-black trees, Rotations, Insertion, Deletion.

Unit IV:	Graphs Algorithms	[12 Periods]

Elementary Graph Algorithms: Topological sort, SingleSource Shortest Path Algorithms: Dijkstra's, Bellman-Ford, All-Pairs ShortestPaths: Floyd-Warshall's Algorithm.

Unit V:	Disjoint Sets	[12 Periods]

Equivalence relation, Basic Data Structure, Simple Union andFind algorithms, Smart Union and Path compression algorithm.String Matching – The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm.

Text Books:
1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4 th Edition, 2014, Pearson.   2. Introduction to Algorithms, Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3 rd Edition, 2009, The MIT Press.

Reference Books:
1. Fundamentals of Computer Algorithms, Ellis Horowitz, SatrajSahani and Rajasekharam, 2nd Edition, 2009, University Press Pvt. Ltd.   2. Advanced Data Structures, ReemaThareja, S. Rama Sree, Oxford University Press, 2018.

Web Resources:
1   http://www.coursera.org/learn/advanced-data-structures   2.   http://www.coursera.org/learn/advanced-data-structures

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Computer Networks	4	5	5	0	Theory

Course Introduction

- This course focus of this unit is providing a background to the basics of networking and its underlying principles. The learners taking this unit will explore the fundamentals of networking, the principle and purpose behind layered models, devices used in networks and their wireless connectivity and the ways to troubleshoot network related issues.

Course Focus on:Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Evaluate the different standard organizations related to computer networks.
CO 2:	Understand the Concept of protocols at different layers.
CO 3:	Compare features of TCP/IP Model with reference to the OSI Model.
CO 4:	Understand the Concept of WAN switching.
CO 5:	Understand the basics of network utility and network troubleshooting.

Unit I:	Networking Fundamentals	[12 Periods]

Basics of Network & Networking, Advantages of Networking, Types of Networks, Network Terms- Host, Workstations, Server, Client, Node, Types of Network Architecture- Peer-to-Peer & Client/Server, Workgroup Vs. Domain. Network Topologies, Types of Topologies, Logical and physical topologies, selecting the Right Topology, Types of Transmission Media, Communication Modes, Wiring Standards and Cabling- straight through cable, crossover cable, rollover cable, media connectors (Fibre optic, Coaxial, and TP etc.) Introduction of OSI model, Seven layers of OSI model, Functions of the seven layers, Introduction of TCP/IP Model, TCP, UDP, IP, ICMP, ARP/RARP, Comparison between OSI model & TCP/IP model. Overview of Ethernet Addresses

Unit II:	Basics of Network Devices	[12 Periods]

Network Devices- NIC- functions of NIC, installing NIC, Hub, Switch, Bridge, Router, Gateways, And Other Networking Devices, Repeater, CSU/DSU, and modem, Data Link Layer: Ethernet, Ethernet standards, Ethernet Components, Point-to-Point Protocol(PPP),PPP standards, Address Resolution Protocol, Message format, transactions, Wireless Networking: Wireless Technology, Benefits of Wireless Technology, Types of Wireless Networks: Ad-hoc mode, Infrastructure mode, Wireless network Components: Wireless Access Points, Wireless NICs, wireless LAN standards: IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, wireless LAN modulation techniques, wireless security Protocols: WEP,WPA, 802.1X, Installing a wireless LAN

Unit III:	Basics of Network, Transport and Application Layers	[12 Periods]

Network Layer: Internet Protocol (IP), IP standards, versions, functions, IPv4 addressing, IPv4 address Classes, IPv4 address types, Subnet Mask, Default Gateway, Public & Private IP Address, methods of assigning IP address, IPv6 address, types, assignment, Data encapsulation, The IPv4 Datagram Format, The IPv6 Datagram Format, Internet Control Message Protocol (ICMP), ICMPv4, ICMPv6, Internet Group Management Protocol (IGMP),Introduction to Routing and Switching concepts, Transport Layer: Transmission Control Protocol(TCP), User Datagram Protocol (UDP), Overview of Ports & Sockets, Application Layer: DHCP, DNS, HTTP/HTTPS, FTP, TFTP, SFTP, Telnet, Email: SMTP, POP3/IMAP, NTP

Unit IV:	WAN Technology	[12 Periods]

What Is a WAN?, WAN Switching, WAN Switching techniques Circuit Switching, Packet Switching etc., Connecting to the Internet : PSTN, ISDN, DSL, CATV, Satellite-Based Services, Last Mile Fiber, Cellular Technologies, Connecting LANs : Leased Lines, SONET/SDH, Packet Switching, Remote Access: Dial-up Remote Access, Virtual Private Networking, SSL VPN, Remote Terminal Emulation, Network security: Authentication and Authorization, Tunneling and Encryption Protocols, IPSec, SSL and TLS, Firewall, Other Security Appliances, Security Threats

Unit V:	Network Operating Systems and Troubleshooting Network	[12 Periods]

Network Operating Systems: Microsoft Operating Systems, Novell NetWare, UNIX and Linux Operating Systems, Macintosh Networking, Trouble Shooting Networks: Command-Line interface Tools, Network and Internet Troubleshooting, Basic Network Troubleshooting : Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring tools.

Text Books:

1. CCNA Cisco Certified Network Associate: Study Guide (With CD) 7th Edition (Paperback), Wiley India, 2011
2. CCENT/CCNA ICND1 640-822 Official Cert Guide 3 Edition (Paperback), Pearson, 2013

Reference Books:

1. Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback), Pearson, 2008
2. CCNA Exploration Course Booklet : Routing Protocols and Concepts, Version 4.0 (Paperback), Pearson, 2010

Web Resources:

2   http://www.coursera.org/learn/advanced-data-structures
3. http://www.coursera.org/learn/advanced-data-structures

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
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CO1	3	2	3	1	1	1	3	3	2	1	1	1
CO2	1	3	2	3	3	2	3	1	1	1	1	1
CO3	3	2	3	3	2	3	1	3	3	1	2	1
CO4	3	3	1	1	3	1	3	2	3	2	2	2
CO5	3	3	2	3	3	2	3	3	3	2	2	1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Data Science	4	-	-	5	**Practical**

Course Introduction

Data Science," an expertly crafted course tailored for those who possess foundational knowledge in data science and aspire to master more intricate and powerful techniques. This course offers an in-depth exploration of sophisticated methodologies, including cutting-edge machine learning algorithms, advanced statistical models, and big data tools, ensuring a comprehensive understanding and practical skills applicable to real-world challenges. By engaging with real-life case studies and hands-on projects, you will emerge with a robust ability to tackle complex data science problems and drive impactful data-driven decisions in your professional sphere.

Course Focus on: Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	Deep understanding of complex algorithms for building sophisticated models.
CO 2:	Skills in handling large datasets with modern tools and techniques.
CO 3:	Ability to apply data science to areas like NLP, computer vision, and time series analysis.
CO 4:	Hands-on project work that simulates real-world data science challenges.
CO 5:	Preparation to tackle industry-specific data science problems with advanced analytical skills.

Unit I:	**IPython: Beyond Normal Python**	**[12 Periods]**

Help and Documentation in IPython, Keyboard Shortcuts in the IPython Shell, IPython Magic Commands, Input and Output History, IPython and Shell Commands, Errors and Debugging, Profiling and Timing Code, More IPython Resources.

Unit II:	**Introduction to NumPy**	**[12 Periods]**

Understanding Data Types in Python, The Basics of NumPy Arrays, Computation on NumPy Arrays: Universal Functions, Aggregations: Min, Max, and Everything In BetweenComputation on Arrays: Broadcasting, Comparisons, Masks, and Boolean Logic, Fancy Indexing, Sorting Arrays, Structured Data: NumPy's Structured Arrays.

Unit III:	**Data Manipulation with Pandas**	**[12 Periods]**

Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat and Append, Combining Datasets: Merge and JoinAggregation and GroupingPivot Tables, Vectorized String Operations, Working with Time Series, High-Performance Pandas: eval() and query(), Practical Programs.

Unit IV:	**Visualization with Matplotlib**	**[12 Periods]**

Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density, Customizing Plot Legends, Customizing Colorbars, Multiple Subplots, Text and Annotation, Customizing Ticks, Customizing Matplotlib: Configurations and Stylesheets, Three-Dimensional Plotting in Matplotlib, Geographic Data with Basemap, Visualization with Seaborn, Practical Programs.

Unit V:	**Machine Learning**	[12 Periods]

Machine Learning, Introducing Scikit-Learn, Hyperparameters and Model Validation, Feature Engineering, Naive Bayes Classification, Linear Regression, Support Vector Machines, Decision Trees and Random Forests, Principal Component Analysis, Manifold Learning, k-Means Clustering, Gaussian Mixture Models, Kernel Density Estimation, Application: A Face Detection Pipeline, Further Machine Learning Resources

Text Books:

1. Python Data Science Hand Book by Jake VanderPlas, Published by O'Reilly Media, Inc.,2007.
2. Python for Data Science, 3rd Edition, by Wes McKinney,Published by O'Reilly Media, Inc., 2022.

Reference Books:

1. Practical Statistics for Data Scientists, Peter Bruce, Published by O'Reilly Media, Inc.,2007.
2. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Published by O'Reilly Media, Inc.,2016.

3. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge University Press (May 2014)
4. Machine Learning: Theory and Applications, SeyedehLeiliMirtaheri, Reza Shahbazian
CRC Press (Sep 2022).
5. Hands-On Machine Learning with Scikit-Learn and TensorFlow, AurélienGéron
O'Reilly Media (Oct 2022).

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Internet of Things (IOT)	4	5	-	-	**Core Theory**

Course Introduction

This course enables the student to explore the foundational principles of grounding in basic and advanced methods to of Internet of Things (IOT)

Course Focus on:Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will
CO 1:	Understand IoT value chain structure (device, data cloud), application areas and technologies involved.
CO 2:	Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules
CO 3:	Market forecast for IoT devices with a focus on sensors
CO 4:	Explore and learn about IP Protocols
CO 5:	Implement IOT systems for robotics

Unit I:	**Introduction to Signals and systems**	[12 Periods]

Definition and Characteristics of IoT, Sensors, Actuators, Physical

Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabledTechnologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels andTemplates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

Unit II:	**IoT and M2M**	[12 Periods]

Software defined networks, network function virtualization, difference between SDN andNFV for IoT, Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMPNETOPEER

Unit III:	**IoT Physical Devices and Endpoints**	[12 Periods]

Introduction to Arduino and Raspberry Pi- Installation,Interfaces (serial, SPI, I2C)Controlling Hardware-Connecting LED, Buzzer, Switching High Power devices with transistors,Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolarand bipolar Stepper motors

Unit IV:	**IP and Non-IP Protocols for IoT**	[12 Periods]

Introduction to IP and Non-IP Protocols for IoT- WPAN- IEEE 802.15.4,-Bluetooth- NFC,-LoWPAN- RFID- Zigbee Wireless HART Protocol- MQTT- IP and Non-IP Protocols,-REST,-CoAP.

Unit V:	**Internet of Robotic Things (IoRT)**	[12 Periods]

Introduction to stationary and mobile robots- Brief introduction to localization,-mapping, planning,andcontrol of robotic systems- Introduction to cloud-enabled robotics- Applications of IIoT in robotics- Architectures for IoRT-Examples and case studies- Open issues and challenges

Text Books:
1. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.2020 3.
2. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014 4.
3. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015

Reference Books:
1. "Industry 4.0: The Industrial Internet of Things", Alasdair Gilchrist, Apress, 2016
2. "Introduction to Industrial Internet of Things and Industry 4.0",SudipMisra,ChandanaRoy,AnadarupMukherjee,CRC Press,2021 3
3. "Hands on Industrial Internet of Things",GiacomoVeneri,AntonioCapasso,Packt Press, 2018.

Web Resources:

1 https://www.tutorialspoint.com/iiot/
2 iiot.apache.org/

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Data Analytics	4	-	-	4	Practical

Course Introduction

Web analytics is the process of gathering and analyzing data from a website to understand user behavior and trends. It can help businesses and website owners improve user experience, increase conversions, and optimize their website's performance. The process involves tracking, reviewing, and reporting data on web activity, including how users use the website's components, such as images, videos and Web pages

Course Focus on:Skill Development/ Entrepreneurship / Employability / **Research**

	List of Programs	
	1. To perform data analysis on weather dataset using MapReduce. 2. To count the number of lines in a document using MapReduce Programs. Find the average, max and min temperature for each year in NCDC data set? 3. Write Pig Latin program to sort, group, join, project, and filter your data. Find out Number of Products Sold in Each Country. 4. Implement Linear and logistic Regression 5. Implement SVM / Decision tree classification techniques 6. Implement clustering techniques **7.** Visualize data using any plotting framework **8.** VISUALIZATIONS find the data distributions using box and scatter plot. **9.** VISUALIZATIONS find the outliers using plot. **10.** VISUALIZATIONS Plot the histogram, bar chart and pie chart on sample data	

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

Semester- II

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Operating System	4	5	-	-	Core Theory

Course Introduction

Advanced Operating Systems aims to provide students with a profound and comprehensive understanding of the complex and sophisticated concepts in operating systems. This involves delving deep into areas such as process synchronization, memory management, file systems, and I/O systems, ensuring that students grasp the intricate workings and interactions within an OS. Another key objective is to equip students with the skills necessary to design and implement various components of an operating system. This includes gaining practical experience in kernel development, understanding system calls, and mastering the interplay between hardware and software.

Course Focus on:Skill Development/ Entrepreneurship / Employability / **Research**

Course Outcomes	On completion of this course, students will	
CO 1:	Understand the design issues associated with operating systems	
CO 2:	Master various process management concepts including scheduling, deadlocks and distributed file systems	
CO 3:	Prepare Real Time Task Scheduling	
CO 4:	Analyze Operating Systems for Handheld Systems	
CO 5:	Analyze Operating Systems like LINUX and iOS	

Unit I:	**BASICS OF OPERATING SYSTEMS**	[12 Periods]

Basics of Operating Systems: What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention – Avoidance – Detection – Recovery.

Unit II:	**DISTRIBUTED OPERATING SYSTEMS**	[12 Periods]

Distributed Operating Systems: Issues – Communication Primitives – Lamport‟s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems – design issues – Case studies – The Sun Network File System-Coda.

Unit III:	**REAL TIME OPERATING SYSTEM**	[12 Periods]

Realtime Operating Systems: Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling

Unit IV:	**HANDHELD SYSTEM**	[12 Periods]

Operating Systems for Handheld Systems: Requirements – Technology Overview –Handheld Operating Systems – PalmOS-Symbian Operating System- Android –Architecture of android Securing handheld systems

Unit V:	**CASE STUDIES**	[12 Periods]

Case Studies: Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

Text Books:

1 Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.
2 MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

Reference Books:

1 Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
2 Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
3 Daniel.P.Bovet& Marco Cesati,"Understanding the Linux kernel",3rdedition,O"Reilly, 2005
4 Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	ProgramOutcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2	3	3	3	3	2	2	2	3	3	3	1
CO2	3	2	3	3	3	3	3	2	3	3	3	2	3
CO3	3	2	3	3	3	3	3	2	3	1	2	1	1
CO4	3	2	3	3	3	3	3	2	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Operating System Lab	4	-	-	4	Core Practical

List of Practical Programs:

1. To write C Programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir.

2. To study of various UNIX editors such as vi, ed, ex and EMACS.

3. To study of Basic UNIX Commands and various UNIX editors such as vi, ed, ex and EMACS.

4. To write C programs to simulate UNIX commands like cp, ls, grep.

5. To write simple shell programs by using conditional, branching and looping statements.

6. To write a C program for implementation of Priority scheduling algorithms.

7. To write a C program for implementation of Round Robin scheduling algorithms.

8. To write a C program for implementation of FCFS and SJF scheduling algorithms.

9. To write a C program for implementation of SJF scheduling algorithms.

10. To write a C-program to implement the producer – consumer problem using semaphores.

11. To write a c program to implement IPC using shared memory

12. To write a C program to implement banker"s algorithm for deadlock avoidance.

13. To write a C program to implement algorithm for deadlock detection.

14. To write a c program to implement Threading and Synchronization Applications.

15. To write a C program for implementation memory allocation methods for fixed partition using first fit.

16. To write a C program for implementation of FCFS and SJF scheduling algorithms worst fit allocation

17. To write a C program for implementation of FCFS and SJF scheduling algorithms for best fit allocation.

18. To write a c program to implement Paging technique for memory management.

19. To write a C program for implementation of FIFO page replacement algorithm.

20. To write a c program to implement LRU page replacement algorithm.

21. To write C program to implement LFU page replacement algorithm.

22. To write C program to organize the file using single level directory.

23. To write C program to organize the file using two level directories.

24. To write a C program for sequential file for processing the student information.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2	3	3	3	3	2	2	2	3	3	3	1
CO2	3	2	3	3	3	3	3	2	3	3	3	2	3
CO3	3	2	3	3	3	3	3	2	3	1	2	1	1
CO4	3	2	3	3	3	3	3	2	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Natural language processing (NLP)	4	4	-	-	**Core Theory**

Course Introduction

Natural language processing (NLP) is to enable computers to understand, interpret, and generate human language in a way that is both meaningful and useful. This field encompasses a wide range of tasks, including text understanding, sentiment analysis, language translation, speech recognition, and more. By leveraging computational algorithms and linguistic principles, NLP aims to bridge the gap between human communication and computer understanding, facilitating applications such as virtual assistants, language translation services, information extraction from text, and automated text summarization. Ultimately, the goal of NLP is to empower computers to interact with humans in a natural and intuitive manner, opening up possibilities for improved human-computer interaction and the development of advanced language-based technologies.

Course Focuses: SkillDevelopment/Entrepreneurship/Employability/**Research**

Course Outcomes	On completion of this course, students will	
CO 1:	Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.	
CO 2:	Demonstrate understanding of the relationship between NLP and statistics & machine learning.	
CO 3:	Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, partsof-speech tagging and syntactic parsing.	
CO 4:	Demonstrate the concept of semantic analysis and word sense disambiguation.	
CO 5:	Understand the components of machine translation process and develop the model for NLP applications.	

Unit I:	**Introduction**	**[12 Periods]**

Introduction - NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field - N-gram Language Models - The role of language models. Simple N- gram models. Estimating parameters and smoothing. Evaluating language models.

Unit II:	**BASIC NLP TECHNIQUES**	**[12 Periods]**

Part of Speech Tagging and Sequence Labeling - Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training) - Basic Neural Networks. Any basic introduction to perceptron and backpropagation

Unit III:	**PARSING**	**[12 Periods]**

LSTM Recurrent Neural Networks -Syntactic parsing - Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs. Neural shift-reduce dependency parsing.

Unit IV:	**SEMANTIC ANALYSIS**	**[12 Periods]**

Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labelling and Semantic Parsing.

Unit V:	**MACHINE TRANSLATION**	**[12 Periods]**

Information Extraction (IE) - Named entity recognition and relation extraction. IE using sequence labelling. -Machine Translation (MT) Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

Text Books:

1 Jurafsky Dan and Martin James H. "Speech and Language Processing" ,3rd Edition, 2018.

Reference Books:

1 Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, Practical Natural Language Processing, 2020.

2 Steven Bird, Ewan Klein, Edward Loper., Natural Language Processing with Python, 2009.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	1	2	2	1	1	1	2	3	2	3	1
CO2	3	3	2	2	2	2	2	1	2	3	3	2	3
CO3	3	3	2	2	2	2	2	1	2	3	2	1	1
CO4	3	3	2	2	2	2	2	1	2	3	3	3	3
CO5	3	3	2	1	2	1	2	1	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Natural Language Processing Lab	4	-	-	6	Core Practical

List of Practical Programs:

1. Implementing word similarity

2. Implementing simple problems related to word disambiguation

3. Simple demonstration of part of speech tagging.

4. Lexical analyzer.

 5. Semantic Analyzer.

6. Sentiment Analysis.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2	3	3	3	3	2	2	2	3	3	3	1
CO2	3	2	3	3	3	3	3	2	3	3	3	2	3
CO3	3	2	3	3	3	3	3	2	3	1	2	1	1
CO4	3	2	3	3	3	3	3	2	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	J2EE	4	4	-	-	Core Theory

Course Introduction

Java is a language and J2EE is a platform which implements java language. J2EE standard for Java 2 Enterprise Edition. Core Java and advanced java are the standard editions of java whereas J2EE is the enterprise edition whichis a combination of both core & advanced java. It is used for creating enterprise web applications. J2EE makes use of Servlets and JSPs to provide enterprise applications like web pages and portals.

Course Focuses: SkillDevelopment/Entrepreneurship/Employability/**Research**

Course Outcomes	On completion of this course, students will	
CO 1:	To understand the importance of extension JDBC package in Enterprise Java applications.	
CO 2:	To understand and use the Java Persistence Architecture API for ORM activities (JPA).	
CO 3:	To implement asynchronous applications and MessageDriven Beans using JMS.	
CO 4:	To apply Security in Java EE Applications.	
CO 5:	To learn send/receive mails using Internet protocols SMTP, IMAP and POP3 (JavaMail).	

Unit I:	JAVA 2 ENTERPRISE EDITION OVERVIEW, DATABASE ACCESS	[12 Periods]

Overview of J2EE and J2SE. The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.

Unit II:	Servlets	[12 Periods]

Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking

Unit III:	JSP, RMI	[12 Periods]

Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects. Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side

Unit IV:	JNDI (Java Naming and Directory Interface)	[12 Periods]

JNDI is an API that provides naming and directory functionality to the application.

to use JNDI Services in your application. Introduction to Naming Services JNDI as Java API to Naming Services Using JNDI.

Unit V:	JDBC Extension	[12 Periods]

New features of jdbc and how to send multiple connection objects to resource, pool, shared different clients. javax.sql package (Extension to JDBC), Data Source, Connection PoolUsing JDBC and JNDI.

Text Books:

1. Java - The Complete Reference – Herbert Schildt, 7 th Edition, Tata McGraw Hill, 2007.
2. J2EE - The Complete Reference – Jim Keogh, Tata McGraw Hill, 2007.

Reference Books:

1. Introduction to JAVA Programming – Y. Daniel Liang, 6 th Edition, Pearson Education, 2007.
2. The J2EE Tutorial – Stephanie Bodoff et al, 2 nd Edition, Pearson Education,

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	2	3		1		2		1		3			1
CO2	1		2		3	1	2		2		3	2	
CO3		1		3	2	3		2	1	1	2	1	1
CO4	2		1	2	1		1		3	2		3	3
CO5		2	3				3	2		3	1		2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	J2EE Lab	4	-	-	6	Core Practical

List of Practical Programs:

1. Display a welcome message usingServlet.

2. Design a Purchase Order form using Html form andServlet.

3. Develop a program for calculating the percentage of marks of a student usingJSP.

4. Design a Purchase Order form using Html form andJSP.

5. Prepare a Employee pay slip usingJSP.

6. Write a program using JDBC for creating a table, Inserting, Deleting records and listouttherecords.

7. Write a program using Java servlet to handle formdata.

8. Write a simple Servlet program to create a table of all the headers it receives along withtheirassociatedvalues. 9. Write a program in JSP by using sessionobject.

10. Write a program to build a simple Client Server application usingRMI.

11. Create an applet for a calculator application.

12. Program to send a text message to another system and receive the text message from the system (use socket programming).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2	3	3	3	3	2	2	2	3	3	3	1
CO2	3	2	3	3	3	3	3	2	3	3	3	2	3
CO3	3	2	3	3	3	3	3	2	3	1	2	1	1
CO4	3	2	3	3	3	3	3	2	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Web Application development Lab	4	-	-	6	Skill

List of Practical Programs:

1. Develop a website for your college using advanced tags of HTML.

2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India.

3. Develop a HTML document to i)display Text with Bullets / Numbers - Using Lists ii) to display the Table Format Data

4. Develop a Complete Web Page using Frames and Framesets which gives the Information about a Hospital using HTML.

5. Write a HTML document to print your Bio-Data in a neat format using several components.

6. Develop a HTML document to display a Registration Form for an inter-collegiate function.

7. Using HTML form accept Customer details like Name, City, Pin code, Phone number and Email address and validate the data and display appropriate messages for violations using PHP (Eg. Name is Mandatory field; Pin code must be 6 digits, etc.).

8. Write a program to accept two numbers n1 and n2 using HTML form and display the Prime numbers between n1 and n2 using PHP.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2	3	3	3	3	2	2	2	3	3	3	1
CO2	3	2	3	3	3	3	3	2	3	3	3	2	3
CO3	3	2	3	3	3	3	3	2	3	1	2	1	1
CO4	3	2	3	3	3	3	3	2	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Web Technology	4	4	-	-	Elective

Course Introduction

The World Wide Web continues to provide a foundation for the development of a broad range of increasingly influential and strategic technologies, supporting a large variety of applications and services, both in the private and public sectors. There is a growing need for management and decision makers to gain a clearer understanding of the application development process, from planning through to deployment and maintenance.

Course Focuses:Skill Development/Entrepreneurship/Employability/Research

Course Outcomes	On completion of this course, students will	
CO 1:	To teach students the basics of server side scripting using PHP	
CO 2:	To explain web application development procedures	
CO 3:	To impart servlet technology for writing business logic	
CO 4:	To facilitate students to connect to databases using JDBC	
CO 5:	To familiarize various concepts of application development using JSP	

Unit I:	Introduction to PHP	[12 Periods]

Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc., Handling File Uploads, Connecting to database (My SQL as reference), executing simple queries, handling results, Handling sessions and cookies. File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.

Unit II:	Client side Scripting	[12 Periods]

Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Simple AJAX applications.

Unit III:	XML	[12 Periods]

Introduction to XML, Defining XML tags, their attributes and values, Document type definition, XML Schemas, Document Object model, XHTML Parsing XML Data - DOM and SAX parsers in java.

Unit IV:	Introduction to Servlets	[12 Periods]

Common Gateway Interface (CGI), Lifecycle of a Servlets, deploying a Servlets, The Servlets API, Reading Servlets parameters, Reading initialization parameters, Handling Http Request & Responses, Using Cookies and sessions, connecting to a database using JDBC.

Unit V:	Introduction to JSP	[12 Periods]

Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session tracking, connecting to database in JSP.

Text Books:
1. Web Technologies, Uttam K Roy, Oxford University Press 2. The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill
Reference Books:
1. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dremtech 2. Java Server Pages – Hans Bergsten, SPD O'Reilly 3. Java Script, D.Flanagan, O'Reilly, SPD. 4. Beginning Web Programming-Jon Duckett WROX. 5. Programming world wide web, R.W. Sebesta. Fourth Edition, Pearson. 6. Internet and World Wide Web – How to program, Dietel and Nieto, Pearson.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	2	3		1		2		1		3			1
CO2	1		2		3	1	2		2		3	2	
CO3		1		3	2	3		2	1	1	2	1	1
CO4	2		1	2	1		1		3	2		3	3
CO5		2	3				3	2		3	1		2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Quantum Computing	4	4	-	-	**Skill**

Course Introduction

A basic introduction to quantum mechanics, linear algebra and familiarity with the Dirac notation is provided first to get one's quantum moorings right . This is then followed byan introductory treatment of quantum computation and quantum information covering aspects of quantum entanglement, quantum algorithms, quantum channels. Rudimentary quantum computing is introduced using the IBM quantum computer and associated simulators.

Course Focuses: Skill Development/Entrepreneurship/Employability/**Research**

Course Outcomes	On completion of this course, students will	
CO 1:	Understand the difference between classical and quantum computing.	
CO 2:	Learn the basic concepts of quantum bits (qubits), quantum gates, and quantum circuits.	
CO 3:	Study key quantum algorithms like Shor's algorithm for factoring and Grover's search algorithm.	
CO 4:	Analyze and implement important quantum algorithms.	
CO 5:	Develop skills in using quantum programming languages and tools such as Qiskit, Cirq, and Quipper.	

Unit I:	**Introduction**	**[12 Periods]**

Introduction:Elementary quantum mechanics: linear algebra for quantum mechanics,Quantum states in Hilbert space,The Bloch sphere, Density operators, generalized measurements, no-cloning theorem. The Quantum Mechanics of Photon Polarization, Single-Qubit Quantum Systems, Quantum State Spaces, Entangled States, Multiple-Qubit Systems, Measurement of Multiple-Qubit States, EPR Paradox and Bell's Theorem, Bloch sphere.

Unit II:	**Quantum correlations**	**[12 Periods]**

Quantum correlations: Bell inequalities and entanglement, Schmidt decomposition, super dense coding, teleportation. Limitations of Quantum Computing, Alternatives to the Circuit Model of Quantum Computation, Quantum Protocols, Building Quantum, Computers, Simulating Quantum Systems, Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.

Unit III:	**Quantum cryptography**	**[12 Periods]**

Quantum cryptography: quantum key distribution, Quantum Subsystems, Properties of Entangled States, Quantum Error Correction, Graph states and codes, CSS Codes, Stabilizer Codes, Fault Tolerance and Robust Quantum Computing.

Unit IV:	**Quantum gates and algorithms**	**[12 Periods]**

Quantum gates and algorithms: Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, factoring.

Unit V:	**Programming a quantum computer**	**[12 Periods]**

Programming a quantum computer: The IBMQ, coding a quantum computer using a simulator to carry out basic quantum measurement and state analysis.

Text Books:

(1) Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University press, 2007. (1) Chris Bernhardt, Quantum Computing for Everyone, The MIT Press,Cambridge, 2020 (2)David McMahon-Quantum Computing Explained-Wiley-Interscience , IEEE Computer Society (2008).

Reference Books:

(1) Quantum Computation and Quantum Information, M. A. Nielsen &I.Chuang, Cambridge University Press (2013).
(2) Quantum Computing, A Gentle Introduction, Eleanor G. Rieffel and Wolfgang H. Polak MIT press (2014).
(3) NielsenM.A.,QuantumComputationandQuantumInformation,CambridgeUniversity Press.2002
(4) Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information,Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. 2004
(5) PittengerA.O.,AnIntroductiontoQuantumComputingAlgorithms 2000

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	2	3		1		2		1		3			1
CO2	1		2		3	1	2		2		3	2	
CO3		1		3	2	3		2	1	1	2	1	1
CO4	2		1	2	1		1		3	2		3	3
CO5		2	3				3	2		3	1		2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	BIG DATA	**4**	**5**	**5**	**0**	**Core**

Course Introduction

This course brings together several key big data technologies used for storage, analysis and manipulation of data. To recognize the key concepts of Hadoop framework, Map Reduce, Pig, Hive, and No-SQL.

Course Focus on: Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Student must be Able to understand the building blocks of Big Data
CO 2:	Student must be able to articulate the programming aspects of cloud computing
CO 3:	Student must be able to understand the specialized aspects of big data with the help of different big data applications
CO 4:	Student must be able to represent the analytical aspects of Big Data
CO 5:	Student must be know the recent research trends related to Hadoop File System, MapReduce and Google File System etc

Unit I:	**Introduction to Big Data**	**[12 Periods]**

Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

Unit II:	**Big Data Technologies**	**[12 Periods]**

Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans- Firewall Analytics - Information Management.

Unit III:	**Processing Big Data**	**[12 Periods]**

Integrating disparate data stores - Mapping data to the programming framework - Connecting and extracting data from storage - Transforming data for processing - Subdividing data in preparation for Hadoop Map Reduce.

Unit IV:	**Hadoop MapReduce**	**[12 Periods]**

Employing Hadoop Map Reduce - Creating the components of Hadoop Map Reduce jobs - Distributing data processing across server farms –Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows - The Building Blocks of Hadoop Map Reduce - Distinguishing Hadoop daemons - Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

Unit V:	**Advanced Analytics Platform**	**[12 Periods]**

Real-Time Architecture – Orchestration and Synthesis Using Analytics Engines – Discovery using Data at Rest – Implementation of Big Data Analytics – Big Data Convergence – Analytics Business Maturity Model.

Text Books:

4. Michael Minelli, Michehe Chambers, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Ambiga Dhiraj, Wiely CIO Series, First Edition, 2013.
5. Arvind Sathi, Big Data Analytics: Disruptive Technologies for Changing the Game, IBM Corporation, First Edition, 2012.

Reference Books:

1. Tom White, Hadoop: The Definitive Guide, O'Reilly, Third Edition, 2012.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												Programme Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2	1	1	1	2	1	1	1	2	3	1	3
CO2	3	2	3	1	1	3	2	1	2	1	1	1	3	2	2	3
CO3	3	3	2	1	2	2	1	3	2	1	2	1	2	3	3	2
CO4	1	1	3	3	1	3	2	3	1	2	2	2	3	2	2	1
CO5	3	1	3	1	3	2	2	3	1	2	2	1	1	2	3	2

Semester-III

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Research Methodology	4	3	-	-	**Elective Theory**

Course Introduction

Research methodology is to provide a systematic, theoretical analysis of the methods used in a study, ensuring replicability, objectivity, and scientific soundness. It involves selecting suitable data collection and analysis methods, establishing best practices, and ensuring validity and reliability. This section outlines procedures and techniques, enabling others to assess the study's credibility and replicate it, thereby enhancing result accuracy and contributing to the broader scientific community.

Course Focuses: Skill Development/Entrepreneurship/Employability/**Research**

Course Outcomes	On completion of this course, students will	
CO 1:	Comprehend various research designs and methodologies, including qualitative, quantitative, and mixed methods.	
CO 2:	Formulate clear, concise, and researchable questions or hypotheses.	
CO 3:	Select and apply appropriate data collection and analysis techniques, ensuring validity and reliability. Recognize and address ethical issues in research, including informed consent and data confidentiality.	
CO 4:	Critically evaluate existing research, assessing the strengths and weaknesses of different methodological approaches.	
CO 5:	Write coherent and structured research proposals and reports, effectively communicating findings.Apply methodological knowledge to solve real-world research problems and contribute to evidence-based practice.	

Unit I:	**Introduction**	**[12 Periods]**

Introduction to Business Research - Research in Business – Research Process- Research need, formulating the problem, designing, sampling, pilot testing.

Unit II:	**Research Design**	**[12 Periods]**

Research Design- Exploratory, Descriptive, Casual, Formulation of hypothesis - types. Measurement-characteristics of sound measurement tool, Scaling methods and sampling techniques.

Unit III:	**Data Collection and Manipulation**	**[12 Periods]**

Sources and Collection of Data: Primary and secondary sources, survey observation, experimentation- details and evaluation. - Questionnaires – schedules, data entry, tabulation & cross tabulation-and Graphic data presentation.

Unit IV:	**Data Analysis**	**[12 Periods]**

Analysis and Preparation: Hypothesis testing – statistical significance, statistical testing procedure. Tests of significance- -Simple Correlation -Regression.

Unit V:	**Presentation and Report**	**[12 Periods]**

Presenting results and writing the report: - The written research Report.

Text Books:

1. Donald R Cooper, Business Research Methods 7th Ed, McGraw Hill,2001

2. Krishnaswami OR, M.Ranganatham, Methodology of Research for Social Science, Himalaya, Mumbai,2001.

Reference Books:

1. Anderson J. et.al, Thesis and Assignment writing, Wiley Eastern

2. Research Methodology by C.R.Kothari

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	3	2	1	2	2		1		3			1
CO2	1		2		3	1	2		2		3	2	
CO3		2	1	3	2	3		2	1	1	2	1	1
CO4	2		3	2	1		1		3	2		3	3
CO5	3	2	3	2		1	3	2		3	1		2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Digital Image Processing	4	3	-	-	Core Theory

Course Introduction

Digital Image Processing course is to provide students with a comprehensive understanding of the fundamental concepts and techniques used to process digital images. This includes teaching the theoretical underpinnings and practical applications of image enhancement, restoration, segmentation, and compression. Students will learn how to implement and apply various algorithms to improve image quality, extract meaningful information, and efficiently store and transmit image data. The course aims to equip students with the skills necessary to develop and analyze digital image processing systems, preparing them for advanced studies or professional work in fields such as computer vision, medical imaging, multimedia, and remote sensing. Through hands-on projects and exercises, students will gain practical experience in using industry-standard software tools and programming languages to solve real-world image processing challenges.

Course Focuses: Skill Development/Entrepreneurship/Employability/**Research**

Course Outcomes	On completion of this course, students will
CO 1:	Understand the fundamentals of Digital Image Processing
CO 2:	Understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement
CO 3:	Apply, Design and Implement and get solutions for digital image processing problems
CO 4:	Apply the concepts of filtering and segmentation for digital image retrieval
CO 5:	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner

Unit I:	INTRODUCTION	[12 Periods]

Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.

Unit II:	IMAGE ENHANCEMENT	[12 Periods]

Image Enhancement in the spatial domain:- Background – some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.

Unit III:	IMAGE RESTORATION	[12 Periods]

Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering –

Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.

Unit IV:	**IMAGE COMPRESSION**	**[12 Periods]**

Image Compression: Fundamentals – Image compression models – Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.

Unit V:	**IMAGE SEGMENTATION**	**[12 Periods]**

Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Second Edition, PHI/Pearson Education.

2. B. Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2003.

Reference Books:

1. Nick Efford, "Digital Image Processing a practical introducing using Java", Pearson Education, 2004.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2	3	3	3	2	3	2	2	3	3	3	1
CO2	3	3	3	3	3	2	3	2	3	3	3	2	3
CO3	3	3	3	3	3	3	3	2	3	1	2	1	1
CO4	3	3	3	3	3	3	3	2	3	2	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Deep Learning	4	3	-	-	**Core Theory**

Course Introduction

The course aims to cover the theoretical foundations as well as the practical aspects of designing, training, and deploying deep neural networks. Students will explore various deep learning architectures, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), and generative adversarial networks (GANs), and learn how to apply them to a wide range of tasks such as image recognition, natural language processing, and game playing. The course will also address the challenges associated with deep learning, such as overfitting, computational efficiency, and the interpretation of model predictions. Through hands-on projects and assignments, students will gain practical experience in using popular deep learning frameworks like TensorFlow and PyTorch, enabling them to build and evaluate complex models. By the end of the course, students will be prepared to apply deep learning techniques to real-world problems, conduct research in the field, or pursue careers in industries where deep learning is transforming the landscape.

Course Focuses: Skill Development/Entrepreneurship/Employability/**Research**

Course Outcomes	On completion of this course, students will	
CO 1:	Understand the deep neural networks methodologies.	
CO 2:	Apply the deep learning methods with parameter tuning on computer vision applications.	
CO 3:	Apply the deep learning methods with parameter tuning on text and sequences data.	
CO 4:	Analyze different deep learning methods in varying conditions of the applications.	
CO 5:	Evaluate the performance of different deep learning methods	

Unit I:	**Fundamentals of Machine Learning**	**[12 Periods]**

Four branches of machine learning, Evaluating machine-learning models, Data pre-processing, feature engineering, and feature learning, Overfitting and under fitting, The universal workflow of machine learning.

Unit II:	**Artificial Neural Networks and Deep Neural Networks**	**[12 Periods]**

Artificial Neural Networks and Deep Neural Networks A first look at a neural network, Data representations for neural networks, The gears of neural networks: tensor operations, The engine of neural networks: gradient-based optimization, Anatomy of a neural network, Introduction to Keras, Setting up a deep-learning workstation, Classifying movie reviews: a binary classification example, Classifying newswires: a multiclass classification example, Predicting house prices: a regression example.

Unit III:	**Deep Learning for Computer Vision**	**[12 Periods]**

Introduction to convenets, The convolution operation, The max-pooling operation, Training a convnet from scratch on a small dataset, The relevance of deep learning for small-data problems, Downloading the data, Building your network, Data preprocessing, Using data augmentation, Using a pretrained convnet, Feature extraction, Fine-tuning, Visualizing what convnets learn, Visualizing intermediate activations, Visualizing convnet filters, Visualizing heatmaps of class activation

Unit IV:	**Deep Learning for Text and Sequences**	**[12 Periods]**

Working with text data, One-hot encoding of words and characters, Using word embeddings, Putting it all together: from raw text to word embeddings, Understanding recurrent neural networks, A recurrent layer in Keras, Understanding the LSTM and GRU layers, A concrete LSTM example in Keras, Advanced use of recurrent neural networks, A temperature-forecasting problem, Preparing the data, A common-sense, non-machine-learning baseline, A basic machine-learning approach, A first recurrent baseline, Using recurrent dropout to

Unit V:	Data Manipulation with Pandas	[12 Periods]

CNN, Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions. Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, and Microsoft ResNet Model. RCNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO .

Text Books:

1. Python Data Science Hand Book by Jake VanderPlas, Published by O'Reilly Media, Inc.,2007.
2. Python for Data Science, 3rd Edition, by Wes McKinney,Published by O'Reilly Media, Inc., 2022.

Reference Books:

1. Deep Learning with Python by Francois Chollet Manning Publications Co., Latest Edition
2. Deep Learning by Ian Goodfellow, YoshuaBengio and Aaron An MIT Press book
3. Neural Networks and Deep Learning by Michael Nielsen http://neuralnetworksanddeeplearning.com
4. Pattern Classification by Richard O. Duda, Peter E. Hart, David G. Stork John Wiley & Sons Inc

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2	3	3	3	2	3	2	2	3	3	3	1
CO2	3	3	3	3	3	2	3	2	3	3	3	2	2
CO3	3	3	3	3	3	3	3	2	3	1	2	1	1
CO4	3	3	3	3	3	3	3	2	3	2	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Digital Image Processing Lab	4	-	-	6	Core Practical

List of Practical Programs:

1. Simulation and Display of an Image, Negative of an Image(Binary &Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5. Display of bit planes of an Image
6. Display of FFT(1-D & 2-D) of an image
7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9. Implementation of image sharpening filters and Edge Detection using Gradient Filters
10. Image Compression by DCT,DPCM, HUFFMAN coding
11. Implementation of image restoring techniques
12. Implementation of Image Intensity slicing technique for image enhancement
13. Canny edge detection Algorithm

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2	3	3	3	3	2	2	2	3	3	3	1
CO2	3	2	3	3	3	3	3	2	3	3	3	2	3
CO3	3	2	3	3	3	3	3	2	3	1	2	1	1
CO4	3	2	3	3	3	3	3	2	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Deep Learning Lab	4	-	-	6	Core Practical

List of Practical Programs:

1. Build a deep neural network model start with linear regression using a single variable.
2. Build a deep neural network model start with linear regression using multiple variables.
3. Write a program to convert speech into text.
4. Write a program to convert text into speech.
5. Write a program to convert video into frames.
6. Write a program for Time-Series Forecasting with the LSTM Model.
7. Build a feed forward neural network for prediction of logic gates.
8. Write a program to implement deep learning Techniques for image segmentation.
9. Write a program for object detection using image labeling tools.
10. Write a program to predict a caption for a sample image using LSTM.
11. Write a program for character recognition using CNN.
12. Write a program to predict a caption for a sample image using CNN.
13. Write a program for character recognition using RNN and compare it with CNN.
14. Write a program to detect Dog image using YOLO Algorithm.
15. Write a program to develop Autoencoders using MNIST Handwritten Digits.
16. Write a program to develop a GAN for Generating MNIST Handwritten Digits.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2	3	3	3	3	2	2	2	3	3	3	1
CO2	3	2	3	3	3	3	3	2	3	3	3	2	3
CO3	3	2	3	3	3	3	3	2	3	1	2	1	1
CO4	3	2	3	3	3	3	3	2	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Software Engineering	4	4	-	-	**Core Theory**

Course Introduction

The course aims to teach students the entire software development lifecycle, from requirements analysis and system design to implementation, testing, and deployment. Students will learn best practices in software engineering, including agile and iterative development, project management, version control, and quality assurance. Emphasis is placed on designing software that is robust, efficient, scalable, and maintainable. Through hands-on projects and collaborative team exercises, students will gain practical experience in using contemporary software development tools and frameworks. The course also aims to develop skills in critical thinking, problem-solving, and effective communication, preparing students to work effectively in diverse and dynamic software development environments. By the end of the course, students will be equipped with the knowledge and skills necessary to contribute to complex software projects, engage in continuous learning, and adapt to the evolving landscape of technology and software engineering practices.

Course Focuses: Skill Development/Entrepreneurship/Employability/**Research**

Course Outcomes	On completion of this course, students will	
CO 1:	Understand about Software Engineering process	
CO 2:	Understand about Software project management skills, design and quality management	
CO 3:	Analyze on Software Requirements and Specification	
CO 4:	Analyze on Software Testing, Maintenance and Software Re-Engineering	
CO 5:	Design and conduct various types and levels of software quality for a software project	

Unit I:	**INTRODUCTION**	**[12 Periods]**

Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.

Unit II:	**SOFTWARE REQUIREMENTS**	**[12 Periods]**

Software Requirements Analysis and Specification : Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management – Software Quality, Software Quality Management System, ISO 9000, SEI CMM.

Unit III:	**PROJECT MANAGEMENT**	**[12 Periods]**

Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.

Unit IV:	**SOFTWARE DESIGN**	**[12 Periods]**

Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.

Unit V:	SOFTWARE TESTING	[12 Periods]

Software Testing: A Strategic approach to software testing – Terminologies – Functional testing – Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging – Testing tools - Metrics-Reliability Estimation. Software Maintenance - Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.

Text Books:

1. An Integrated Approach to Software Engineering – Pankaj Jalote, Narosa Publishing House, Delhi, 3rd Edition.
2 Fundamentals of Software Engineering – Rajib Mall, PHI Publication, 3rd Edition.

Reference Books:

1. Software Engineering – K.K. Aggarwal and Yogesh Singh, New Age International Publishers, 3 rd edition.
2 A Practitioners Approach- Software Engineering, - R. S. Pressman, McGraw Hill.
3 Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Manodrioli,PHIPublication.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2	3	3	3	2	3	2	2	3	3	3	1
CO2	3	3	3	3	3	2	3	2	3	3	3	2	
CO3	3	3	3	3	3	3	3	2	3	1	2	1	1
CO4	3	3	3	3	3	3	3	2	3	2	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Software Testing Lab	4	-	-	6	Skill

List of Practical Programs:

1. To write a c program to demonstrate the working of the following, a) Construct, b) Looping
2. To write a c program for matrix multiplication fails and write down the possible reasons
3. To test the various bugs.
4. To write the test cases for any knowing applications.
5. To create the test plan documents for any applications.
6. To study of the testing tools.
7. To study of the web testing tools.
8. To study of the bug tracking tools.
9. To study on the testing management tools.
10. To study of the open sources testing tools.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2	3	3	3	3	2	2	2	3	3	3	1
CO2	3	2	3	3	3	3	3	2	3	3	3	2	3
CO3	3	2	3	3	3	3	3	2	3	1	2	1	1
CO4	3	2	3	3	3	3	3	2	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	1	3	2

Semester-IV

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Artificial Intelligence	4	4	-	-	**Core Theory**

Course Introduction

The objective of an Artificial Intelligence (AI) course is to provide students with a comprehensive understanding of the fundamental principles, techniques, and applications of AI. The course aims to cover a wide range of topics including machine learning, neural networks, natural language processing, computer vision, robotics, and expert systems. Students will learn how to design, implement, and evaluate AI systems, gaining insights into the algorithms and models that drive intelligent behavior in machines. Emphasis is placed on both the theoretical underpinnings and practical applications of AI, ensuring that students can apply AI methods to solve real-world problems across various domains.

Course Focuses: Skill Development/Entrepreneurship/Employability/**Research**

Course Outcomes	On completion of this course, students will	
CO 1:	Describe the nature of AI problems and techniques of AI, Problem space search and Issues in design of search.	
CO 2:	Apply the appropriate Heuristic Search techniques to solve the problems by using Various algorithms.	
CO 3:	Select the suitable knowledge representation method and issues.	
CO 4:	Explain Representing simple facts and logic computable functions and predicates Using Predicate Logic.	
CO 5:	Compare the Procedural Versus Declarative knowledge, forward and backward Reasoning and Matching by Representing the knowledge using Rules.	

Unit I:	**Introduction**	**[12 Periods]**

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

Unit II:	**Problem Solving Techniques**	**[12 Periods]**

Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems -Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games

Unit III:	**Knowledge Representation**	**[12 Periods]**

Knowledge Representation First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories - Reasoning with Default Information

Unit IV:	**Software Agent**	**[12 Periods]**

Software Agents Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

Unit V:	**Applications**	**[12 Periods]**

Applications AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware –Perception – Planning – Moving.

Text Books:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.

2. Artificial Intelligence: A Modern Approach, 4th Edition, Stuart Russell, peter Norvig University of California at Berkeley, Pearson education, 2020.

Reference Books:

I. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth Edition, Addison-Wesley Educational Publishers Inc., 2011.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2	3	3	3	2	3	2	2	3	3	3	1
CO2	3	3	3	3	3	2	3	2	3	3	3	2	
CO3	3	3	3	3	3	3	3	2	3	1	2	1	1
CO4	3	3	3	3	3	3	3	2	3	2	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Artificial Intelligence Lab	4	-	-	6	Core

List of Practical Programs:

1: Implementation of toy problems

2: Developing agent programs for real world problems

3: Implementation of constraint satisfaction problems

4: Implementation and Analysis of DFS and BFS for an application

5: Developing Best first search and A* Algorithm for real world problems

6: Implementation of minimax algorithm for an application

7: Implementation of unification and resolution for real world problems.

8: Implementation of knowledge representation schemes - use cases

9: Implementation of uncertain methods for an application

10: Implementation of block world problem

11: Implementation of learning algorithms for an application

12: Development of ensemble model for an application

13: Expert System case study

14: Implementation of NLP programs

15: Applying deep learning methods to solve an application

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2	3	3	1	3	2	2	2	3		3	2
CO2	3	2	3	3	3	2	3	2	1	3	1		
CO3	3	1	3	3	3	3	2	2	3	1		1	3
CO4	3	2	3	2	3	2	3	2	3	2	3		
CO5	3	2	3	3	3	3	3	2	3	3	1	3	1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Cloud Computing Lab	4	-	-	6	Skill

List of Practical Programs:

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
 8. Install Hadoop single node cluster and run simple applications like wordcount.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2	3	3	3	3	2	2	2	3		3	1
CO2	3	2	3	3	3	3	3	2	3		3	2	3
CO3	3	2	3	3	3	3	3	2	3	1	2		1
CO4	3	2	3	3	3	3	3	2	3	2		3	
CO5	3	2	3	3	3	3	3	2	3		1	3	2

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Virtual Reality and Augmented Reality	4	4	-	-	**Elective**

Course Introduction

Virtual Reality (VR) and Augmented Reality (AR) course is to provide students with a thorough understanding of the fundamental concepts, technologies, and applications of VR and AR. The course aims to cover the principles of immersive environments, including the hardware and software components essential for creating and experiencing VR and AR content. Students will learn about the design and development of interactive 3D environments, user interface design, and the integration of virtual elements into the real world. The course emphasizes hands-on experience with VR and AR development tools and platforms such as Unity, Unreal Engine, and ARKit/ARCore. Additionally, the course explores the various applications of VR and AR across different fields such as gaming, education, healthcare, and industrial training, highlighting the potential and challenges of these technologies.

Course Focuses:Skill Development/Entrepreneurship/Employability/Research

Course Outcomes	On completion of this course, students will
CO 1:	Describe how VR systems work and list the applications of VR.
CO 2:	Understand the design and implementation of the hardware that enables VR systems to be built.
CO 3:	Understand the system of human vision and its implication on perception and rendering.
CO 4:	Explain the concepts of motion and tracking in VR systems.
CO 5:	Describe the importance of interaction and audio in VR systems.

Unit I:	**Introduction to Virtual Reality**	**[12 Periods]**

Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality

Unit II:	**Representing the Virtual World**	**[12 Periods]**

Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR

Unit III:	**The Geometry of Virtual Worlds &The Physiology of Human Vision**	**[12 Periods]**

Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.

Unit IV:	**Visual Perception & Rendering**	**[12 Periods]**

Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates

Unit V:	**Motion & Tracking**	**[12 Periods]**

Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies-Interaction - Motor Programs and Remapping, Locomotion,

Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Text Books:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002

3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009

Reference Books:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.

2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.

3. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.

4. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2	3	3	3	2	3	2	2	3	3	3	1
CO2	3	3	3	3	3	2	3	2	3	3	3	2	
CO3	3	3	3	3	3	3	3	2	3	1	2	1	1
CO4	3	3	3	3	3	3	3	2	3	2	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	1	3	2