Sanjay Ghodawat University, Kolhapur
Established as a State Private University under Govt. of Maharashtra Act no. XL dated 3rd May 2017
Empowering Lives Globally !

Department of Computer Applications

Programme Structure for M. C.A. First Year A.Y. 2024-25 (R24)

Semester I: Teaching Scheme

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total credits
P72PC101	Principles of Operating Systems	3	-	-	3	-	-	3
P72PC102	Data Structures using C++	3	-	-	3	-	-	3
P72PC103	Advance Database Concepts	3	-	-	3	-	-	3
P72PE1XX	Program Specific Elective I	3	-	-	3	-	-	3
P01RM101	Research Methodology	2	-	-	2	-	-	2
PXXOE1XX	Open Elective I	2	-	-	2	-	-	2
P72VS101	Advance Python Programming	-	4	-	-	2	-	2
P72PC104	Data Structures using C++ Lab	-	4	-	-	2	-	2
Total		**16**	**08**	**-**	**16**	**4**	**-**	**20**

Th: Theory, Pr: Practical, Tu: Tutorial

Department of Computer Applications

Programme Structure for M. C.A. First Year A.Y. 2024-25 (R24)

Semester I: Evaluation Scheme

Course Code	Course Name	Theory Marks					Practical Marks		Total
		Internal Assessment				SEE	Term work	Practical Oral/ POE	
		T1	T2	FET	Total				
P72PC101	Principles of Operating Systems	10	10	5	25	50	-	-	75
P72PC102	Data Structures using C++	10	10	5	25	50	-	-	75
P72PC103	Advance Database Concepts	10	10	5	25	50	-	-	75
P72PE101	Program Specific Elective I	10	10	5	25	50	-	-	75
P01RM101	Research Methodology	-	10	5	15	35	-	-	50
PXXOE1XX	Open Elective I	-	10	5	15	35	-	-	50
P72VS101	Advance Python Programming	-	-	-	-	-	25	25	50
P72PC104	Data Stuctures using C++ Lab	-	-	-	-	-	25	25	50

FET – Faculty evaluation for Theory, T1, T2, Continuous Assessment Test, SEE - Semester End Examination

Department of Computer Applications

Programme Structure for M. C.A. First Year A.Y. 2024-25 (R24)

Semester II: Teaching Scheme

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total credits
P72PC201	Application Development using Java	3	-	-	3	-	-	3
P72PC202	Unified Modeling Language	3	-	-	3	-	-	3
P72PC203	Computer Network and Security	3	-	-	3	-	-	3
P72PE201	Program Specific Elective II	3	-	-	3	-	-	3
P01RM201	Research Publications and Ethics	2	-	-	2	-	-	2
PXXOE2XX	Open Elective II	2	-	-	2	-	-	2
P72VS201	Advance Web Development	-	4	-	-	2	-	2
P72PC204	Java Programming Lab	-	4	-	-	2	-	2
Total		**16**	**08**	**-**	**16**	**4**	**-**	**20**

Th: Theory, Pr: Practical, Tu: Tutorial

Department of Computer Applications

Programme Structure for M. C.A. First Year A.Y. 2024-25 (R24)

Semester II: Teaching Scheme

Course Code	Course Name	Theory Marks					Practical Marks	
		Internal Assessment				SEE	Term work	Practical Oral/ POE
		T1	T2	FET	Total			
P72PC201	Application Development using Java	10	10	5	25	50	-	-
P72PC202	Unified Modeling Language	10	10	5	25	50	-	-
P72PC203	Computer Network and Security	10	10	5	25	50	-	-
P72PE2XX	Program Specific Elective II	10	10	5	25	50	-	-
P01RM201	Research Publications and Ethics	-	10	5	15	35	-	-
PXXOE2XX	Open Elective II	-	10	5	15	35	-	-
P72VS201	Advance Web Development	-	-	-	-	-	25	25
P72PC204	Java Programming Lab	-	-	-	-	-	25	25

Exit Option: Students who exit at the end of first year shall be awarded a PG Diploma after successful completion of first year with additional 4 credits earned through industry internship/field work/ vocational training/generic course/(s).

Department of Computer Applications

Programme Structure for M. C.A. Second Year A.Y. 2024-25 (R24)

Semester III: Teaching Scheme

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total credits
P72PC301	Mobile Application Development	3	-	-	3	-	-	3
P72PC302	MOOC	3	-	-	3	-	-	3
P72PR301	Dissertation Phase I	-	-	-	-	6	-	6
P72OT301	Industry Internship	-	-	-	-	8	-	8
Total		**6**	**-**	**-**	**06**	**14**	**-**	**20**

Th:

Theory, Pr: Practical, Tu: Tutorial

Department of Computer Applications

Programme Structure for M. C.A. Second Year A.Y. 2024-25 (R24)

Semester III: Evaluation Scheme

Course Code	Course Name	Theory Marks					Practical Marks		Total
		Internal Assessment				SEE	Term work	Practical Oral/ POE	
		T1	T2	FET	Total				
P72PC301	Mobile Application Development	10	10	5	25	50	-	-	75
P72PC302	MOOC	-	-	-	-	50	25	-	75
P72PR301	Dissertation Phase I	-	-	-	-	-	100	50	150
P72OT301	Industry Internship	-	-	-	-	-	150	50	200

FET – Faculty evaluation for Theory, T1, T2, Continuous Assessment Test, SEE - Semester End Examination

Department of Computer Applications

Programme Structure for M. C.A. Second Year A.Y. 2024-25 (R24)

Semester IV: Teaching Scheme

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total credits
P72PR401	Dissertation Phase II	-	40	-	-	20	-	20
	Total	-	40	-	-	20	-	20

Semester IV: Evaluation Scheme

Course Code	Course Name	*Theory Marks*					*Practical Marks*		Total
		Internal Assessment				SEE	Term work	Practical Oral/ POE	
		T1	T2	FET	Total				
P72PR401	Dissertation Phase II	-	-	-	-	-	350	150	500

OR

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Programme Structure for M. C.A. Second Year A.Y. 2024-25 (R24)

Semester III: Teaching Scheme (research)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total credits
P72RP301	Dissertation Phase I – Research	-	40	-	-	20	-	20

Semester III: Evaluation Scheme

Course Code	Course Name	*Theory Marks*					*Practical Marks*		Total
		Internal Assessment				SEE	Term work	Practical Oral/ POE	
		T1	T2	FET	Total				
P72RP301	Dissertation Phase I – Research	-	-	-	-	-	350	150	500

Department of Computer Applications

Programme Structure for M. C.A. Second Year A.Y. 2024-25 (R24)

Semester IV: Teaching Scheme (Research)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total credits
P72RP401	Dissertation Phase II – Research	-	-	-	-	20	-	20

Semester IV: Evaluation Scheme

Course Code	Course Name	*Theory Marks*					*Practical Marks*		Total
		Internal Assessment				SEE	Term work	Practical Oral/ POE	
		T1	T2	FET	Total				
P72RP401	Dissertation Phase II – Research	-	-	-	-	-	350	150	500

Department of Computer Applications

Programme Structure for M. C.A. First Year A.Y. 2024-25 (R24)

Program Specific Electives

Program Specific Elective –I		Credits
P72PE101	Artificial Neural Network	3
P72PE102	Artificial Intelligence	3
P72PE103	Cloud Computing	3
P72PE104	Quantum Computing	3
Program Specific Elective –II		
P72PE201	Soft Computing	3
P72PE202	Machine Learning	3
P72PE203	Block Chain Technology	3
P72PE204	Edge Computing	3

Department of Computer Applications

Programme Structure for M. C.A. First Year A.Y. 2024-25 (R24)

Open Electives

Open Elective –I		
P72OE101	Internet of Things	2
P72OE102	Industrial Internet of Things	2
Open Elective –II		
P72OE201	Multimedia Application	2

SEMESTER I

Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PC101	**Principles of Operating Systems**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PC101	**Principles of Operating Systems**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:
This course focuses on working of operating system and to understand the computer operating system, its structures, functioning and algorithms. Also, this course covers various commands used in Linux operating system and knowledge of shell programming.

Course Objectives:

1	To gain a comprehensive understanding of operating system structures, functions, and components.
2	To understand process creation, scheduling, concept.
3	To learn the concept pf memory hierarchy, allocation, virtual memory.
4	To study about file management.

Course Outcome: At the end of this course students will able to:	
CLO1	**Classify**[2] different types of Operating System.
CLO2	**Summarize**[2] the operating system services, system structure and process concept.
CLO3	**Write**[3] the appropriate CPU scheduling algorithms on various processes.
CLO4	**Distinguish**[4] between various file access method, structure and memory allocation.

Course Contents

Module	Unit	Description	Hours
1.0		**INTRODUCTION:**	9
1	1.1	Operating Systems Overview, Operating system functions, Overview of Computer Operating systems, Protection and Security, Distributed Systems, Special purpose systems, Operating System structures system components, Operating system services, system calls, system programs, system structure, Virtual machines, System Design and Implementation, System Generation.	
	1.2	PROCESS MANAGEMENT: Process Concept, Process Scheduling, Operations on Processes, Inter process Communication, Communication in Client – Server Systems	
2.0		**CPU SCHEDULING:**	9
2	2.1	Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real-time Scheduling, Algorithm Evaluation.	
	2.2	**PROCESS SYNCHRONIZATION:** Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Atomic Transactions	
	2.3	**DEADLOCKS:** System Model, Deadlock Characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	
3.0		**MEMORY MANAGEMENT:**	9
3	3.1	Background, Swapping, Contiguous Memory Allocation, paging, Structure of the Page Table, Segmentation, Segmentation with Paging.	
	3.2	**VIRTUAL MEMORY:** Background, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing.	
	3.3	**FILE SYSTEM INTERFACE:** File Concept, Access Methods, Directory Structure, File – System Mounting, File Sharing, Protection.	
4.0		**FILE SYSTEM IMPLEMENTATION:**	
4	4.1	File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free Space Management.	9

	4.2	**MASS - STORAGE STRUCTURE:** Disk Structure, Disk Scheduling, Disk Management, Swap- Space management, RAID Structure, Stable – Storage Implementations, Tertiary Storage Structure	
5.0		**SECURITY :**	9
5	5.1	User Authentication, program threads, system threats, security system facilities.	
	5.2	**LINUX SYSTEMS:** History, design principles, kernel modules, Management scheduling, scheduling, memory management and file system.	

Text Books:

1. Operating System Principles by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Seventh Edition.

References:

1. Chauhan, N. "Principles of Operating Systems", 2014, Oxford Press.
2. Tanenbaum, A. S., & Bos, H. "Modern Operating Systems", Fourth Edition, 2014, Pearson

- **Internal Assessment (T1, T2 and FET):**

1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
2. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**

1. Question paper will comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be 2/3/4 hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
P72PC102	**Data Structures using C++**	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
P72PC102	**Data Structures using C++**	10	10	5	25	40%	50	40%	75

Course Description:

The study of data structures helps to understand the basic concepts involved in organizing and storing data as well as the relationship among the data sets. This in turn helps to determine the way information is stored, retrieved and modified in a computer's memory.

Pre-requisite: - Basic knowledge of programming like C/C++, Computer Architecture

Course Objectives:

1.	To learn the concept and need of data structure.
2.	To understand the classification of data structures.
3.	To know algorithm complexity.
4.	To identify various operations on data structures

Course Outcomes: after the end of this course students will able to

CO1	**Explain**[2] the fundamental concept and importance of data structures in developing and implementing efficient algorithms.
CO2	**Use**[3] abstract data types including stacks, queues and lists.
CO3	**Design**[5] and implement nonlinear data structures - graphs
CO4	**Design**[5] and Implement Tree data structures and Sets.

Course Contents

Module	Unit	Description	Hours
1.0		**SEARCHING AND SORTING:**	
1	1.1	**Searching**: Importance of searching, Sequential, Binary search algorithms	9
	1.2	**Sorting**: Selection Sort, Insertion Sort, Merge sort, Shell sort, Radix sort.	
2.0		**LINEAR DATA STRUCTURES:**	
2	2.1	Abstract Data Types (ADT) – Stack – Queue – Circular Queue - Double Ended Queue - Applications of stack – Evaluating Arithmetic Expressions - Other Applications	9
	2.2	Applications of Queue - Linked Lists - Singly Linked List - Circularly Linked List - Doubly Linked lists – Applications of linked list – Polynomial Manipulation.	
3.0		**NON-LINEAR DATA STRUCTURES:**	
3	3.0	Binary Tree – expression trees – Binary tree traversals – applications of trees – Huffman Algorithm - Binary search tree - Balanced Trees - AVL Tree - B-Tree - Splay Trees – Heap- Heap operations- -Binomial Heaps – Fibonacci Heaps- Hash set.	9
4.0		**GRAPH:**	
4	4.1	**Graph** Representation of graph - Graph Traversals - Depth-first and breadth first traversal - Applications of graphs - Topological sort – shortest- path	9
	4.2	**Algorithms** Dijkstra's algorithm – Bellman-Ford algorithm – Floyd's Algorithm - minimum spanning tree – Prim's and Kruskal's algorithms.	
5.0		**ALGORITHM DESIGN & ANALYSIS:**	
5	5.1	**Algorithm Design & Analysis** Algorithm Analysis – Asymptotic Notations - Divide and Conquer – Merge Sort – Quick Sort - Binary Search - Greedy Algorithms – Knapsack Problem – Dynamic Programming – Optimal Binary Search Tree Warshall‟s Algorithm for Finding Transitive Closure.	9

	5.2	**Advanced Algorithm Design & Analysis** Backtracking – N-Queen's Problem - Branch and Bound – Assignment Problem . P & NP problems – NP-complete problems – Approximation algorithms for NP hard problems Traveling Salesman Problem-Amortized Analysis.	

Textbook:

1. Data structure with C, Seymour Lipschutz, Seymour Lipschutz (MGH)
2. Data structure through C, Yashavant Kanetkar, BPB Publication, 2nd Edition, 2003
3. Schaum's Outlines Data Structures – Seymour Lipschutz (MGH)

References:

1. Gilles Brassard, "Fundamentals of Algorithms", Pearson Education 2015
2. Harsh Bhasin, "Algorithms Design and Analysis", Oxford University Press 2015
3. John R. Hubbard, "Data Structures with Java", Pearson Education, 2015

- **Internal Assessment (T1, T2 and FET):**

  T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**
  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 2 /3/ 4 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PC103	**Advanced Database Concepts**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PC103	**Advanced Database Concepts**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:

This course deals with the basic understanding of programming in database. It touches security, recovery, and transaction aspects of database. The course will increase the confidence among the learner while dealing with database.

Pre-requisites: Basic Database Concepts**,** Normalization, Transaction Management.

Course Objectives:

1.	To learn the concept and need of data structure.
2.	To understand the classification of data structures.
3.	To know algorithm complexity.
4.	To identify various operations on data structures

Course Outcomes: after the end of this course students will able to

CO1	**Create**[6] tables and insert/update/delete data, and query data in a relational DBMS.
CO2	**Use**[3] the PL/SQL for data management.
CO3	**Understand**[3] concepts and implementations of transaction management and crash Recovery.
CO4	**Use**[3] the concepts of stored procedure, functions, cursors and triggers.

Course Contents

Module	Unit	Description	Hours
1.0		**OVERVIEW OF DBMS:**	
1	1.1	Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture, datatypes, DDL Commands, integrity constraints, DML Commands, aggregate functions, group by clause, having clause	9
	1.2	DML Commands, aggregate functions, group by clause, having clause	
2.0		**OVERVIEW OF PL/SQL:**	
2	2.1	Advantages of PL/SQL, Architecture of PL/SQL **Fundamentals of PL/SQL:** Defining variables and constants, PL/SQL expressions and comparisons, Data Types.	9
	2.2	**Control Statements:** Conditional Selection Statements, LOOP Statements, Sequential Control Statements.	
3.0		**SEQUENCES:**	
3	3.1	Creating sequences, referencing, altering, and dropping a sequence.	9
	3.2	**Stored Procedures and Functions:** Procedures: Types and benefits of stored procedures, creating stored procedures, executing stored procedures, altering stored procedures, viewing stored procedures. Functions: Calling function and recursion function.	
4.0		**ERROR HANDLING:**	
4	4.1	**Error Handling:** Compile-Time Warnings, Overview of Exception Handling, Internally Defined Exceptions, Predefined Exceptions, User Defined Exceptions, Redeclared Predefined Exceptions, Raising Exceptions Explicitly, Exception Propagation, Unhandled Exceptions.	9
	4.2	**Cursors:** Overview of Cursor, Types of cursors, Invalid cursor Exception	
5.0		**STATIC AND DYNAMIC SQL:**	
5	5.1	**Static and Dynamic SQL:** Static SQL: Description of Static SQL, Cursors Overview, Processing Query Result Sets, Cursor Variables, CURSOR Expressions, Transaction Processing and Control, Autonomous Transactions. Dynamic SQL: Native Dynamic SQL, DBMS_SQL Package, SQL Injection	9
	5.2	**Triggers:** Overview of Triggers, implementing triggers – creating triggers, Insert, delete, and update triggers, nested triggers, viewing, deleting, and	

		modifying triggers, and enforcing data integrity through triggers.	
	5.3	**Crash Recovery:** ARIES algorithm. The log-based recovery, recovery related structures like transaction and dirty page table, Write-ahead log protocol, check points, recovery from a system crash, Redo and Undo phases	

Text Books:

1. "Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke
2. "Database Systems: The Complete Book" by Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom.

References

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley, 2021
2. Achyut S. Godbole, Atul Kahate, Operating Systems, Tata McGraw Hill, 2017
3. Naresh Chauhan, Principles of Operating Systems, Oxford Press, 2014
4. Andrew S Tanenbaum, Herbert Bos, Modern Operating Systems, 4e Fourth Edition, Pearson Education, 2016.

- **Internal Assessment (T1, T2 and FET):**
  1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
  2. Fifth module will be assessed for 5 marks separately.
- **Semester End Examination:**
  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 2 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PE101	Artificial Neural Network	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PE101	Artificial Neural Network	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:

This course will cover both theoretical foundations and practical applications. Students will learn about the historical development, basic concepts, architectures, and learning algorithms of neural networks.

Pre-requisite: - Basic knowledge of architectures, and learning algorithms of neural networks.

Course Objectives:

1.	To gain exposure in the field of neural networks and relate the human neural system into the digital world.
2.	To provide knowledge of computation and dynamical systems using neural networks
3.	To apply neural network techniques to solve real-world problems in areas such as image and speech recognition, natural language processing, and predictive analytics.

Course Outcomes: after the end of this course students will able to

CO1	**Understand**[2] the principles of Neural Networks
CO2	**Identify**[3]different types of models of artificial neural networks.
CO3	**Analyse** [4] the feed-forward neural networks.
CO4	**Analyse** [4] the feedback neural networks.
CO5	**Compare** [4] different applications of artificial neural networks.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Artificial Neural Networks:**	
1	1.1	Basics of Artificial Neural Networks: Characteristics of Neural Networks, Historical Development of Neural Network Principles,	9
	1.2	Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws.	
2.0		**Activation and Synaptic Dynamics**:	
	2.1	Introduction, Activation Dynamics Models, Synaptic Dynamics Models, Learning Methods	9
3.0		**Feedforward Neural Network**:	
3	3.1	Introduction, Analysis of Pattern Association Networks, Analysis of Pattern Classification Networks,	9
4.0		**Feedback Neural Networks**:	
4	4.1	Introduction, Analysis of Linear Auto Associative FF Networks, Analysis of Pattern Storage Networks.	9
5.0		**Neural Network:**	
5	5.1	Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters.	9
	5.2	Neocognitron – Recognition of handwritten characters, to convert English text to speech. Recognition of consonant vowel (CV) segments, texture classification and segmentation.	

Text Books:

1. B. Yegnanarayana - Artificial neural network PHI Publication.2005Melanie Mitchell , An Introduction to Genetic Algorithms, MIT Press Publications, 2000.
2. S. Raj sekaran, Vijayalakshmi Pari - Neural networks, Fuzzy logic and Genetic Algorithms.

References:

1. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005.
2. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press, 1995

- **Internal Assessment (T1, T2 and FET)**

1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.

2. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**

1. Question paper will comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be 2 /3/ 4 hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PE102	Artificial Intelligence	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PE102	Artificial Intelligence	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:

This course provides an introduction to artificial intelligence. This course covers core topics of knowledge representation, reasoning, and learning, heuristic search techniques and expert systems.

Pre-requisite: - Basic knowledge of programming

Course Objectives:

1.	To learn the advantages, disadvantages, challenges and search algorithm of AI.
2.	To learn first order and predicate logic.
3.	To design user interfaces to improve human– AI interaction and real-time decision making.
4.	To solve complex problems and to provide decision-making ability using expert system.

Course Outcomes: after the end of this course students will able to

CO1	Use appropriate search algorithm for any AI problem
CO2	Represent a problem using first order and predicate logic
CO3	Design software agent to solve a problem
CO4	Solve complex problems and to provide decision-making ability using expert system.

Course Contents

Module	Unit	Description	Hours
1.0		**HEURISTIC SEARCH TECHNIQUES-I:**	
1	1.1	AI and its importance, AI Problem, Application area. State space representation, problem characteristics, problem-reduction representation,	9
	1.2	Production system, production system characteristics, and types of production system.	
2.0		**HEURISTIC SEARCH TECHNIQUES-II:**	
2	2.1	AI and search process, brute force search,depth-first search,breadth-first search, time and space complexities, heuristics search,hill climbing, simulated annealing, best first search,	9
	2.2	A* algorithm and beam search. problem reduction AO* algorithm, constraint satisfaction, means end analysis	
3.0		**KNOWLEDGE ACQUISITIONS:**	
3	3.1	Knowledge representation issues, knowledge representation mechanism Representing knowledge using rules, Horne clause, matching, control knowledge,	9
	3.2	Type of learning, Knowledge Acquisition, Early working machine learning, learning by induction	
4.0		**LOGIC:**	
4	4.1	Representing knowledge through simple logic, prepositional logic and predicate logic, Prepositional logic: syntax and semantics,	9
	4.2	First Order Predicate Logic (FOPL): Syntax and semantics, conversion to clausal form, inference rules, unification, and the resolution principles	
5.0		**REASONING:**	
5	5.1	Reasoning under uncertainty, types of reasoning's, abduction, inheritance, DFS and BFS, truth maintenance system.	9

	5.2	Expert System: Introduction to expert system, building blocks of expert systems, knowledge engineering, Phases of expert system, characteristics of expert system and a case study	

Textbook:

1. Artificial Intelligence and machine learning-Vinod Chandra S.S. And Anand Hareendran S.

References:

1. Artificial Intelligence–II Edition, Elaine Rich, Kevin Knight TMH
2. Foundations of Artificial Intelligence and Expert Systems, V S Janakiraman, K Sarukesi, P Gopalakrishan, Macmillan India Ltd.
3. Introduction to AI and Expert System, Dan W. Patterson, PHI

- **Internal Assessment (T1, T2 and FET):**

  T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**
  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 2 /3/ 4 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PE103	**Cloud Computing**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PE103	**Cloud Computing**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:

This course provides learners with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture, implantation and applications. To expose the learners to frontier areas of Cloud Computing, while providing sufficient foundations to enable further study and research.

Pre-requisite: - Basic Knowledge of Cloud Computing, Cloud Services, Virtualization, Data, Security, Networking

Course Objectives:

1.	To understand the concept of Cloud Computing**.**
2.	Understand the characteristics of virtualized environments, including hardware virtualization, software virtualization, and emulation
3.	Create and manage virtual machines (VMs) using KVM
4.	Identify the core components and services of OpenStack.

Course Outcomes: after the end of this course students will able to

CO1	Articulate the main concepts, key technologies, strengths, and limitations of cloud computing.
CO2	Identify the architecture and infrastructure of cloud computing.
CO3	Explain the core issues of cloud computing such as security, privacy, and interoperability
CO4	Recognize possible applications for state-of-the-art cloud computing using open source technology.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Cloud Computing**	
1	1.1	Introduction to Cloud Computing, Characteristics and benefits of Cloud Computing, Basic concepts of Distributed Systems, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing.	9
	1.2	Elements of Parallel Computing. Elements of Distributed Computing. Technologies for Distributed Computing.	
2.0		**Cloud Computing Architecture**	
2	2.1	Cloud Computing Architecture. The cloud reference model. Infrastructure as a service. Platform as a service. Software as a service. Types of clouds.	9
	2.2	Characteristics of Virtualized Environments. Taxonomy of Virtualization Techniques. Virtualization and Cloud Computing. Pros and Cons of virtualization.	
3.0		**Introduction of Virtualization**	
3	3.1	Virtualization using KVM, Creating virtual machines	9
	3.2	Virt - management tool for virtualization environment. Open challenges of Cloud Computing	
4.0		**Introduction to OpenStack**	
4	4.1	Introduction to OpenStack, OpenStack test-drive, Basic Open Stack operations, OpenStack CLI and APIs	9
	4.2	Tenant model operations, Quotas, Private cloud building blocks, Controller deployment, Networking deployment	
5.0		**Deployment and orchestration**	
5	5.1	Block Storage deployment, Compute deployment, deploying and utilizing OpenStack in production environments,	9
	5.2	Building a production environment, Application orchestration using OpenStack Heat	

References:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, Tata McGraw Hill Education Private Limited, 2013

2. OpenStack in Action, V. K. CODY BUMGARDNER, Manning Publications Co, 2016
3. OpenStack Essentials, Dan Radez, PACKT Publishing, 2015
4. OpenStack Operations Guide, Tom Fifield, Diane Fleming, Anne Gentle, Lorin Hochstein,Jonathan Proulx, Everett Toews, and Joe Topjian, O'Reilly Media, Inc., 2014
5. https://www.openstack.org

- **Internal Assessment (T1, T2 and FET):**

  T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**
  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 2 /3/ 4 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PE104	Quantum Computing	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PE104	Quantum Computing	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:

The objective of this course is to provide the students, an introduction to quantum computation. Much of the background, material related to the algebra of complex vector spaces and quantum mechanics is covered within the course

Pre-requisite: - Basic Knowledge of Linear Algebra

Course Objectives:

1.	To train students to handle various quantum technologies-based applications required for research and industry.
2.	To train students with the potential for developing quantum technologies in Space Science and Development: Quantum communication, quantum cryptography, quantum sensing, etc.
3.	To train the students to think out-of-box of the usual curriculum through research level projects and laboratory training.
4.	To develop new quantum technologies with the help of students, R&D labs, and Industries.

Course Outcomes: after the end of this course students will able to

CO1	**Undersand**[2] the fundamental and technological aspects of quantum technologies.
CO2	**Develop**[4] in quantum technologies to take up challenges in communications, cryptography, sensing, computing, spectroscopy and new materials.
CO3	**Design**[5] cutting-edge research and advanced futuristic devices directly.
CO4	**Develop**[4] human resources for the quantum technology-based Space Technology research to be a value-addition to the Indian Space Research program and other national scientific establishments

Course Contents

Module	Unit	Description	Hours
1.0		**Qubit & Quantum States**	
1	1.1	Quantum bits, Bloch sphere representation of a qubit, multiple qubits,Vector Spaces. Linear Combination of Vectors, Uniqueness of a spanning set, basis & dimensions.	9
	1.2	Inner products, orthonormality, gram-schmidt ortho gonalization, bra-ket formalism, the Cauchy-schwarez and triangle	
2.0		**Matrices & Operators**	
2	2.1	Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator.	9
	2.2	Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators, Commutator Algebra, Heisenberg uncertainty principle, polar decomposition & singular values, Postulates of Quantum Mechanics.	
3.0		**Tensor Products and Density Operator**	
3	3.1	Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices.	9
	3.2	Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector	
4.0		**Quantum Measurement Theory, Noise and error correction**	
4	4.1	Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite systems, Generalized Measurements,	9
	4.2	Positive Operator-Valued Measures, Graph states and codes, Quantum error correction	
5.0		**Quantum Algorithms**	
5	5.1	Classical computation on quantum computers, Relationship between quantum and classical complexity classes.	9
	5.2	Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search	

References:

1. Quantum Computation and Quantum Information, M A Nielsen and I L Chuang, Cambridge University Press.
2. Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific.
3. An Introduction to Quantum Computing, Pittenger,
4. An Introduction to Quantum Computing, P Kaye, R Laflamme and M Mosca.
5. Linear Algebra and its Applications, G. Strang.

- **Internal Assessment (T1, T2 and FET):**

  T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**
  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 2 /3/ 4 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P01RM101	**Research Methodology**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P01RM101	**Research Methodology**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		-	10	5	15	40%	35	40%	50

Course Description:

This course provides a comprehensive introduction to research methods used in various disciplines. Students will explore the fundamentals of research design, data collection, analysis, and interpretation. Emphasis is placed on understanding the theoretical under pinnings of different methodologies and their practical application in academic and professional settings.

Pre-requisites: Students should have a foundational understanding of what research is, including basic terminology such as hypothesis, variables, and literature review.

Course Objectives:

1.	To understand the basic concepts of research
2.	To learn an appropriate research design for a given research question
3.	Understand the basic statistical concepts and techniques for data analysis.
4.	To write a clear and comprehensive research proposal

Course Outcomes: after the end of this course students will able to

CO1	**Explain**[2] the principles and concepts of research methodology
CO2	**Use**[3] appropriate research designs and methods for different research questions.
CO3	**Design**[5] and evaluate research literature and methodologies
CO4	I**mplement**[5] practical skills in data collection, analysis, and interpretation.

Course Contents

Module	Unit	Description	Hours
1.0		**INTRODUCTION:**	
1	1.1	Meaning, Purpose and Nature of Research; Objectives & Motivations for Research; Scientific Method & Types of Research, Qualitative Research, Quantitative Research.	6
	1.2	Problem Formulation- Techniques involved in defining a problem. Introduction to Research Process- Steps in Research Process, Types of Research.	
2.0		**RESEARCH DESIGN:**	
2	2.1	Introduction to Research Design- Nature and components of good research design; Steps in developing a research design, Contents of research design; Identifying Research Gap-Problem Statement, Setting of Objectives and Formulation of Hypothesis, Operational definition of concepts.	**6**
	2.2	**Sampling Techniques-** Population, Sampling Frame, Sample, Bias; Statistical Terms in Sampling: statistic, parameter; Sampling Distribution, Sampling & non-sampling errors; Probability & Non-Probability Sampling, Identifying the Variables, Dependent Independent and Intervening Variables.	
3.0		**DATA COLLECTION METHODS:**	
3	3.1	Surveys and questionnaires, Interviews (structured, semi-structured, unstructured) Create observation guidelines, schedules, or checklists to ensure consistency in data collection.	**6**
	3.2	Observational methods Participants observations, non participants observations, structured observations, unstructured observations, Secondary data sources (archives, databases, literature reviews)	
4.0		**DATA ANALYSIS:**	
4	4.1	Introduction to statistical analysis (descriptive and inferential statistics, Qualitative data analysis techniques (thematic analysis, content analysis)	6
	4.2	Software tools for data analysis (e.g., SPSS, R, NVivo) Application of research methods in specific fields (e.g., social sciences, natural sciences, humanities)	
5.0		**RESEARCH PROPOSAL WRITING AND PRESENTATION:**	

5	5.1	Components of a research proposal (title, abstract, introduction, literature review, methodology, timeline, budget Grant writing basics	6
	5.2	Writing research papers (structure, style, citations)Presenting research findings (conference presentations, posters) Publishing in academic journals	

Textbook:

1. Research Methodology: Methods and Techniques by C.R. Kothari, New Age International Publishers

Reference Book:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches by John W. Creswell
2. Practical Research: Planning and Design by Paul D. Leedy and Jeanne Ellis Ormrod
3. Research Methods for Business: A Skill-Building Approach by Uma Sekaran and Roger Bougie.

- **Internal Assessment (T1, T2 and FET):**

T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**

1. Question paper will comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be 2 /3/ 4 hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72OE101	**Internet of Things**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72OE101	**Internet of Things**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		-	10	5	15	40%	35	40%	50

Course Description:
The purpose of this course is to impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications like home automation, healthcare, Agriculture etc.

Pre-requisites:

Course Objectives:

1.	To study fundamentals of IoT and role of sensors in IoT
2.	To learn different protocols used for IoT design
3.	To understand different IoT platforms to design and develop different applications
4.	Understand the role of IoT in various domains of Industry.

Course Outcomes: after the end of this course students will able to

CO1	**Explain**[2] the basics of IoT and its application sectors
CO2	**Describe**[2] Machine to Machine(M2M) in IoT
CO3	**Develop**[3] applications using IoT platforms
CO4	**Apply**[3] IoT protocols appropriately for developing application

Course Contents

Module	Unit	Description	Hours
1.0		**Fundamentals of IoT**:	
1	1.1	Introduction to IOT, definition and characteristics of IoT Architecture of Internet of Things, Physical and logical design of IOT	6
	1.2	Connectivity and Networking - Wireless Technologies, 5G in IioT, LPWAN (Low-Power Wide-Area Network)	
2.0		**Understanding Sensor Technology:**	
2	2.1	Definition of Sensors and Transducers, Importance and Applications of Sensors, Sensor Characteristics, Basic sensor types and principle	6

	2.1	Classification of Sensors (based on measurement, working principle, etc.), Sensor Interfaces and Communication, Analog and Digital Interfaces.	
3.0		**IoT Technical standards and protocols:**	
3	3.1	IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, Blutooth Loe Energy, Radio Frequency Identification	6
	3.2	Industry standards communication technology (LoRAWAN, MQTT etc), Wireless Sensor Networks (WSN)	
4.0		**IoT and M2M Communication and IoT Platforms**	
4	4.1	M2M, difference between IOT and M2M, ETSI M2M Architecture, system architecture ETSI M2M SCL resource structure, Security in ETSI M2M framework	6
	4.2	Design and Development - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi withPython Programming	
5.0		**Case Studies of IoT**	
5	5.1	Smart Metering, e-Health Body Area Networks.	6
	5.2	Home Automation, City Automation.	
	5.3	Smart Cards, Smart Agriculture	

Text Books:

1 Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)", st Edition, VPT, 2014.

2 Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.

References:

1 Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Willy Publications

2 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key pplications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications

3 Internet of Things- From Research and Innovation to Market Deployment, Ovidiu & Peter, River Publishers Series

Evaluation Scheme

- **Internal Assessment (T2 and FET):**
  1. T2 should be based on first three modules, for 10 marks each.
  2. Fourth and fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**
  1. Question paper will comprise of 4 questions.
  2. The duration of end semester examination shall be 2 hours.
  3. The students need to solve all 4 questions.
  4. Question No.1 will be compulsory, based on entire syllabus and carries 5 marks.
  5. Remaining question (Q.2 to Q.4) will be selected from all the modules caries 5 marks each.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72OE102	**Industrial Internet of Things**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72OE102	**Industrial Internet of Things**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		-	10	5	15	40%	35	40%	50

Course Description:
The purpose of this course is to impart knowledge on Industrial Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications and examples overview (building automation, transportation, healthcare, industry, etc.) with a focus towards industry.

Pre-requisites:

Course Objectives:

1.	Understand the various concepts, terminologies and architecture of IoT systems.
2.	Understand and apply various protocols for design of IoT systems
3.	Use sensors and actuators for design of IoT.
4.	Understand various applications of IoT in various domain of industry

Course Outcomes: after the end of this course students will able to

CO1	**Integrate** IoT devices, sensors, and actuators into manufacturing systems for real-time data collection.
CO2	**Apply** IoT protocols appropriately for developing application
CO3	**Evaluate** the security considerations and challenges associated with IoT-based systems and Explore about IoT platforms.
CO4	**Build** IIoT architecture for relevant industry application.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Industrial IoT**:	
1	1.1	Definition and Evolution of IIoT, History of IioT, Difference between IIoT and IoT, Key Components of IIoT, Sensors and actuators, Connectivity technologies.	6
	1.2	Connectivity and Networking - Wireless Technologies, 5G in IioT, LPWAN (Low-Power Wide-Area Network), Network Topologies.	
2.0		**Understanding Sensor Technology:**	

2	2.1	Definition of Sensors and Transducers, Importance and Applications of Sensors, Sensor Characteristics, Basic sensor types and principle	6
	2.1	Classification of Sensors (based on measurement, working principle, etc.), Sensor Interfaces and Communication, Analog and Digital Interfaces.	
3.0		**Communication Protocols in IIoT :**	
3	3.1	IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, Blutooth Loe Energy, Radio Frequency Identification	6
	3.2	Industry standards communication technology (LoRAWAN, MQTT etc), Wireless Sensor Networks (WSN)	
4.0		**Visualization of IIoT and Privacy and Security**	
4	4.1	Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.	6
	4.2	Introduction to web security, Conventional web technology and relationship with IIoT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Security model for IoT, Network security techniques.	
5.0		**Application of IIoT**	
5	5.1	Smart Metering, e-Health Body Area Networks.	6
	5.2	City Automation, Plant Automation.	
	5.3	Real life examples of IIOT in Manufacturing Sector.	

Text Books:

1 Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications 2. Bernd Scholz-Reiter, Florian

2 Michahelles, “Architecting the Internet of Things”, ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer

References:

1 Hakima Chaouchi, “ The Internet of Things Connecting Objects to the Web” ISBN : 978-1-84821-140-7, Willy Publications

2 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key pplications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications

3 Internet of Things- From Research and Innovation to Market Deployment, Ovidiu & Peter, River Publishers Series

Evaluation Scheme

- **Internal Assessment (T2 and FET):**
  3. T2 should be based on first three modules, for 10 marks each.
  4. Fourth and fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**
  6. Question paper will comprise of 4 questions.
  7. The duration of end semester examination shall be 2 hours.
  8. The students need to solve all 4 questions.
  9. Question No.1 will be compulsory, based on entire syllabus and carries 5 marks.
  10. Remaining question (Q.2 to Q.4) will be selected from all the modules caries 5 marks each.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72VS101	**Advanced Python Programming**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		Semester End Exam (POE)		
P72VS101	**Advanced Python Programming**	FEP	Min pass	Marks	Min pass	Total (Marks)
		25	40%	25	40%	50

Course Description:
The Advanced Python Programming course is designed for students who have a solid foundation in Python and are looking to deepen their understanding and mastery of the language. This course covers programming concepts, techniques, and libraries to equip students with the skills necessary to develop complex and efficient Python applications.

Pre-requisites: Basic knowledge of python programming language.

Course Objectives:

1	To enhance students' understanding of exception handling.
2	To introduce students to Python's powerful standard library.
3	To teach students how to build python GUI applications by using Tkinter module.
4	To provide hands-on experience with real-world applications and projects.

Course Outcomes: after the end of this course students will able to

CO1	**Define**[1] exception handling and user defined exception
CO2	**Illustrate**[2] Module(s) and Package(s) in python
CO3	**Build**[3] python applications using Tkinter module.
CO4	**Analyze**[4] the use of Pandas Library.

List of Experiments

Sr. No	List of Practical
1	Programs based on Python environment, basic syntax, and arithmetic operations.
2	Implementing control structures and loops in python.
3	Creating and manipulating basic data structures (lists, tuples, sets).
4	Creating and manipulating basic data structures (lists, tuples, sets).
5	Writing and using functions and modules.
6	Object-oriented programming concepts: classes, objects, and inheritance.
7	Implement advanced OOP: polymorphism, encapsulation, and magic methods.
8	Program based on Iterators, generators, and decorators.
9	Implementing, Multithreading, multiprocessing, and context managers.
10	Implementing File handling, regular expressions, and exception handling.
11	Design Data manipulation with NumPy and Pandas.
12	Implementation of Data visualization techniques.
13	Implement Web scraping and basic web development.
14	Working with APIs and JSON.

References

1. Martin C. Brown (Author), "Python: The Complete Reference" McGraw Hill Education, Fourth edition , 2018
2. R. Nageswara Rao, "Core Python Programming" Dreamtech Press India Pvt Ltd 2018

Evaluation Scheme

1. Term work assessment shall be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
3. Based on above scheme grading and Term work assessment should be done.
4. OE/POE shall be based on all Term work and work carried out during semester.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PC104	**Data Structures using C++ Lab**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		Semester End Exam (POE)		
P72PC104	**Data Structures using C++ Lab**	FEP	Min pass	Marks	Min pass	Total (Marks)
		25	40%	25	40%	50

Course Outcomes: after the end of this course students will able to

CO1	**Explain**[2] the fundamental concept and importance of data structures in developing and implementing efficient algorithms.
CO2	**Use**[3] abstract data types including stacks, queues and lists.
CO3	**Design**[5] and Implement Tree data structures and Sets.
CO4	**Design**[5] and implement nonlinear data structures – graphs.

List of Experiments

Experiments based on Course (**P72PC102**) Data Structures using C++.

Text Book:

1 Kick Start Python, Dr. Sangram, Patil, De,. Jaydeep Patil, Pinnacle Publication.

2 The complete reference Python, Martin Brown, MaCRAW Hills

References:

1 Kick Start Advance Python, Dr. Sangram, Patil, De,. Jaydeep Patil, Pinnacle Publication.

Evaluation Scheme

1. FEP assessment must be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per ‘credit and grading system’ manual and should be added and averaged.
3. Based on above scheme grading and FEP assessment should be done.

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SEMESTER II

Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PC201	**Application Development using Java**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PC201	**Application Development using Java**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:

This course provides an in-depth introduction to Java programming, covering core concepts such as the Java programming environment, basic syntax, data types, control flow, and arrays. It delves into Object-Oriented Programming (OOP) principles including classes, objects, inheritance, polymorphism, and interfaces. Students will learn about Java packages, exception handling, multi threading, and the Java Foundation Classes (JFC) and Swing for building graphical user interfaces. Additionally, the course explores Java Database Connectivity (JDBC) for database interactions and Servlets for web application development.

Pre-requisite: - Basic Knowledge of Core Java

Course Objectives:

1.	To understand the different mobile application Architectures
2.	Learn user interfaces for interacting with apps and triggering actions.
3.	To learn and know about data storing, retrieval and sharing in android.
4.	Appraise the role of security and performance in Android applications

Course Outcomes: after the end of this course students will able to

CO1	**Understand**[2] the core principles and environment of Java programming, including JVM, JIT Compiler, and Byte Code Concept.
CO2	**Apply**[3] object-oriented programming concepts such as inheritance, polymorphism, abstraction, and encapsulation using Java.
CO3	**Utilize**[4] Java Foundation Classes (JFC), Swing for GUI development, JDBC for database connectivity, and Servlets for web applications.
CO4	**Develop**[5] proficiency in handling Java exceptions, multithreading, and synchronization to create robust and efficient applications.

Course Contents

Module	Unit	Description	Hours
1.0		**FUNDAMENTAL PROGRAMMING IN JAVA:**	
1	1.1	The Java Buzzwords, The Java Programming Environment- JVM, JIT Compiler, Byte Code Concept, A Simple Java Program, Source File Declaration Rules, Comments, Data Types, Variables, Operators, Strings, Input and Output, Control Flow, Arrays Jagged Array.	9
	1.2	**OOPS**: Introduction, Class, Object, Static Keywords, Constructors, this keyword, Inheritance, Inner class, Anonymous Inner class, super keyword, Polymorphism (overloading and overriding), Abstraction, Encapsulation, Abstract Classes, Interfaces	
2.0		**EXCEPTION HANDLING & MULTITHREADING:**	
2	2.1	**Packages:** Introduction to predefined packages, User Defined Packages, Access specifiers. **Exception Handling**: Introduction, Pre-Defined Exceptions, try-catch-finally, throws, throw, User Defined Exceptions	9
	2.2	**Multithreading:** Thread Creations, Thread Life Cycle, Life Cycle Methods, Synchronization, wait() notify() notify all() methods.	
3.0		**INTRODUCTION TO JFC AND SWING:**	
3	3.1	Features of the Java Foundation Classes, Swing API Components, JComponent Class, Windows, Dialog Boxes, and Panels, Labels, Buttons, Check Boxes, Menus, Toolbars	9
	3.2	Implementing Action interface, Pane, JScrollPane, Desktop pane, Scrollbars, Lists and Combo Boxes, Text-Entry Components, Colors and File Choosers, Tables and Trees	
4.0		**JAVA DATABASE CONNECTIVITY:**	
4	4.1	Introduction, JDBC Architecture, JDBC Drivers, JDBC Connectivity Model, java.sql package, Using Statement, Prepared Statement, Callable Statement.	9
	4.2	ResultSet, Scrollable and Updatable ResultSet, Navigating and manipulating data, ResultSetMetaData, Managing Transactions in JDBC, JDBC Exception classes	
5.0		**SERVLETS:**	

5	5.1	Introduction, Servlet Life Cycle, Types of Servlet, Servlet Configuration with Deployment Descriptor, Working with ServletContext and ServletConfig Object, Attributes in Servlet,	9
	5.2	Response and Redirection using Request Dispacher and using sendRedirect Method, Filter API, Manipulating Responses using Filter API, Session Tracking: using Cookies, HTTPSession, Hidden Form Fields and URL Rewriting, Types of Servlet Event: ContextLevel and SessionLevel.	

References:

1. Herbert Schildt, Java The Complete Reference, Eleventh Edition, McGraw-Hill Education, 2020
2. Bryan Basham, Kathy Sierra, Bert Bates, Head First Servlets and JSP, O'reilly (SPD), 2018 ▪ Cay S. Horstmann, Gary Cornell, Core Java™ 2: Volume II–Advanced Features Prentice Hall PTR, 2004
3. Ivan Bayross, Web Enabled Commercial Applications Development Using Java 2, BPB Publications
4. E. Balagurusamy, Programming with Java- A Primer, Tata McGraw-Hill Education India, 2014
5. Programming in JAVA, 2nd Ed, Sachin Malhotra & Saurabh Choudhary, Oxford Press, 2018

- **Internal Assessment (T1, T2 and FET):**

  T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**

  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 2 /3/ 4 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PC202	**Unified Modelling Language**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PC202	**Unified Modelling Language**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total Marks
		10	10	5	25	40%	50	40%	75

Course Description:

This course provides a comprehensive overview of Unified Modeling Language (UML) and its various diagrams, including structural, behavioral, and interaction diagrams. Students will learn key concepts, notations, and best practices for creating UML models using popular UML modeling tools. By the end of the course, students will have the skills to effectively communicate and visualize software development projects using UML.

Course Objectives:

CLO1	Understand the purpose and evolution of UML, and identify the different types of UML diagrams.
CLO2	Master the concepts and notations of UML structural diagrams like Class and Object diagrams, and comprehend relationships within these diagrams.
CLO3	Develop proficiency in creating and interpreting UML behavioral diagrams, such as Use Case and Sequence diagrams, to model user and object interactions.
CLO4	Explore advanced UML concepts like Collaboration and Communication diagrams, and understand their significance in modeling object interactions.
CLO5	Gain practical experience in using popular UML modeling tools, applying best practices for creating accurate and consistent UML models.

Course Outcome: At the end of this course students will able to:	
CLO1	**Classify**[2] the fundamental concepts and purpose of Unified Modeling Language (UML)

CLO2	**Summarize**[2] different types of UML diagrams, including structural, behavioral, and interaction diagrams
CLO3	**Write**[3] model user interactions with a system using UML diagrams
CLO4	**Distinguish**[4] UML tools and software to create accurate and consistent UML models for software development projects)

Course Contents

Module	Unit	Description	Hours
1.0		**INTRODUCTION TO UNIFIED MODELING LANGUAGE (UML):**	
1	1.1	Overview of UML - Definition and purpose of UML - History and evolution of UML	9
	1.2	UML Diagrams - Different types of UML diagrams (Class, Use Case, Sequence, etc.) - Use cases of each UML diagram.	
2.0		**UML STRUCTURAL DIAGRAMS:**	
2	2.1	Class Diagram - Concepts and notations used in class diagrams - Relationships in class diagrams (inheritance, associations, etc..	9
	2.2	Object Diagram - Purpose and usage of object diagrams - Differences between class and object diagrams	
3.0		**UML BEHAVIORAL DIAGRAMS:**	
3	3.1	Use Case Diagram - Components of a use case diagram - Modeling user interactions with the system	9
	3.2	Sequence Diagram - Sequence diagram notations and elements - Representing interactions between objects in a system	
4.0		**UML INTERACTION DIAGRAMS:**	
4	4.1	Collaboration Diagram	9

		- Characteristics and uses of collaboration diagrams - Modeling interactions between objects in a system.	
	4.2	Communication Diagram - Purpose and benefits of communication diagrams - Visual representation of object interactions	
5.0		**ADVANCED UML CONCEPTS:**	
5	5.1	UML Tools and Software - Popular UML modeling tools and their features - Hands-on experience with UML tools.	9
	5.2	UML Best Practices - Guidelines and best practices for creating UML diagrams - Ensuring consistency and accuracy in UML models	

Text Books:

1. UML Distilled: A Brief Guide to the Standard Object Modeling Language" by Martin Fowler
2. "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development" by Craig Larman
3. "UML 2.0 in Action: A Project-Based Tutorial" by Patrick Graessle, Albert Fleishman, and Tony Lai
4. "The Unified Modeling Language Reference Manual, Second Edition" by James Rumbaugh, Ivar Jacobson, and Grady Booch.

References:

1. "UML For The IT Business Analyst" by Howard Podeswa
2. "Learning UML 2.0" by Russell Miles and Kim Hamilton
3. Online resources such as the official OMG UML specification and various UML tutorial websites.

- **Internal Assessment (T1, T2 and FET):**

1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
2. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**

1. Question paper will comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be 2 hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PC203	**Computer Network and Security**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PC203	**Computer Network and Security**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total Marks
		10	10	5	25	40%	50	40%	75

Course Description:

The course explores the principles of up-to-date network systems and focuses on key operational and technical aspects. Core modules such as Data Communications, Computer Networks, and Programming and Problem Solving for Communications are covered in this course.

Course Objectives:

1	To learn and understand the fundamentals of computer security.
2	To learn and understand the fundamentals of symmetric and public/private encryption algorithms
3	To learn and understand the fundamentals of message digest and hash function.
4	To learn and understand the fundamental of message authentication and digital signature.

Course Outcome: At the end of this course students will able to:	
CLO1	**Analyze**^{4} different computer network modelling layers and addressing schemes
CLO2	**Demonstrate**^{5} performance of TCP, UDP & different application layer protocols.
CLO3	**Demonstrate**^{2}message authentication Methods
CLO4	**Illustrate**^{2} symmetric and asymmetric cryptographic algorithms

Course Contents

Module	Unit	Description	Hours
1.0		**DATALINK LAYER:**	
1	1.1	Techniques, Issues in the Data Link Layer, Framing, Error correction and detection, Link Level Flow Control	9
	1.2	Medium Access, Ethernet, Token Ring, FDDI.	
2.0		**NETWORK LAYER:**	
2	2.1	Circuit Switching, Packet Switching Virtual Circuit Switching, IP, ARP, DHCP, ICMP, Routing, RIP, OSPF	9
	2.2	Subnetting,CIDR, Inter domain Routing–BGP. Logical Addressing IPV4 Addressing & IPV6, Basic Features, Inter Domain Multicast, Congestion.	
3.0		**TRANSPORT LAYER**	
3	3.1	User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Application Layer Network Architecture, Layers	9
	3.2	HTTP, DNS, E-Mail (SMTP, MIME, POP3, IMAP, Web(WWW), FTP, Telnet, SNMP	
4.0		**INTRODUCTION TO CYBER SECURITY:**	
4	4.1	Security goals, Cryptographic Attacks, Services and Mechanism, technique Mathematics of Cryptography: Integer Arithmetic, Modular Arithmetic, Matrices	9
	4.2	Traditional. Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers.	
5.0		**DATA ENCRYPTION AND MESSAGE AUTHENTICATION:**	

5	5.1	Introduction, DES Structure, DES Analysis, Security of DES, IDEAAdvanced Encryption Standard: Introduction, Transformations	9
	5.2	Key Expansion, and Analysis of AES.Message authentication and Hash functions-Authentication functions, MACs, HMAC, CMAC, Hash functions, Digital signatures and authentication protocols, Digital signaturestandard.	

References:

1. William Stallings, “Data and Computer Communications”, Eighth Edition, Pearson Education, 2011.
2. James F. Kurose, Keith W.Ross,“Computer Networking, A Top, Down Approach Featuring the Internet”, Third Edition, Pearson Education, 2006.
3. BehrouzA.Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security",2nd Edition, McGraw Hill Education, 2014
4. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
5. Tanenbaum,Computer Networks, PHI Publication, 5th Edition, 2011.

- **Internal Assessment (T1, T2 and FET):**
  1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
  2. Fifth module will be assessed for 5 marks separately.
- **Semester End Examination:**
  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 2/3/4 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PE201	**Soft Computing**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PE201	**Soft Computing**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:
This course will cover fundamental concepts used in Soft Computing. Enhancing communication between the research communities of statistics and soft computing is the primary goal of Soft Computing Techniques to improve. Soft Computing offer a knowledge and methods for creating intelligent systems.

Pre-requisite: - Basic knowledge of Mathematics,Proficiency with algorithms, Programming skills

Course Objectives:

1.	To learn soft computing problems and solve it.
2.	To learn concept of fuzzy logic and use it in various industrial applications.
3.	Understand different multi objective optimization problems and solve them
4.	Learn Neural Network concepts and apply its techniques to various applications.

Course Outcomes: after the end of this course students will able to

CO1	**Identify**[3] applications of soft computing to solve real life problems
CO2	**Make Use of**[3] concepts of Fuzzy Logic in industrial applications.
CO3	**Integrate**[3] and Solve multi-objective optimization problems
CO4	**Apply**[3] suitable Neural Network techniques to various applications.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Soft Computing:**	
1	1.1	Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, FuzzyComputing,NeuralComputing, Genetic Algorithms, Associative Memory.	9
	1.2	Adaptive Resonance Theory, Classification, Clustering, Bayesian Networks, Probabilistic reasoning, applications of soft computing**.**	
2.0		**Fuzzy Logic:**	
2	2.1	Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theoryand operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzyto Crisp conversion.	9
	2.2	Membership Function: features of the membership functions,fuzzification, methods of membership value assignments. Defuzzification: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods.Fuzzy Controller, Industrial applications	
3.0		**Genetic Algorithm:**	
3	3.1	History of Genetic Algorithms (GA), Working Principle,Various Encoding methods, Fitness function	9
	3.2	Genetic Algorithm Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization,Problem Solving using Genetic Algorithm, Advantages and limitations and applications ofgenetic algorithm.	
4.0		**Multi-objective Optimization Problem Solving:**	
4	4.1	Concept of multi-objective optimization problems (MOOPs) and issues of solving them, Multi-Objective Evolutionary Algorithm (MOEA)	9
	4.2	Non Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs, Some applications with MOEAs	
5.0		**Neural Network:**	
5	5.1	Fundamental Concepts, Basic Models and Architecture; Machine Learning Using Neural Networks; Associative Memory Networks and their Applications.	9
	5.2	Supervised Learning Neural Networks: Perceptron Networks, Radial Basis Function Networks: Back Propagation Neural Network: Architecture, Learning, Applications, & Research Directions; The Boltzman Machine.	

	5.3	Unsupervised Learning Networks: Competitive Learning networks; Kohonen Self-Organizing Networks; Hebbian learning; The Hopfield Network; Counter propagation Networks; Adaptive Resonance Theory: Introduction, Architecture, & Applications; Feed forward Networks; Reinforcement Learning.	

Text Books:

1. S. Rajasekaran, G. A.VijayalakshmiPai, Neural Networks, Fuzzy Logic and GeneticAlgorithm, Synthesis and Applications, PHI Learning Pvt. Ltd., 2017.
2. Melanie Mitchell , An Introduction to Genetic Algorithms, MIT Press Publications,2000.
3. D. K. Pratihar, Soft Computing : Fundamentals and Applications, Second Edition,Narosa Publications, 2013.

References:

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Third Edition, Wiley India Publications, 2011.
2. Kwang H. Lee, First course on Fuzzy Theory and Applications, Springer Publications, 2005.
3. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall Publications, 1996.

- **Internal Assessment (T1, T2 and FET):**

  T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**

  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 2 /3/ 4 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PE202	Machine Learning	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PE202	**Machine Learning**	**T1**	**T2**	**FET**	**Total**	**Min pass**	**Marks**	**Min pass**	**Total (Marks)**
		10	10	5	25	40%	50	40%	75

Course Description:

This course provides a comprehensive introduction to machine learning, a field of artificial intelligence that focuses on the development of algorithms and statistical models that enable computers to perform specific tasks without explicit instructions. Students will explore the fundamental principles and techniques of machine learning.

Pre-requisites: Artificial Intelligence (P72PE102)

Course Objectives:

1.	To provide a comprehensive understanding of Machine Learning concepts
2.	To develop practical kills in implementing Machine Learning algorithms
3.	To expose students to real-world applications and case studies
4.	To elaborate the deep learning architecture

Course Outcomes: After the end of this course students will able to

CLO1	**Understand**[2] the fundamental concepts and techniques in machine learning
CLO2	**Apply**[3] various machine learning algorithms to real-world problems
CLO3	**Evaluate**[5] the performance of machine learning models
CLO4	**Find**[1] the role of IoT in machine learning.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Machine Learning**	
1	1.1	Concept and history of machine learning, Types of machine learning- supervised, unsupervised, and reinforcement learning, Overview of applications in different fields	9
	1.2	Basic Concepts and Terminology (Features, labels, datasets, Training, validation, and test sets)	
2.0		**Supervised Learning**	
2	2.1	Regression - Linear and polynomial regression, Regularization techniques (Ridge and Lasso), Evaluation metrics (MSE, RMSE, MAE)	9
	2.2	Classification - Logistic regression, K-Nearest Neighbors (KNN), Support Vector Machines (SVM), Evaluation metrics (accuracy, precision, recall, F1 score)	
3.0		**Decision Trees and Ensemble Methods**	
3	3.1	Decision Trees - Construction and pruning, Feature importance, algorithm	9
	3.2	Ensemble Methods, Random Forest, Gradient boosting, Bagging and boosting techniques	
4.0		**Neural Networks and Deep Learning**	
4	4.1	Basics of Neural Networks, Perceptrons and multi-layer Perceptrons, Back propagation algorithm	9
	4.2	Deep Learning – Concept, Convolutional Neural Networks, Recurrent Neural Networks	
5.0		**Unsupervised Learning and Advanced Topics**	
5	5.1	Clustering - K-means clustering, Hierarchical clustering, concept of Principal Component Analysis (PCA)	9
	5.2	Reinforcement learning basics, concept of Natural Language Processing (NLP)	
	5.3	Internet of Things, Applications of Internet of Things, The Architecture of IoT	

Textbooks:

1. Mitchell, T. M. (1997). Machine Learning. McGraw Hill Education, International Edition.

References:

1. Jain, V. K. (2020). Machine Learning. Khanna Publishing House.
2. Vinod Chandra, S. S. (2014). Artificial Intelligence & Machine Learning. PHI.

- **Internal Assessment (T1, T2 and FET):**

1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
2. Fifth module will be assessed for 5 marks separately.

- **End Semester Examination:**
    1. Question paper will comprise of 5 questions, each carrying 10 marks.
    2. The duration of end semester examination shall be 2/3/4 hours.
    3. The students need to solve all 5 questions.
    4. Question No.1 will be compulsory and based on entire syllabus.
    5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PE203	Blockchain Technology	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PE203	Blockchain Technology	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:
This course focuses on working of Blockchain Technology and to understand the Blockchain Technology,its Types platforms and network. Also, this course covers various languages used in blockchain technology

Course Objectives:

1	Gain a comprehensive understanding of Blockchain Technology its types and network.
2	Understand blockchain and its various features.
3	Learn the concept of solidity programming and its implementation
4	To study smart contract.

Course Outcome: At the end of this course students will able to:

CLO1	**Classify**[2] different types of Blockchain.
CLO2	**Summarize**[2] the Blockchain Technology its types and network
CLO3	**Write**[3] the concept of solidity programming and its implementation
CLO4	**Implementation**[4] of Smart contract in transportation.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction:**	
1	1.1	Introduction to Blockchain Technology – Distributed systems – The history of Blockchain – Introduction to Blockchain – CAP theorem and Blockchain, Benefits and limitations of Blockchain – Decentralization using Blockchain - Methods of decentralization – Routes to decentralization	9
	1.2	Cryptography in Blockchain: Cryptography in Blockchain: Introduction – cryptographic primitives Asymmetric cryptography – public and private keys, line interface – Bitcoin improvement proposals (BIPs) – Consensus Algorithms	
2.0		**Digital Currency:**	
2	2.1	Introduction to Bitcoin: Bitcoin Introduction – Transactions – Structure - Transactions types The structure of a block– The genesis block – The bitcoin network– Wallets and its types.	9
	2.2	Bitcoin payments– Bitcoin investment and buying and selling bitcoins Bitcoin installation – Bitcoin programming and the command-line interface– Bitcoin improvement proposals (BIPs).	
	2.3	Ethereum - Ethereum block chain- Elements of the Ethereum block chain– Precompiled contracts – Accounts and its types – Block header- Ether Messages	
3.0		**Blockchain Platform**	
3	3.1	Mining - Clients and wallets – Trading and investment – The yellow paper , The Ethereum network - Applications developed on Ethereum Scalability and security issues.	9
	3.2	Smart Contract and Hyper ledger – History of Smart Contract – Ricardian contracts - The DAO, Hyper ledger projects	
	3.3	Hyper ledger as a protocol –Fabric – Hyper ledger Fabric – Sawtoothlake, Create Smart Contract.	
4.0		**Blockchain Security and Privacy**	
4	4.1	Threats and vulnerabilities in Blockchain networks.Security measures: encryption, key management, and consensus protocols	9

	4.2	Data privacy importance, Data controller, Data principal, Data Processors, Pruning, Forking, Application of Data Privacy to Blockchain.	
5.0		**Blockchain Application:**	
5	5.1	Disruptive innovations in Blockchain, Ethical, social, and economic implications of widespread Blockchain adoption.	9
	5.2	Exploration of emerging Blockchain technologies (e.g., Blockchain interoperability, scalability solutions),Potential future applications	

Text Books:

1. Operating System Principles by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Seventh Edition.

References:

1. Chauhan, N. "Principles of Operating Systems", 2014, Oxford Press.
2. Tanenbaum, A. S., & Bos, H. "Modern Operating Systems", Fourth Edition, 2014

- **Internal Assessment (T1, T2 and FET):**

1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
2. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**

1. Question paper will comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be 2/3/4 hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PE204	Edge Computing	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72PE204	Edge Computing	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description:
This course focuses on working of Blockchain Technology and to understand the Blockchain Technology,its Types platforms and network. Also, this course covers various languages used in blockchain technology

Course Objectives:

1	To understand the students about edge computing, an important branch of distributed
2	To learn edge computing and IoT with significant applications in Data Science.

Course Outcome: At the end of this course students will able to:

CLO1	**Understand**[2] the need for new computing paradigms.
CLO2	**Elobrate**[2] major components of fog and edge computing architectures.
CLO3	**Identify**[2] potential technical challenges of the transition process and suggest solutions.
CLO4	**Analyze**[4] data and application requirements and pertaining issues and design model infrastructures.

Course Contents

Module	Unit	Description	Hours
1.0		**INTRODUCTION:**	
1	1.1	Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition.	9
	1.2	Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog, and M2M.	
2.0		**IOT ARCHITECTURE AND CORE IOT MODULES**	
2	2.1	IoT Architecture and Core IoT Modules-A connected ecosystem,IoT versus machine-to-machine versus.	9
	2.2	SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect.	
	2.3	Understanding Implementations with the examples- Edge computing with RaspberryPi, Industrial, and Commercial IoT and Edge, and Edge computing and solutions	
3.0		**Edge Computing Architectures**	
3	3.1	Introduction to Edge Computing Architectures, Edge Computing to support User Applications (5G-Slicing, self-driving)	9
	3.2	Concepts of distributed systems in edge computing such as time ordering and clock synchronization, distributed snapshot, etc.	
	3.3	Introduction to Edge Data Center, Lightweight Edge Clouds and its services provided by different service providers.	
4.0		**Edge Computing Storage System:**	
4	4.1	Introduction to MQTT and Kafka for end-to-end edge pipeline. Edge analytics topologies for M2M and WSN network (MQTT)	9
	4.2	Introduction to docker container and Kubernetes in edge computing. Design of edge storage systems like key-value stores	
5.0		**Case Study using Edge Computing:**	

5	5.1	Use cases of machine learning for edge sensor data in predictive maintenance, image classifier and self-driving cars.	9
	5.2	Deep Learning On-Device inference at the edge to support latency-based application	

References:

1. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322
3. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE

- **Internal Assessment (T1, T2 and FET):**

1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
2. Fifth module will be assessed for 5 marks separately.

- **Semester End Examination:**

1. Question paper will comprise of 5 questions, each carrying 10 marks.
2. The duration of end semester examination shall be 2/3/4 hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P01RM201	**Research Publications and Ethics**	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**
		02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P01RM201	**Research Publications and Ethics**	**T1**	**T2**	**FET**	**Total**	**Min pass**	**Marks**	**Min pass**	**Total (Marks)**
		-	10	5	15	40%	35	40%	50

Course Description:

This course provides a comprehensive overview of the ethical considerations and best practices in research and scholarly publication. It aims to equip students with the knowledge and skills necessary to navigate the complex landscape of academic publishing, ensuring integrity and ethical conduct throughout the research process.

Pre-requisites: Research Methodology.

Course Objectives:

1	To understand the principles of research ethics, including honesty, integrity, and responsibility.
2	To develop skills in identifying and addressing ethical dilemmas in research and publication.
3	To gain insights into issues related to plagiarism, authorship disputes, and conflicts of interest.
4	To learn best practices for writing and submitting research papers to academic journals.

Course Outcomes: after the end of this course students will be able to

CO1	**Memorize**[1] the fundamental principles of research ethics, including integrity, honesty, and accountability
CO2	**Identify**[2] and avoid unethical practices such as plagiarism, data fabrication, and falsification.
CO3	**Develop**[5] skills for writing clear, concise, and ethical research papers.
CO4	**Discover**[3] best practices for data sharing and the importance of data transparency and reproducibility also the ethical implications of data ownership and intellectual property rights.

Course Contents

Module	Unit	Description	Hours
1.0		**PHILOSOPHY, ETHICS AND SCIENTIFIC CONDUCT**	
1	1.1	Introduction to philosophy: definition, nature and scope, concept, branches, Ethics: definition, moral philosophy, nature of moral judgments and reactions. Ethics with respect to science and research, Intellectual honest and research integrity.	9
	1.2	Scientific misconducts: Falsification, Fabrication,and Manipulation, Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.	
2.0		**PUBLICATION ETHICS**	
2	2.1	Publication ethics: definition, introduction and importance, Best practices / standards setting initiatives and guidelines :COPE, WAME, etc., Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa,	9
	2.2	Violation of publication ethics, authorship and contributor-ship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals; Approved and peer reviewed Research journals	
3.0		**WRITING OF GOOD QUALITY RESEARCH PAPERS**	
3	3.1	What is good quality research paper in Science and Technology?, Identify good research journal for publication of good quality of research, Writing good paper, interpretation of good research, presentation of data, original research, validation of original data, protection of original research.	9
	3.2	Effect of publication of original research on patent filing, Open access publications and initiatives SHERPA-RoMEO online resource to check publisher copyright and self-archiving policies	
4.0		**DATABASES AND RESEARCH METRICS**	
4	4.1	Databases: Indexing databases, Citation databases: Web of Science, Scopus.	9
	4.2	Research Metrics: Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, CiteScore. Metrics: h-index, g-index, i10-index,	

		Altmetrics, Google Scholar, Research Gate, Pub-med etc.	
5.0		**INTELLECTUAL PROPERTY RIGHTS**	
5	5.1	History of intellectual property and various conventions governing IPR, Key concepts of copyright and trademarks law.	9
	5.2	Key concepts of patent law, Advisory on filing and prosecuting copyright, trademark application and Patent application applications.	

Text Books

1 Loue, S. (2000). Research ethics: Theory and practice. Kluwer Academic/Plenum Publishers.

2 Jasanoff, S. (2016). The ethics of invention: Technology and the human future. W.W. Norton & Company.

3 Subramanian, R. Professional ethics. Oxford University Press

References

1 Kapoor, P. Professional ethics and human values. Khanna Book Publishing.

2 Gaur, R.R., Sangal, R., & Bagaria, G.P. A foundation course in human values and professional ethics. Excel Books

- **Internal Assessment (T1, T2 and FET):**
  1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
  2. Fifth module will be assessed for 5 marks separately.
- **End Semester Examination:**
  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 2 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72OE201	Multimedia Application	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**
		02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					Semester End Exam (SEE)		
P72OE201	Multimedia Application	**T1**	**T2**	**FET**	**Total**	**Min pass**	**Marks**	**Min pass**	**Total (Marks)**
		-	10	5	15	40%	35	40%	50

Course Description

This course provides an in-depth exploration of multimedia applications, tailored for M.Tech students. It covers the fundamental principles and advanced concepts of multimedia systems, focusing on the creation, manipulation, and presentation of multimedia content. Students will gain both theoretical knowledge and practical skills essential for developing and managing multimedia applications across various domains such as entertainment, education, and business.

Pre-requisites: Computer Graphics, Computer Networks, and programming.

Course Objectives

1	Comprehensive Understanding of Multimedia Data.
2	Skill Development in Multimedia Processing Techniques.
3	Proficiency in Multimedia Data Management and Retrieval.
4	Exploration of Advanced Multimedia AI Applications

Course Outcomes: After the end of this course students will be able to

CO1	**Analyze**[4]complex multimedia systems and architectures to understand their components and functionalities.
CO2	**Evaluate**[5]various multimedia compression techniques to determine their effectiveness and suitability for different applications.
CO3	**Formulate**[6]innovative solutions to multimedia-related challenges by applying advanced technologies and emerging trends.
CO4	**Design**[6] interactive educational multimedia application that includes animations, videos, and interactive quizzes.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Multimedia**	
1	1.1	Definition and Components of Multimedia, Applications and Significance in Various Fields, Multimedia Hardware and Software, Multimedia Data Representation, Metadata and Its Role in Multimedia	5
2.0		**Multimedia Data Representation**	
2	2.1	Text Data Representation: Character Encoding: ASCII, Unicode, UTF-8 Image Data Representation: Bitmap Graphics: Formats (BMP, GIF, JPEG, PNG), Vector Graphics: Formats (SVG, AI, EPS), Color Models: RGB, CMYK, HSL, HSV. Audio Data Representation: Digital Audio Basics: Sampling Rate, Bit Depth. Audio File Formats: MP3, WAV, AAC, FLAC	5
	2.2	Audio Compression: Lossy vs. Lossless.4 Video Data Representation Video Basics: Frame Rate, Resolution, Color Depth Video File Formats: AVI, MP4, MKV, MOV Video Compression: Codecs (H.264, HEVC).Metadata in Multimedia: Definition and Importance , Types of Metadata: Descriptive, Structural, Administrative Usage of Metadata: Search, Organization, CMS	
3.0		**Multimedia Systems and Architectures**	
3	3.1	Multimedia Databases: Database Management Systems for Multimedia Querying Multimedia Databases Multimedia Content Management Systems (CMS), Features and Functions of CMS. Multimedia Servers and Distribution Networks: Types of Servers: Streaming, Storage Content Distribution Networks (CDN). Real-Time Multimedia Systems: Requirements and Challenges, Protocols for Real-Time Communication Multimedia Synchronization: Techniques for Synchronizing Multimedia Elements.	5
4.0		**Multimedia Content Creation**	
4	4.1	Multimedia Authoring Tools: Software Tools: Adobe Creative Suite, Final Cut Pro, And Blender. Image Editing Techniques: Tools and Techniques for Image Manipulation. Audio Editing Techniques: Tools and Techniques for Sound EditingVideo Editing Techniques: Tools and Techniques for Video Production. Animatio and Special Effects: Basics of AnimationAdding Special Effects to Multimedia Projects	5
5.0		**Multimedia Compression Techniques**	
5	5.1	Fundamentals of Compression: Importance of Compression in Multimedia Lossless Compression Techniques: Algorithms: Run-Length Encoding, Huffman Coding, LZW, Lossy Compression Techniques Algorithms: JPEG, MP3, MPEGEvaluation of Compression PerformanceMetrics: Compression Ratio, Quality, and Speed.	5

		Applications of CompressionUse Cases in Different Domains	
	5.2	Multimedia Communication Protocols RTP, RTSP, SIP. Streaming Technologies and ServicesLive Streaming, On-Demand Streaming. Quality of Service (QoS) in Multimedia Networks QoS Metrics and Management. Interactive Multimedia ApplicationsHuman-Computer Interaction in MultimediaVirtual Reality and Augmented Reality. Future Trends in MultimediaEmerging TechnologiesEthical and Legal Considerations	

Text Books

1. Multimedia – An Introduction: John Villamil – Casanova, Louis Molina – Prentice Hall, India

2 Multimedia Systems: Buford Koegel John F., Addison Wesley (Pearson Education Asia), 2000,

.

References

1 Multimedia Systems and Techniques: BorkoFurht, Kluwer Academic Publishers

2 Multimedia Systems: John F. Koegel Buford, ACM Press, Addison Wesley

Evaluation Scheme

Internal Assessment (T1, T2 and FET)

1. T2 should be based on First to Two modules, for 10 marks.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. Question paper will be of 35 marks comprise of 5 questions, each carrying 7 marks
2. The duration of end semester examination shall be Two hours.
3. The students need to solve all questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

Lab course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
P72VS201	**Advance Web Development**	-	04	-	-	02	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		Semester End Exam (POE)		
		Term Work	Min pass %	Marks	Min pass %	Total (Marks)
P72VS201	**Advance Web Development**	25	40	25	40	50

Course Objectives:

1	To create and publish HTML pages with the help of frames, scripting language and CSS.
2	To understand and use Java Script and PHP.

Course Outcomes: after the end of this course students will able to

CLO1	**Introduce**[1] basic concept of HTML and CSS.
CLO2	**Demonstrate**[3] the different concepts of Java Script.
CLO3	**Develop**[6] jQuery code to access web document.
CLO4	**Design**[6] and develop dynamic, database-driven web applications using PHP.

List of Experiments

1. Implement simple programs using html tags.
2. Implement a responsive design using CSS media queries.
3. Create animations and transitions using CSS.
4. Add interactivity to a webpage using JavaScript.
5. Write a program for calculator by using JavaScript
6. Apply form validation on any registration form.
7. Create calendar using jQuery.
8. Demonstrate the use of session and cookies in PHP.
9. Connecting MySQL database from PHP and create table, insert, update, delete record.
10. Use jQuery plugins to enhance functionality on a webpage.

Text Book

1. "HTML and CSS: Design and Build Websites" by Jon Duckett
2. "JavaScript and JQuery: Interactive Front-End Web Development" by Jon Duckett
3. "PHP Objects, Patterns, and Practice" by Matt Zandstra

Reference Books

1. A beginner's guide to HTML, NCSA,14th May 2003
2. JavaScript and JQuery the missing manual, David Sawyer McFaland, o'Reilly publication.
3. Programming PHP: Creating dynamic web pages, Kevin Tatroe, Peter Maclntyre, O'Reilly publication.
4. Beginning HTML, XHTML, CSS and Javascript, John duckett, Wiley India
5. Beginning PHP and MySQL from Novice to professional" by W Jason Gilmore.

- **Evaluation Scheme**
  1. Termwork assessment shall be based on the overall performance of the student with every assignment graded from time to time.
  2. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
  3. Based on above scheme grading and Termwork assessment should be done.
  4. OE/POE shall be based on all Termwork and work carried out during semester

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Lab course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
P72PC204	Java Programming Lab	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		-	04	-	-	02	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		Semester End Exam (OE/POE)		
P72PC204	Java Programming Lab	Term Work	Min pass %	Marks	Min pass %	Total (Marks)
		25	40	25	40	50

Course Objectives:

1	Learn core Java concepts such as data types, control structures, classes, and objects.
2	Learn how to use advanced programming concepts like encapsulation, inheritance, polymorphism, and abstraction in Java.

Course Outcomes: after the end of this course students will able to

CLO1	**Undersand**[1] basic concept of oop implementation
CLO2	**Demonstrate**[3] the different data types
CLO3	**Develop**[6] threading reating threads, synchronizing thread execution, implementing thread
CLO4	**Design**[6] and devlop java based applications.

List of Experiments

1 Write a program tofind the average and sum of the numbers using Command line argument.

2 Write a program to demonstrateTypeCasting.

3 Write a program to find the number of arguments provide at run time.

4 Write a program to Test the Prime number.

5 Write a program to calculate the Simple Interest and Input by the user.

6 Write a program to find G.C.D of the number.

7 Write a program to design a class account using the inheritance and static that show all function of bank (withrowal, deposite).

8 Write a program to find the factorial of a given number using Recursion.

9 Write a program to design a class using abstract Methods and Classes.

10 Write a program to designa String class that perform String Method (Equal,Reverse the string,change case).

11 Write a program to handle the Exception using try and multiple catch block.

Text Book:-

1. Programming With Java Balagurusamy, E. 2nd ed TMH

Reference Book:-

1. Java 2 Programming: Black Book Holzner, Steven 5th ed Dreamtech
2. Beginning Java Server Pages Chopra, Vivek/ Others Wiley- Dreamtech India
3. Core Java : Volume I – Fundamentals Horstmann, C. S/ Cornell, G. 8th ed Pearson
4. Core Java 2: Volume I – Fundamentals Horstmann, C. S/ Cornell, G. 7th ed Pearson 20

Evaluation Scheme

1. Termwork assessment shall be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per ‘credit and grading system’ manual and should be added and averaged.
3. Based on above scheme grading and Termwork assessment should be done.
4. OE/POE shall be based on all Termwork and work carried out during semester

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