MCA SCHEME & SYLLABUS

(2026-2027)

B.V.V.S

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BASAVESHWARENGINEERINGCOLLEGE, BAGALKOTE-587102
Department of Computer Applications (MCA)
For the Admitted Batch 2026-27

MCA–I Semester Scheme of teaching and examinations for 2026-2027

Sl. No.	Course	Course Code	Subject	Credits	Hours/Week			Examination Marks		
					Lecture	Tutorial /SDA	Practical/ Seminar	CIE	SEE	Total
1.	BSC	2PCAA101C	Mathematical Foundations for Computer Applications	3	3	-	-	50	50	100
2.	IPCC	2PCAA102C	Database Management Systems	4	3	-	2	50	50	100
3.	PCC	2PCAA103C	Introduction to Data Science and Applications	3	3	-	-	50	50	100
4.	PCC	2PCAA104C	Operating Systems and Concepts	3	3	-	-	50	50	100
5.	PCC	2PCAA105C	Python Programming	4	4	-	-	50	50	100
6.	PCCL	2PCAA106L	Python Laboratory	1	-	-	2	50	50	100
7.	PCCL	2PCAA107L	Web Programming Laboratory	2	-	2	2	50	50	100
			Total	**20**	**16**	**02**	**06**	**350**	**350**	**700**

Note:**BSC**-BasicScienceCourses,**PCC**:Professionalcore.**IPCC**-IntegratedProfessionalCoreCourses,**PCC(PB):**ProfessionalCoreCourses(ProjectBased),**PCCL**-ProfessionalCoreCourselab**,NCMC**-NoneCreditMandatoryCourse,**PP-**Pass/Pass, **NP-** Not Pass ,**L-**Lecture**,P-**Practical**,T/SDA-**Tutorial**/**SkillDevelopmentActivities(Hours are for Interaction between faculty and students NCMC-Research Methodology (**Online**) course is not counted for vertical progression; Students have to qualify for the award of the master's degree.

NCMC- Non Credit Mandatory Course (NCMC),Research Methodology, which students have to register and pass the course mandatorily through NPTEL/VTU Online Courses between 1st to 3rd semester for the award of the degree. Passing the course will be as per NPTEL/VTU Online Course Criteria. The result of the same will be reflected in the 4th semester.

MOOCS (3 credits / 12 weeks- PEC/MDC): This is mandatory course of 3 credits (12 weeks duration), which student have to register between 1st to 3rd semester or 4th semester from the BOS approved list of Swayam/ NPTEL /VTU Online Courses and passed with minimum of **50%** score for the award of the degree. The result will be reflected in the 4th semester.

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Bridge Course: Non-Credit Mandatory Course - Bridge Course Mathematics for MCA Program Students who have not taken Mathematics at the 10+2 or degree level are required to study and pass this course in the 1st semester. However, this course/subject will not be considered for vertical progression.
BSC: Basic Science Courses: Courses like Mathematics/ Science are the prerequisite courses that the concerned board of Studies will decide. **PCC: Professional Core Course:** Courses related to the stream of engineering, which will have both CIE and SEE components, students have to qualify in the course for the award of the degree. **Integrated Professional Core Course (IPCC)**: Refers to a Professional Theory Core Course Integrated with practical of the same course. The IPCC's theory part shall be evaluated by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE).However, questions from the practical part of IPCC shall be included in the SEE question paper. **PCCL: Professional Core Course Laboratory:** Practical courses whose CIE will be evaluated by the class teacher and SEE will be evaluated by the two examiners.

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Department of Computer Applications (MCA)

For the Admitted Batch 2026-27

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MCA-II Semester Scheme of teaching and examinations for 2026-2027

Sl. No.	Course	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
					Lecture	Tutorial / SDA	Practical	CIE	SEE	Total
1	PCC	2PCAA201C	Machine Learning	3	3	-	-	50	50	100
2	PCC	2PCAA202C	Data Structures and Algorithms using Python	3	3	-	-	50	50	100
3	PCC	2PCAA203C	Software Engineering	3	3			50	50	100
4	PCC	2PCAA204C	Computer Networks	3	3	-	-	50	50	100
5	PEC	2PCAA2XXE	Professional Elective Course - 1	3	3	-	-	50	50	100
6	IPCC	2PCAA205C	Java Full Stack Development	4	3	-	2	50	50	100
7	AEC	2PCAA206L	Machine Learning and Data Visualization Lab	1	-	-	2	50	50	100
8	PCCL	2PCAA207L	Data Structures Laboratory	2	-	-	3	50	50	100
			Total	**22**	**18**	**00**	**07**	400	400	800

PEC-1	
Code	**Title of the Course**
2PCAA201E	Natural Language Processing
2PCAA202E	Content Management System
2PCAA203E	Big Data Analytics
2PCAA204E	Blockchain Technology
2PCAA205E	Quantum Computing

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For the Admitted Batch 2026-27

Note: BSC-Basic Science Courses, PCC: Professional core. IPCC-Integrated Professional Core Courses, PCC(PB): Professional Core Courses (Project Based), PCCL-Professional Core Course lab ,NCMC- Non Credit Mandatory Course, ,L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities(Hours are for Interaction between faculty and students) Research Methodology (**Online**) for the students who have **not studied** this course in the Undergraduate level. This course is not counted for vertical progression; Students have to qualify for the award of the master's degree.

BSC: Basic Science Courses: Courses like Mathematics/ Science are the prerequisite courses that the concerned engineering stream board of Studies will decide. PCC: Professional Core Course: Courses related to the stream of engineering, which will have both CIE and SEE components, students have to qualify in the course for the award of the degree. Integrated Professional Core Course (IPCC): Refers to a Professional Theory Core Course Integrated with practicals of the same course. The IPCC's theory part shall be evaluated by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. Project Based Learning Course (PCC(PB): Project Based Learning course is a professional core Course only Students have to complete a project out of learning from the course and SEE will be viva voce on project work. PCCL: Professional Core Course Laboratory: Practical courses whose CIE will be evaluated by the class teacher and SEE will be evaluated by the two examiners.

Skill development activities: Under Skill development activities in a concerning course, the students should

1. Interact with industry (small, medium, and large).
2. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
3. Involve in case studies and field visits/ fieldwork.
4. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in the modeling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze, and authenticate the output to interpret and conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc. Students and the course instructor/s are to be involved either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical –activities that will enhance their skills. The prepared report shall be evaluated for CIE marks.

Ability Enhancement Courses : Data Visualization Lab

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Department of Computer Applications (MCA)

For the Admitted Batch 2026-27

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MCA-III Semester Scheme of teaching and examinations for 2027-2028

Sl. No.	Course	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
					Lecture	Tutorial / SDA	Practical	CIE	SEE	Total
1.	IPCC	2PCAA301C	Software Testing	4	3	-	2	50	50	100
2.	PCC	2PCAA302C	Cloud Computing	3	3	-	-	50	50	100
3.	PEC	2PCAA3XXE	Professional Elective Course - II	3	3	-	-	50	50	100
4.	PEC	2PCAA3XXE	Professional Elective Course - III	3	3	-	-	50	50	100
5.	PROJ	2PCAA3XXP	Project Work	09	15-20 hours per week			50	50	100
			Total	**22**	**12**	**00**	**02**	250	250	500

Professional Elective Courses (PECs)				
PEC - II			**PEC - III**	
Course Code	**Title of the Course**		**Course Code**	**Title of the Course**
2PCAB301E	Internet of Things		2PCAC306E	Wireless Network and Mobile Computing
2PCAB302E	Robotic Process Automation		2PCAC307E	Software Quality Assurance
2PCAB303E	Deep Learning		2PCAC308E	Agentic AI
2PCAB304E	Generative AI		2PCAC309E	Digital Forensics
2PCAB305E	Cyber Security		2PCAB310E	DevOps

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Project work is a significant component aimed at fostering research, practical application of knowledge, and innovation. The evaluation process generally follows these steps:

1. **Selection and Approval of Project Work:**
   - Topic Selection: Students propose project topics, often in consultation with their faculty advisor.
   - Approval Process: The proposed topic is submitted for approval by a project committee or department, ensuring alignment with academic standards and relevance.

2. **Project Execution:**
   - Research and Development: Students carry out research, experiments, or development work as per the project plan.
   - Periodic Reviews: Regular progress reviews are conducted by faculty to monitor the project's progress and provide feedback.
   - Documentation: Students maintain a detailed record of their methodology, data, results, and analysis. Finalized Scheme V4 8

3. **Submission of the Project Report:**
   - Format and Guidelines: The report must follow the prescribed format by the university or department.
   - Plagiarism Check: The report is often checked for plagiarism to ensure originality.

4. **Evaluation Process:**
   - Internal Evaluation: Faculty members from the department review the project report and presentation for content quality, innovation, and depth of research.
   - External Evaluation: An external examiner, often an industry expert or academician from another institution, reviews the project.
   - Viva Voce Examination: The student defends their project work before a panel comprising internal and external examiners. This assesses their understanding, analytical ability, and application of the project work.

5. **Grading Criteria (Guidelines only)**
   - Report Quality: Depth of research, organization, and clarity of the document.
   - Presentation Skills: Effectiveness in communicating key aspects of the project.
   - Technical Merit: Innovation, accuracy, and the applicability of the research.
   - Viva Performance: Understanding of the subject, responses to questions, and ability to discuss the work effectively.

6. **Final Outcome:**
   - Marks Allocation: Typically, evaluation is a blend of internal (guided by the department) and external (examiner's input) assessments, distributed over the report, presentation, and viva.
   - Pass Requirement: Students must meet a minimum threshold to pass, as per university policies.

This structured evaluation ensures a comprehensive assessment of the student's practical and research capabilities, preparing them for further research or professional practice.

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BASAVESHWARENGINEERINGCOLLEGE, BAGALKOTE-587102
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For the Admitted Batch 2026-27

MCA-IV Semester Scheme of teaching and examinations for 2027-2028

Sl. No.	Course	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
					Lecture	Tutorial / SDA	Practical	CIE	SEE	Total
1.	PEC	2PCAA4XXM	Professional Elective Course - III (Online Courses NPTEL/NPTEL + -12 weeks)	3	-	-	-	-	-	100
2.	PEC	2PCAA4XXM	Professional Elective Course - III (Online Courses NPTEL/ NPTEL + -12 weeks)	3	-	-	-	-	-	100
3.	SDC	2PCAA4XXI	Internship (15 weeks)	10	-	-	-	100	100	200
			Total	**16**	-	-	-	100	100	400

INT: Industry/ Research Internship leading to the project work /startup **PROJ:** Project work outcome of Internship (Project Work Phase-II is Viva voce SEE)

2PCAAXXX: 2 course Online NPTEL/ NPTEL + can be cumbersome so one research article may be accepted/Published. A patent can be also one option.

Industry Internship: The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

Research Internship: A research internship is an opportunity for students or early career professionals to gain hands-on experience in conducting research under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, government agencies, or private companies

Research /Industry Internship: In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks. he/she has to attend the SEE at the parent Institute.

MCA I SEMESTER SYLLABUS
(2026-2027)

Course Code		**:**	**2PCAA101C**	**Mathematical Foundation for Computer Applications**	**Semester**	**:**	**I**
L:T:P		**:**	**3: 0 :0**		**Course Type**	**:**	**Theory**
Hours/Sem.	**Teaching**	**:**	**42Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**6Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90Hrs**		**Credits**	**:**	**3**

Professional Competency:

Develop the ability to apply mathematical foundations, logical reasoning, and statistical techniques to solve computational and real-world problems effectively.

Course Outcomes:

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

CO1: Apply the fundamentals of set theory and mathematical logic to perform various set operations and logic to the real world problems.
CO2: Apply the concept of relations and functions on sets to determine their types and compositions.
CO3: Acquire ability to work with graph theory.
CO4: Analyze mathematical concepts like statistics and probability to optimize the solutions of engineering problem.
CO5: Demonstrate the ability to use counting techniques, permutations, combinations, and the principles of inclusion and exclusion to solve complex computational and analytical problems.

UNIT-I	**12Hrs.**

Set Theory: Sets and Subsets , Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, Principles of Inclusion and Exclusion, Permutations and Combinations with repetition. **Fundamentals of Logic :**Basic Connectives and Truth Tables, Logic Equivalence- the laws of Logic, Logical Implications, Rules of Inference, The use of Quantifiers, Quantifier Definitions.

UNIT-II	**10Hrs.**

Functions: Cartesian products and Relations, Functions-Plain and One-to-One, Onto Functions, Special functions, The Pigeon-hole principle, Function composition and inverse functions. **Relations :**Properties of Relations, Computer recognition-Zero One Matrices and Directed graphs, Posets and Hasse Diagrams

UNIT-III	**10Hrs.**

Graph Theory :Graphs and Graphs models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring,

UNIT-IV	**10Hrs.**

Statistics: Introduction**,** Measures of central tendency (Arithmetic mean ,Geometric mean, Harmonic mean, Median , Quartiles , Mode). Measures of dispersion (Range, Quartile deviation, mean deviation and standard deviation).**Random variable and probability distribution** Concept of random variable, discrete probability distributions, continuous probability distributions, Mean, variance and co-variance and co-variance of random variables. Binomial and normal distribution, Exponential and normal distribution with mean and variables and problems.

Text Books:

1. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics an Applied Introduction, 4th Edition, Pearson Education, 2003.
2. Kolman, Busby and Ross, Discrete Mathematics for Computer Science, PHI Publication.
3. A.K.Jaiswal and Anju khandelwal , "Computer based numerical and statistical techniques", New age international publishers , 2009.
4. Richard A Johnson and C.B Gupta "Probability and statistics for engineers" Pearson Education.
5. H.K.Dass , "Advanced engineering mathematics ", S.Chand Ltd, 2009.

Reference Books:

1. Dr. K. S. Chandrashekhar, Engineering Mathematics- IV, Sudha Publications

Course Outcomes	Programme Outcomes							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**3**	-	-	-	-	-	-	**2**
CO2	**3**	-	-	-	-	-	-	-
CO3	**3**	-	-	**2**	-	-	-	-
CO4	**3**	**2**	**2**	**2**	-	-	-	**3**
CO5	**3**	**2**	**2**	**3**	-	-	-	-

Course Code		:	2PCAA102C	Database Management Systems	Semester	:	1
L:T:P		:	03:00:00		Course Type	:	Theory
Hours/Sem.	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	90 Hrs		Credits	:	03

Professional Competency:

Demonstrates comprehensive expertise in designing, implementing, and managing enterprise relational database systems. Equipped with core competencies in:

- **Data Modeling & Architecture:** Designing conceptual and logical data structures using ER/EER modeling and translating them into optimized relational schemas.
- **Database Design Optimization:** Applying normalization algorithms (up to BCNF, 4NF, and 5NF) to eliminate data redundancy and ensure schema integrity.
- **Advanced SQL & Querying:** Writing complex SQL-99 queries, defining schemas, managing views, and implementing business logic via constraints, assertions, and triggers.
- **Transaction & Recovery Management:** Ensuring data reliability (**ACID** properties) through concurrency control protocols (2PL, Timestamps), deadlock management, and ARIES-based crash recovery.
- **Database Security:** Enforcing robust data governance using Discretionary (DAC) and Mandatory (MAC) Access Control models.

Course Outcomes:

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

- **CO 1: Design & Model –** Translate complex business requirements into high-level conceptual data models using ER diagramming and accurately map them into relational database schemas.
- **CO 2: Optimize & Normalize** – Evaluate relational schemas using functional dependencies and apply normalization algorithms (up to BCNF/5NF) to eliminate data redundancy and anomalies.
- **CO 3: Implement & Query** – Construct structured database definitions, complex data manipulation queries, views, and automation logic (triggers and assertions) using standard SQL-99.
- **CO 4: Manage & Secure** – Analyze transaction schedules to ensure **ACID** properties, implement concurrency control and crash recovery protocols, and enforce robust data security using access control models.

UNIT-I	12Hrs.

Databases and Database Users: Introduction, Characteristics of the Database Approach, Actors on the scene, Workers behind the scene, Advantages of using the DBMS approach, When not to use a DBMS, **Database System Concepts and Architecture**: Data models, schemas and instances, Three-schema architecture and data independence, Database language and interfaces, The database system environment. **Data Modelling Using the Entity-Relationship(ER) Model:** Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationships, Relationship Types, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design for the COMPANY Database; ER Diagrams, Naming Conventions and Design Issues.

UNIT-II	10Hrs.

The Relational Data Model and Relational Database Constraint: Relational Model Concepts, Relational Constraints and Relational Database Schemas, Update Operations, Transactions,

and Dealing with Constraint Violations. Relational Algebra and Relational Calculus: Unary Relational Operations, Relational Algebra Operations from Set Theory, Binary Relational Operations, Additional Relational Operations, Overview of Tuple Relational Calculus and Domain Relational Calculus; Examples of Queries in Relational Algebra. **Relational Database Design Using ER and EER to-Relational Mapping:** Relational Database Design Using ER to Relational Mapping. **SQL-99: Schema Definition, Constraints, Queries and Views:** SQL Data Definition and Data types, Specifying Constraints in SQL, Schema Change statement in SQL, Basic Queries in SQL, Insert, Delete and Update Statements in SQL, Specifying Constraints as Assertion and Triggers, Views in SQL.

UNIT-III	**10Hrs.**

Functional Dependencies and Normalization for Relational Database: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form. **Relational Database Design Algorithms and Further Dependencies:** Multi-valued Dependencies and fourth normal form, Join Dependencies and fifth normal form.

UNIT-IV	**10Hrs.**

Overview of Transaction Management: The ACID Properties: Consistency and Isolation, Atomicity and Durability; Transactions and Schedules; Concurrent Execution of Transactions: Motivation for Concurrent Execution, Serializability, Anomalies due to Interleaved Execution, Schedules Involving Aborted Transactions; Lock- Based Concurrency Control: Strict Two-Phase Locking, Deadlocks; Performance of Locking; Timestamp Based Protocols- Validation- Based Protocols, Multiple Granularity. Transaction Support in SQL: Creating and Terminating Transactions, What Should We Lock? Transaction Characteristics in SQL.

Introduction to Crash Recovery: Stealing Frames and Forcing Pages, Recovery - Related Steps during Normal Execution, Overview of ARIES recovery algorithm, Atomicity: Implementing Rollback. Check Points Buffer Management, Failure with loss of nonvolatile storage.

Database Security: Introduction to Database Security; Access Control; Discretionary Access Control: Grant and Revoke on Views and Integrity Constraints; Mandatory Access Control: Multilevel Relations and Poly instantiation, Covert Channels, DoD Security Levels.

Text Books:

Text Books:

1. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education, 6th Edition , 2011.
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, , TATA McGrawHill.

Reference Books:

Reference Book format:

1. Silberschatz and Korth, Database System Concepts, 7th edition, Mc Graw hill.
2. C.J. Date, A.Kannan, S.Swami Nadhan, An Introduction to Database systems, 8th Edition, Pearson.
3. M. L. Gillenson, Fundamentals of Database Management Systems, Wiley Student Edition.
4. S.Shah and V. Shah, Oracle for Professionals, The X Team, SPD.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	2	3	3	2	-	-	-	-
CO2	3	3	2	2	-	-	-	-
CO3	2	2	3	-	3	-	-	-
CO4	3	2	2	-	-	2	-	2

Course Code		**:**	**2PCAA104C**	**Operating Systems and Concepts**	**Semester**	**:**	**I**
L:T:P		**:**	**3:0:0**		**Course Type**	**:**	**Theory**
Hours/Sem.	**Teaching**	**:**	**42 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

Understand and define role of operating systems and appreciate different functions and services provisioned. Explore different functionalities with associated data structure and algorithms. Comprehend scope in the domain.

Course Outcomes:

CO1: Describe the elements and various functionalities of the operating system
CO2: Apply the techniques of process management and demonstrate process synchronization.
CO3: Recognize deadlock condition and technique to handle deadlock situation.
CO4: Analyze various memory management strategies.
CO5: Describe file handling concepts.

UNIT-I	**12 Hrs.**

Introduction to Operating Systems, What operating systems do, Operating System Operations, Computing Environments, **Operating Systems Structure**, Operating System Services, System Calls, Types of System Calls, System Programs, Operating System Structure, System Boot. **Processes,** Process Concept, Process Scheduling, Interprocess Communication.

UNIT-II	**10 Hrs.**

Process Scheduling, Basic Concepts, Scheduling Criteria, Scheduling Algorithms. **Synchronization**, Background, The Critical Section Problem, Mutex Locks, Semaphores, Classic Problems of Synchronization: Readers-Writers Problem, Dining Philosophers Problem using Semaphores.

UNIT-III	**10 Hrs.**

Deadlocks, System model, Deadlock Characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock. **Memory Management** Strategies Basic Hardware, Swapping, Contiguous Memory Allocation, Segmentation, Paging.

UNIT-IV	**10 Hrs.**

Virtual Memory Management Background, Demand Paging, Page Replacement. **File System,** File concept, Access methods, Directory overview Implementing File System Allocation methods, Free Space Management

Suggested Learning resources

Text Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Principles, 10th Edition, Wiley India, 2019.

Reference Books:

1. D M Dhamdhere: Operating Systems A Concept Based Approach, 3rd Edition, Tata McGraw Hill,

2017.
2. Harvey M Deital: Operating Systems, 3rdEdition, Addison Wesley, 1990.

Course Outcomes:

CO-PO Mapping

Course Outcomes	Programme Outcomes							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**1**	**2**	**3**					
CO2	**2**	**1**	**3**					
CO3	**2**	**3**	**1**					
CO4	**3**	**2**	**1**					
CO5	**1**	**2**	**3**					

Course Code		:	2PCAA105C	Python Programming	Semester	:	1
L:T:P		:	04:00:00		Course Type	:	Theory
Hours/Sem.	Teaching	:	56 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	58 Hrs		SEE Marks	:	50
	Exam	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	120 Hrs		Credits	:	04

Professional Competency:

Design, develop, and deploy production-ready Python applications by implementing robust object-oriented architectures, concurrent processing modules, data serialization pipelines (JSON/XML/Binary), and secure network socket communications to solve real-world industry problems.

Course Outcomes:

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

- **CO1: Construct Modular Scripts using core procedural syntax**, built-in collections, and comprehensive string-slicing techniques to handle fundamental data processing.
- **CO2: Implement Robust Exception Handling and Libraries** by designing custom functions, packages, and utilizing the Python Standard Library to build clean, error-resistant applications.
- **CO3: Build Object-Oriented Architectures** using inheritance, polymorphism, and property controls to create integrated, reusable custom data types.
- **CO4: Develop Data Persistence Pipelines** capable of writing, parsing, and validating binary, CSV, JSON, and XML file formats.
- **CO5: Deploy Concurrent and Networked Solutions** by leveraging multiprocessing, multithreading, TCP/IP socket programming, and regular expressions for enterprise-level deployment.

UNIT-I	13Hrs.

Rapid Introduction to Procedural Programming: Creating and Running Python Programs; Python's "Beautiful" Objects; Data Types (Object References, Collection Types); Control Structures and Functions. Data Types: Integral Types (Integers, Booleans); Floating-Point Types (Floating-Point Numbers, Complex Numbers, Decimal Numbers); Strings (Comparing, Slicing, Formatting). Collection Types: Tuple and Named Tuples; Lists (Comprehensions); Sets (Sets, Frozensets); Mappings (Dictionaries, Dictionary Comprehensions).

UNIT-II	13Hrs.

Control Structures and Functions: Control Structures (Conditional Branching, Looping); Exception Handling (Catching, Raising); Custom Functions (Namespaces, Arguments, Lambda Functions, Assertions). Modules: Custom Modules and Packages; Overview of Python's Standard Library (String Handling, Command-Line Programming, Mathematics, Dates and Times, Algorithms and Collections, File Formats, File System, Networking).

UNIT-III	13Hrs.

Object-Oriented Programming: The Object-Oriented Approach; Custom Classes (Attributes and Methods, Inheritance and Polymorphism, Using Properties to Control Attribute Access); Creating Complete Fully Integrated Data Types. File Handling: Writing and Reading Binary Data (Pickles, Raw Binary Data); Writing and Parsing Text Files (CSV, JSON); Writing and Parsing XML Files (ElementTree, DOM, SAX).

UNIT-IV	13Hrs.

Advanced Programming Techniques: Advanced Function and Module Features; Advanced

Attribute Access; Metaclasses; Functional Programming Techniques. Processes and Threading: Introduction to the Multiprocessing Module; Introduction to the Threading Module; Networking (TCP/IP Client/Server). Regular Expressions: The re Module; Using Regular Expressions to Match, Search, and Replace Text.

Text Books:

Text Book :

- Summerfield, M. (2009). Programming in Python 3: A Complete Introduction to the Python Language. 2nd Edition. Addison-Wesley Professional.

Reference Books:

Reference Book

5. Downey, A. B. (2016). Think Python: How to Think Like a Computer Scientist. 2nd Edition. O'Reilly Media.
6. Lutz, M. (2013). Learning Python. 5th Edition. O'Reilly Media.
7. Brown, M. C. (2018). Python: The Complete Reference. 4th Edition. McGraw-Hill Education.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	2	0	0	1
CO2	3	2	3	1	2	0	0	1
CO3	3	3	3	2	2	0	0	1
CO4	2	2	3	2	2	0	0	1
CO5	3	3	3	3	3	1	1	1

Course Code: 1PCAA106L	Python Laboratory	Credits : 02
Hours/Week (L:T:P) : 0:2:2		CIE Marks : 50
Total Hours of Pedagogy (Theory + Lab):		SEE Marks : 50

Course Type: Practical

Professional Competency:

Develop static and dynamic web pages using HTML, CSS, XHTML, and JavaScript with appropriate client-side validation and styling techniques.

Course Outcomes:

At the end of the course, students will be able to:

CO1: Design static web pages using HTML/XHTML by utilizing text formatting, tables, lists, images, hyperlinks, and forms.

CO2: Apply different types of CSS to improve the appearance, layout, and styling of web pages.

CO3: Develop client-side scripts using JavaScript to implement user interaction, input validation, message boxes, and string/number processing.

CO4: Design and develop complete web applications incorporating HTML, CSS, JavaScript, and form validation techniques.

Experiments

Sl. No.	
01	In a town, the percentage of men is 52. The percentage of total literacy is 48. If total percentage of literate men is 35 of the total literacy, write a program to find the total number of illiterate men and women if the population of the town is entered through keyboard.
02	Program to reverse the given 4 digits without using any looping and also check whether the given number is palindrome or not.
03	Program that reads the marks of 5 subjects, calculate the average/percentage and announce the result for the following Criteria by considering the eligibility marks in a single subject:

Percentage of Marks	Result
Greater than or equal to 70	First Class with Distinction
Greater than or equal to 60 and Less than 70	First Class
Greater than or equal to 50 and Less than 60	Second Class
Greater than or equal to 40 and Less than 50	Pass Class
Less than 40	Fail

04	Generate the prime numbers between 1 to n using looping statement
05	Program that demonstrates the working of Stack using list based on the user's choice.
06	Program that demonstrates the working of Queue using list based on the user's choice.
07	Program that finds the sine series $x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$with help of user-defined functions for factorial and exponent
08	Program that creates an object called Complex number and overloads the operator by

	performing addition of two Complex numbers.
09	Program that demonstrates the working of singly linked list for the following using list based on the user's choice: i. Insert at the beginning ii. Delete from the rear end Display
10	Program that counts the number of tabs, spaces and newline characters in a given file.

CO-PO Mapping

Course Outcomes	Programme Outcomes							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	**3**	**2**	**2**	**-**	**3**	**-**	**-**	**1**
CO2	**2**	**2**	**3**	**-**	**3**	**-**	**-**	**1**
CO3	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**2**
CO4	**3**	**3**	**3**	**2**	**3**	**1**	**-**	**2**
CO5								

Course Code: 1PCAA107L	Web Programming Laboratory	Credits : 02
Hours/Week (L:T:P) : 0:2:2		CIE Marks : 50
Total Hours of Pedagogy (Theory + Lab):		SEE Marks : 50

Course Type: Practical

Professional Competency:

Develop static and dynamic web pages using HTML, CSS, XHTML, and JavaScript with appropriate client-side validation and styling techniques.

Course Outcomes:

At the end of the course, students will be able to:

CO1: Design static web pages using HTML/XHTML by utilizing text formatting, tables, lists, images, hyperlinks, and forms.

CO2: Apply different types of CSS to improve the appearance, layout, and styling of web pages.

CO3: Develop client-side scripts using JavaScript to implement user interaction, input validation, message boxes, and string/number processing.

CO4: Design and develop complete web applications incorporating HTML, CSS, JavaScript, and form validation techniques.

Sl. No.	Experiments
01	Design and develop a static web page using basic HTML tags to demonstrate use of different color, font, table format, bold, italic etc.
02	Create a HTML code to display the following web page using list.
03	Design and develop a web page to demonstrate different types of style sheets.
04	Create an internal style sheet to define the following CSS properties for element(s) on your page: a. text-decoration b. text-align c. font-size d. font-family e. font-weight
05	Design and develop external CSS style sheet to create a login page form and validate using JavaScript.
06	Write a JavaScript to demonstrate use of alert, prompt and confirm message box by considering general feedback form.

07	Develop and demonstrate a XHTML file that includes Javascript script for the following problems: a) Input : A number n obtained using prompt Output : The first n Fibonacci numbers
08	Demonstrate use of hyperlink to pass parameters and validate those parameters in second page using JavaScript
09	Design and develop a Registration form Forward the request to success and failure page by validating user credentials using JavaScript.
10	Create a HTML form containing textbox to enter text. Write a JavaScript code block, which checks the contents entered in a form's Text element. If the text entered is in the lower case, convert to upper case. Make use of function to Uppercase( ).

CO-PO Mapping

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	3	2	2	-	3	-	-	1
CO2	2	2	3	-	3	-	-	1
CO3	3	3	3	2	3	-	-	2
CO4	3	3	3	2	3	1	-	2
CO5								

MCA II SEMESTER SYLLABUS
(2026-2027)

Course Code		:	2PCAA201C	Machine Learning	Semester	:	II
L:T:P		:	3:0 :0		Course Type	:	Theory
42 Hrs\Sem	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	90 Hrs		Credits	:	03

Professional Competency:

Data Analysis: Competency in visualizing and analyzing univariate, bivariate, and multivariate data using descriptive and multivariate statistics.

Feature Engineering: Ability to optimize machine learning performance through dimensionality reduction and advanced feature engineering techniques.

Predictive Modeling: Proficiency in implementing and validating regression analysis, similarity-based learning, and probabilistic Bayesian classification algorithms.

Decision Tree Architecture: Skill in designing, inducing, and pruning decision tree learning models for targeted data classification.

Neural & Reinforcement Learning: Fundamental knowledge of Artificial Neural Networks and implementing Q-learning models for dynamic decision-making environments.

Practical Applications: Capacity to engineer end-to-end machine learning pipelines by executing a real-world applied course project.

Course Outcomes:

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

1. Explain the foundational concepts, types, and workflows of machine learning, and distinguish its role in relation to other fields.
2. Perform exploratory data analysis by visualizing multivariate data and applying dimensionality reduction and feature engineering techniques.
3. Implement and validate similarity-based learning algorithms and various regression models to solve predictive problems.
4. Construct, prune, and evaluate decision tree induction models and probabilistic Bayesian classifiers for data classification tasks.
5. Explain the mechanics of artificial neural networks and reinforcement learning components, and develop a machinelearning solution for a real-world application project.

UNIT-I — 12 Hrs.

Introduction to Machine Learning: Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to Other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Applications.**Understanding Data:** Introduction, Big Data Analytics and Types of Analytics, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization, Bivariate Data and Multivariate Data. Multivariate Statistics, Essential Mathematics for Multivariate Data, Overview of Hypothesis, Feature Engineering and Dimensionality Reduction Techniques.

UNIT-II — 10 Hrs.

Understanding Data: Basics of Learning Theory: Introduction to Learning and its Types,

Introduction to Computation Learning Theory, Design of a Learning System, Introduction to Concept Learning, Induction Biases, Modeling in Machine Learning. **Decision Trees Learning:** Introduction to Decision Tree Learning model, Decision Tree Induction Algorithms, Validating and Pruning of Decision Trees.

UNIT-III	**10 Hrs.**

Similarity-based Learning: Introduction to Similarity or Instance-based Learning, Nearest-Neighb or Learning, WeightedK-Nearest-Neighb or Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR).

Regression Analysis: Introduction to Regression, Introduction to Linearity, Correlation, and Causation, Introduction to Linear Regression, Validation of Regression Methods, Multiple Linear Regression, Polynomial Regression, Logistic Regression.

UNIT-IV	**10 Hrs.**

Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model. **Artificial Neural Networks:** Introduction, Biological Neurons, Artificial Neurons, Perceptron and Learning Theory, Types of Artificial Neural Network. **Reinforcement Learning:** Overview and Scope of Reinforcement Learning, Components of Reinforcement Learning, Q-Learning.

Text Books:

Text Book format:

1. S Sridharand M Vijayalakshmi,"MachineLearning",OxfordUniversityPress,2021.
2. MNMurtyandAnanthanarayanaVS,"MachineLearning:TheoryandPractice",UniversitiesPress(India)Pvt. Limited, 2024.

Reference Books:

1. TomM.Mitchell,"MachineLearning,"McGraw-HillEducation,2013.
2. MiroslavKubat,"AnIntroductiontoMachineLearning,"Springer,2017.

CO PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
1.	3	1	-	-	-	-	-	2
2.	3	3	2	2	2	-	-	2
3.	3	3	3	2	3	-	-	2
4.	3	3	3	2	3	-	-	2
5.	3	3	3	3	3	1	3	3

Course Code		:	**2PCAA203C**	**Software Engineering**	**Semester**	:	**II**
L:T:P		:	**3:0 :0**		**Course Type**	:	**Theory**
Hours/Sem.	**Teaching**	:	**42Hrs**		**CIE Marks**	:	**50**
	Learning (TW+SL)	:	**42Hrs**		**SEE Marks**	:	**50**
	Exam	:	**06Hrs**		**Total Marks**	:	**100**
	Total Hrs.	:	**90Hrs**		**Credits**	:	**03**

Professional Competency:

Apply the knowledge, skills, ethics, communication, teamwork, and professional practices required to develop, test, maintain, and deliver high-quality software effectively while meeting industry standards and user requirements.

Course Outcomes:

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

CO1: Understand software process models, agile methods, and requirements engineering concepts.

CO2: Identify and analyze functional and non-functional requirements for software systems.

CO3: Develop system models and software designs using UML and object-oriented principles.

CO4: Apply software testing, project management, and quality management techniques.

CO5: Understand and apply Scrum framework and agile practices in software development.

Unit-I	**12Hrs.**

Software Process & Software Development Methods: Professional Software Development, software engineering ethics, Software process models, Process activities, Coping with change. Agile Software Development: Agile methods, Plan-driven and agile development, Extreme programming, Requirements Engineering: Functional and non-functional requirements, The software requirements document, Requirements specification. Requirements engineering processes, Requirements elicitation and analysis, Requirements validation. Requirements change.

Unit-II	**10Hrs.**

System Models: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering, Design and Implementation: Introduction to RUP, Design Principles. Object-oriented design using the UML Design patterns, Implementation issues, Open source development.

Unit-III	**10Hrs.**

Software testing: Development testing, Test-driven development, Release testing, User testing. Project management: Risk management, Managing people, Teamwork, Project planning, Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques. Quality management: Software quality, Software standards, Reviews and inspections, Software measurement and metrics.

Unit-IV	10Hrs.
Scrum Framework :Foundation of Scrum, pillars of empiricism, Scrum Values, Identifying a Scrum Team; Scrum Events: Spring planning, Implementation and review, Scrum Artifacts: Creating, Managing and refining product backlog. Scrum in Action: Planning and Estimating with Scrum: Estimation Scale, Bucket method, Envisioning the product journey with a product roadmap; Sprint Journey: Refining the Product Backlog, Tracking progress with a Scrum Board, Defects in Sprint; Facets of Scrum: software development practices for Scrum, Source control model for continuous integration, Continuous delivery and continuous deployment, Leveraging testing methods for Scrum, Applying Scrum to remote teams.	

Text Books:

1. Ian Sommer ville, Software Engineering, 10th Edition, Pearson India Education ServicesPvt. Ltd., 2020.
2. Roger S. Pressman, Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
3. Pankaj Jalote, An Integrated Approach to Software Engineering, Wiley India.
4. Fred heath, The Professional Scrum Master Guide, Packt Publishing, 2021.
5. Stacia Viscardi, The Professional Scrum Master's Handbook, Packt Publishing, 2013

Reference Books:

1. Andrew T. Pham and David K. Pham, Business-Driven IT-Wide Agile (Scrum) and Kanban (Lean) ,Implementation, CRC Press.

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	2	2	1	2	-	-	1	1
CO2	1	3	2	-	-	-	-	1
CO3	1	2	3	2	1	-	-	1
CO4	1	2	2	3	2	3	1	1
CO5	-	1	2	2	3	2	1	2

	Course Code	:	2PCAA204C	**Computer Networks**	Semester	:	III
	L:T:P	:	3: 0:0		Course Type	:	Theory
Hours/Sem.	Teaching	:	42Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42Hrs		SEE Marks	:	50
	Exam	:	06Hrs		Total Marks	:	100
	Total Hrs.	:	90Hrs		Credits	:	03

Professional Competency:

Analyze, design and implement computer networking solutions by applying networking principles, protocols, routing techniques, transport services, and Internet technologies to support reliable communication in modern computer networks.

Course Outcomes:

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

CO1: Explain the fundamentals of computer networks, network architectures, reference models, transmission media, and multiplexing techniques.

CO2: Analyze data link layer functionalities including framing, flow control, error detection/correction, sliding window protocols, medium access control, and network devices.

CO3: Apply network layer concepts, routing algorithms, congestion control mechanisms, IPv4/IPv6 addressing, and Internet control protocols for efficient packet delivery.

CO4: Illustrate transport layer services, TCP/UDP protocols, sockets, and application layer services including DNS, E-mail, and WWW.

CO5: Evaluate networking protocols and communication mechanisms to design reliable and efficient computer network solutions.

Unit-I — **12 Hrs.**

Introduction: Uses of Computer Networks, Network Hardware. Network Software: Protocol Hierarchies, Design Issues for the Layers. Types of Networks, Topologies, Reference Models: The OSI Reference Model,The TCP/IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models. Physical Layer- Guided Transmission Media, Digital Modulation and Multiplexing.

Unit-II — **10 Hrs.**

Data Link Layer-Data link Layer Design issues, Framing, Flow Control and Error Correcting and Detection codes, Sliding Window Protocols (Stop and Wait, Go-Back-N (GBN) and Selective Repetitive (SR)), Medium Access Control-The Channel Allocation Problem, Multiple Access Protocols.Data Link Layer Switching: Uses of bridges, repeaters, hubs, switches, routers and gateways.

Unit-III — **10 Hrs.**

The Network Layer: Network Layer Design issues, Routing algorithms- The Optimality Principal, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical routing, Congestion Control Algorithms, Quality of Service, Internetworking. The Network Layer in the Internet: The Network Layer in the internet- IP version 4 Protocol(IPv4), The Main IPv6 Header, Extension Headers,Internet Control Protocols: ICMP, ARP, DHCP.

Unit-IV — **10 Hrs.**

The Transport Layer -The Transport Service: Services Provided to the Upper Layers, Berkeley Sockets, Elements of Transport Protocols, Internet transport protocols.

TCP: Introduction to TCP, The Service Model, Protocol,Segment Header, UDP.

The Application Layer- The Domain Name System, Electronic Mail, The World-Wide-Web.

Text Books:

1. Andrew S. Tanenbaum, David J Wetherall, “Computer Networks”, Pearson Education, Pearson Publication, 5th Edition, 2012.
2. Behrouz A Forouzan, Firouz Mosharraf, “Computer Networks A Top-Down Approach”, Tata McGraw-Hill Education Pvt. Ltd, 2011.
3. William Stallings, "Data and Computer Communication " ,8th edition, Pearson Publications,2007.

CO-PO Mapping

Course Outcomes	**Programme Outcomes**							
	1	2	3	4	5	6	7	8
CO1	3	2	-	-	-	-	-	-
CO2	3	3	2	-	2	-	-	-
CO3	3	3	2	2	2	-	-	-
CO4	3	2	2	-	2	-	-	1
CO5	3	3	3	2	2	-	1	1

Course Code		:	2PCAA205C	JAVA FULL STACK DEVELOPMENT	Semester	:	II
L:T:P		:	04:00:00		Course Type	:	Theory
Hours/Sem.	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	120Hrs		Credits	:	04

Course objectives: The main objective of the course is to provide understanding on the essential javascript, bootstrap, ReactJS concepts for web development and to store and model data in a no sql database.

UNIT-I	10 Hrs.
Basic JavaScript Instructions, Statements, Comments, Variables, Data Types, Arrays, Strings, Functions, Methods & Objects, Decisions & Loops. Document Object Model: DOM Manipulation, Selecting Elements, Working with DOM Nodes, Updating Element Content & Attributes, Events, Different Types of Events, How to Bind an Event to an Element, Event Delegation, Event Listeners.	
UNIT–II	**10 Hrs.**
Form enhancement and validation. Introduction to MERN: MERN components, Server less Hello world. React Components: Issue Tracker, React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition.	
UNIT–III	10 Hrs.
React State: Initial State, Async State Initialization, Updating State, Lifting State Up, Event Handling, Stateless Components, Designing Components, State vs. Props, Component Hierarchy, Communication, Stateless Components. Express, REST API, GraphQL, Field Specification, Graph Based, Single Endpoint, Strongly Typed, Introspection, Libraries, The About API GraphQL Schema File, The List API, List API Integration, Custom Scalar types, The Create API, Create API Integration, Query Variables, Input Validations, Displaying Errors.	
UNIT–IV	10 Hrs.
MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization, Reading from MongoDB, Writing to MongoDB. Modularization and Webpack, Back-End Modules Front-End Modules and Webpack Transform and Bundle, Libraries Bundle, Hot Module Replacement, DebuggingDefinePlugin: Build Configuration, Production Optimization.	
Text Books / Reference Books *	
1. Jon Duckett, "JavaScript & jQuery: Interactive Front-End Web Development", Wiley, 2014. 2. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node. Apress, 2019. e-Resources: 1. https://github.com/vasansr/pro-mern-stack 2. https://nptel.ac.in/courses/106106156 3. https://archive.nptel.ac.in/courses/106/105/106105084/	

1	Develop a program to create histograms for all numerical features and analyze the distribution of each feature. Generate box plots for all numerical features and identify any outliers. Use California Housing dataset.
2	Develop a program to Compute the correlation matrix to understand the relationships between pairs of features. Visualize the correlation matrix using a heat map to know which variables have strong positive/negative correlations. Create a pair plot to visualize pair wise relationships between features. Use California Housing dataset.
3	Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2.
4	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Find-Salgorithmtooutputadescriptionofthesetofallhypothesesconsistentwiththetraining examples.
5	Develop a program to implement k-Nearest Neighbour algorithm to classify the randomly generated 100 values of x in the range of [0,1]. Perform the following based on dataset generated.a.Labelthefirst50points{x1,……,x50}asfollows:if(xi≤0.5),thenxiClass1, elsexiClass1b.Classifytheremainingpoints,x51,……,x100usingKNN.Performthisfor k=1,2,3,4,5,20,30
6	Implementthenon-parametricLocallyWeightedRegressionalgorithminordertofitdata points. Select appropriate data set for your experiment and draw graphs.
7	Develop a program to demonstrate the working of Linear Regression and Polynomial Regression. Use Boston Housing Dataset for Linear Regression and Auto MPG Dataset (for vehicle fuel efficiency prediction) for Polynomial Regression.
8	Develop a program to demonstrate the working of the decision tree algorithm. Use Breast Cancer Data set for building the decision tree and apply this knowledge to classify a new sample.
9	Develop a program to implement the Naive Bayesian classifier considering Olivetti Face Data set for training. Compute the accuracy of the classifier, considering a few test data sets.
10	Develop a program to implement k-means clustering using Wisconsin Breast Cancer data set and visualize the clustering result.

Course Code		**:**	2PCAA206L	**Machine Learning and Data Visualization Laboratory**	**Semester**	**:**	**II**
L:T:P		**:**	**0:0:3**		**Course Type**	**:**	**PCC**
42 Hrs\Sem	**Teaching**	**:**	**28 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**28 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**04 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**32 Hrs**		**Credits**	**:**	**01**

Course Outcomes:

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

1. Illustrate the principles of multivariate data and apply dimensionality reduction techniques.
2. Demonstrate similarity-based learning methods and perform regression analysis.
3. Develop decision trees for classification and regression problems, and Bayesian models for probabilistic learning.
4. Implement the clustering algorithms to share computing resources.

1	Develop a program to create histograms for all numerical features and analyze the distribution of each feature. Generate box plots for all numerical features and identify any outliers. Use California Housing dataset.
2	Develop a program to Compute the correlation matrix to understand the relationships between pairs of features. Visualize the correlation matrix using a heat map to know which variables have strong positive/negative correlations. Create a pair plot to visualize pair-wise relationships between features. Use California Housing dataset.
3	Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2.
4	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Find-Salgorithmtooutputadescriptionofthesetofallhypothesesconsistentwiththetraining examples.
5	Develop a program to implement k-Nearest Neighbour algorithm to classify the randomly generated 100 values of x in the range of [0,1]. Perform the following based on dataset generated.a.Labelthefirst50points{x1,……,x50}asfollows:if(xi≤0.5),thenxiClass1, elsexiClass1b.Classifytheremainingpoints,x51,……,x100usingKNN.Performthisfor k=1,2,3,4,5,20,30
6	Implementthenon-parametricLocallyWeightedRegressionalgorithminordertofitdata points. Select appropriate data set for your experiment and draw graphs.
7	Develop a program to demonstrate the working of Linear Regression and Polynomial Regression. Use Boston Housing Dataset for Linear Regression and Auto MPG Dataset (for vehicle fuel efficiency prediction) for Polynomial Regression.
8	Develop a program to demonstrate the working of the decision tree algorithm. Use Breast Cancer Data set for building the decision tree and apply this knowledge to classify a new sample.
9	Develop a program to implement the Naive Bayesian classifier considering Olivetti Face Data set for training. Compute the accuracy of the classifier, considering a few test data sets.
10	Develop a program to implement k-means clustering using Wisconsin Breast Cancer data set and visualize the clustering result.

Course Code		**:**	**2PCAA201E**	**Natural Language Processing**	**Semester**	**:**	**II**
L:T:P		**:**	**3:0:0**		**Course Type**	**:**	**PEC**
Hours/Sem.	**Teaching**	**:**	**42Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

Develop and deploy automated text-mining and natural language processing (NLP) pipelines that parse, tag, and extract semantic insights from unstructured textual data to build production-ready content extraction and information retrieval systems.

Course Outcomes:

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

8. **CO-1:** Implement Finite State Transducers (FSTs) and stemming algorithms (like the Porter Stemmer) to tokenize, analyze, and preprocess word structures in natural language.
9. **CO-2:** Develop and evaluate N-gram language models using smoothing, back-off, and interpolation techniques to solve spelling, pronunciation, and text-prediction tasks.
10. **CO-3:** Apply Part-of-Speech (POS) tag sets and construct Context-Free Grammars (CFGs) using parsing algorithms (such as the Earley parser) to analyze sentence structures.
11. **CO-4:** Integrate syntax-driven semantic attachments and utilize WordNet to resolve word sense ambiguity and map meaning to textual data.
12. **CO-5:** Design and deploy functional information retrieval, text-recognition, and semantically guided text-mining pipelines to extract patterns from unstructured enterprise data.

UNIT-I **12 Hrs.**

Introduction, Morphology: Knowledge in Speech & Lang Processing, Ambiguity, Models & Algorithms, Language, Thought & Understanding, Some Brief History, The State of the Art & Near-Term Future, Summary Morphology and Finite State Transducers: Survey of English Morphology, Finite state Morphological Parsing, Lexicon-Free FST: The Porter Stemmer, Human Morphological Parsing, Summary, Combining FST Lexicon and Rules.

UNIT-II **10 Hrs.**

N-Grams: Counting Words in Corpora, Simple N-Grams, Smoothing, Back off, Deleted Interpolation, N-Grams for Spelling and Pronunciation, Entropy, Summary. Word Classes and Part-of- Speech Tagging: English Word Classes, Tag sets for English, Part-of-Speech Tagging.

Context-Free Grammars and Predicate Calculus for English: Constituency, Context-Free Rules and Trees, Sentence Level Constructions

UNIT-III **10 Hrs.**

Coordination, Agreement, The Verb Phrase Sub Categorization, Auxiliaries, Spoken Language Syntax, Grammar Equivalence and Normal Form, Finite –State and Context- Free Grammars, Grammars and Human Processing, The Early Algorithm, Finite-State Parsing Method, Summary Representing Meaning Semantic Analysis: Syntax-Driven Semantic Analysis, Attachments for a Fragment of English, Integrating Semantic Analysis into the Earley Parser

UNIT-IV **10 Hrs.**

Idioms and Compositionality, Robust Semantic Analysis, Summary. Lexical Semantics: Relations Among Lexemes and Their Senses, WordNet: A Database of Lexical Relations, The Internal Structure of Words, Creativity and the Lexicon, Summary Word Sense Disambiguation and Information. Retrieval: Selection Restriction Based Disambiguation, Robust Word Sense Disambiguation, Information Retrieval, Other Retrieval Tasks, and Summary. Case Study of Simple Text Recognition or Content Based Text Extraction System. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.

Text Books:

Text Book:

- DanielJurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2009.

Reference Books:

Reference Book:

- Christopher D.Manning and HinrichSchutze, “Foundations of Statistical Natural LanguageProcessing”, MIT Press, 1999.
- TanveerSiddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
- Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer Verlag London Limited 2007.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	1	2	-	1	2
CO2	3	3	2	2	3	1	1	3
CO3	3	3	3	2	2	-	1	2
CO4	3	3	3	2	3	1	1	3
CO5	3	3	3	3	3	2	2	3

Course Code		:	2PCAA202E	Content Management System	Semester	:	II
L:T:P		:	04:00:00		Course Type	:	Theory
Hours/Sem.	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	90 Hrs		Credits	:	03

Course Objectives:

- To get proficiency in Website designing
- To learn Wordpress as Content Management System
- To get familiar to use all setting and components of Wordpress

UNIT-I	12 Hrs.
Domain Hosting Content Management System (Wordpress), Domain – Registration , Manage DNS , Nameserver WordPress- Installation of WordPress	
UNIT–II	**10 Hrs.**
Header and Footer Configuration General Configuration –Site Configuration – Logo , Site Icon , Site Name, Home page Setting , Website layout Setting ,General Writing Reading ,Discussion , media, permalinks and privacy data Themes Activate Plugin	
UNIT–III	10 Hrs.
Themes, Downloading, installing, and activating themes, WordPress Plugin: Downloading, installing, and activating Templates Downloading, installing, and activating Templates, Design Pages using Template Adding Hyperlinks, Playing with Media content, Previewing and Editing Pages, Page Order, Creating a post, Adding Media files to content	
UNIT–IV	10 Hrs.
Demonstrate the use of WooCommerce plugin Add WhatsApp Chat button to website for communication Integrate Shipping solution to website Integrate Payment gateway to website	

Reference Books *

1 Lisa Sabin - Wilson Wordpress Web Design for Dummies 2015 For Dummies
2 Lisa Sabin- Wilson Wordpress All in One for Dummies 2017 John Wiley & Sons
3 Sayyed Majid Wordpress Web Development:Basic to Advance 2021 Code Academy, Aurangabad
4 Joseph Joyner WordpressFor Beginners: How to Create and Set Up Your Own Website or Blog Using Wordpress 2015 Mihails Konoplovs
5 Dr. Ritesh Kumar Learn WordPress in Easy Way 2019 Ganpati Book Centre

e-resources:

1 https://www.tutorialspoint.com/wordpress
2 https://www.javatpoint.com/wordpress-tutorial
3 https://www.w3schools.in/wordpress

Course Outcomes**

After completion of the course student will be able to:

CO1: To demonstrate Hosting,Website layout, Admin Panel, Header, footer
CO2 : To demonstrate general setting and use of Themes and Templates, PlugIn in Wordpress
CO3: To create Website with Themes and Templates, PlugIn

Course Code		:	2PCAA203E	Big Data Analytics	Semester	:	II
L:T:P		:	3:0:0		Course Type	:	Theory
Hours/Sem.	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	90 Hrs		Credits	:	03

Professional Competency:

Understand and define digital data and types, business intelligence, big data and analytics and appreciate different techniques for big data analytics. Comprehend HDFS architecture and programming environment.

Course Outcomes:

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

CO1: Differentiation of digital data and to define business intelligence, big data and analytics.
CO2: Apply different techniques for big data analytics.
CO3: Comprehend HDFS architecture and programming environment.
CO4: Device NoSQL statement to process unstructured data.
CO5: Understanding programming in Hive and Pig technologies.

UNIT-I — 12 Hrs.

Types of digital data: Classification of Digital Data, Structured Data, Semi-Structured Data, Unstructured Data. **Introduction to Big Data:** Characteristics, Evolution, Definitions and Challenges of big data, other characteristics of data which are not definitional traits of big data, Why big data? Are we just an information consumer or do we also produce information? Traditional Business Intelligence (BI) versus Big data, A typical Data Warehouse environment, A typical Hadoop environment, What is changing in the realms of big data? **Big data analytics** Where do we begin? What is big data analytics? What big data analytics isn't? Why this sudden hype around big data analytics? Classification of analytics, Top challenges facing big data, why is big data analytics important? Greatest challenges that prevent businesses from capitalizing on big data, what kind of technologies are we looking towards to help meet the challenges posed by big data? Data science, Data Scientist, Terminologies used in big data environment, BASE, Few top Analytics tools.

UNIT-II — 10 Hrs.

The big data technology landscape: NoSQL, Where is it used? What is it? Types of NoSQL databases, Why NoSQL? Advantages of NoSQL, What we miss with NoSQL? NoSQL Vendors, SQL Versus NoSQL , NewSQL, Comparison of SQL, NoSQL and NewSQL, Hadoop: Features of Hadoop, Key advantages of Hadoop,Versions of Hadoop, Overview of Hadoop Ecosystems, Hadoop Versus, SQL, Integrated Hadoop systems offered by leading market vendors, Cloud based Hadoop solutions. **Hadoop:** Introducing Hadoop, Why not RDBMS, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Hadoop Components, High Level Architecture of Hadoop, Hadoop Distributed File System(HDFS), HDFS Architecture, Daemons Related to HDFS, Working with HDFS Command, Special Features of Hadoop, Processing Data With Hadoop, Introduction, How Map Reduce Works? Map Reduce Example, Word Count Example using Java. **Managing Resources and Applications with YARN**, Introduction, Limitation of Hadoop 1.0, Hadoop 2: HDFS, Hadoop 2: YARN, Interacting with Hadoop EcoSystem, Hive,Pig, HBASE, Sqoop, Business Intelligence on Hadoop.

UNIT-III — 10 Hrs.

NoSQL - MongoDB: What is MongoDB? Why MongoDB? Using JSON, Creating or generating a unique key, Support for dynamic queries, Storing binary data, Replication, Sharding, Updating

information in-place, Terms used in RDBMS and MongoDB, Data types in MongoDB, MongoDB - CRUD (Insert(), Update(), Save(), Remove(), find()), MongoDB- Arrays, Java Scripts, Cursors, Map Reduce Programming, Aggregations. **NoSQL - Cassandra:** What is Cassandra? Why Cassandra? Peer to peer network, Gossip and Failure detection, Anti-Entropy & Read Repair, Writes in Cassandra, Hinted handoffs, Tunable consistency,Cassandra- CQLSH - CRUD, Counter, List, Set, Map, Tracing.

UNIT-IV	**10 Hrs.**

Hadoop Hive: Introduction to Hive - The Problem, Solution - Hive Use Case, Data Growth, Schema Flexibility and Evolution, Extensibility, What is Hive, History of Hive and Recent Releases of Hive, Hive Features, Hive Integration and Work Flow, Hive Data Units, Hive Architecture, Hive Primitive Data Types and Collection Types, Hive File Formats, Hive Query Language - Statements, DDL , DML, Hive Partitions, Bucketing, Views, Sub Query, Joins, Hive User Defined Function, Aggregations in Hive, Group by and Having, Serialization and Deserialization, Hive Analytic Functions. **Hadoop - Pig:** Introducing Pig, History and Anatomy of Pig, Pig on Hadoop, Pig Features, Pig Philosophy, Word count example using Pig, Use Case for Pig, Pig Primitive Data Types, Collection Types and NULL, Pig Latin Overview, Pig Latin Grammar - Comments, Keywords, Identifiers, Case sensitivity in Pig, Common Operators in Pig, Pig Statements, LOAD, STORE, DUMP, Interactive Shell -GRUNT, FILTER, SORT, GROUP BY, ORDER BY, JOIN, LIMIT, Pig Latin Script, Local Mode, Map Reduce Mode, Running Pig Script, Working with Field, Tuple, Bag, User Defined Function, Parameters in Pig.

Text Books:

1. Seema Acharya, Subhashini Chellappan, Big Data and Analytics, Wiley Publications, 2nd Edition, 2015, ISBN:978-81-265-5478-2.
2. Raj Kamal, Preethi Saxena, Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning, McGraw hill Education.
3. Cindi Howson, Successful Business Intelligence, McGraw-Hill Publications, E-ISSN:0-07-149851-6.
4. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012.
5. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
6. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, “Harness the Power of Big data – The big data platform”, McGraw Hill, 2012.

Course Outcomes	**Programme Outcomes**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CO1	3	2	1	3	-	-	-	3
CO2	2	3	1	2	-	-	-	3
CO3	2	3	2	2	-	-	-	3
CO4	2	2	3	3	-	-	-	3
CO5	2	3	3	3	-	-	-	3

Course Code		**:**	**2PCAC204E**	**Block Chain Technology**	**Semester**	**:**	**II**
L:T:P		**:**	**3:0:01**		**Course Type**	**:**	**Theory**
Hours/Sem.	**Teaching**	**:**	**42 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

Apply blockchain concepts, cryptocurrencies, Bitcoin, Ethereum, and smart contract technologies to analyze, design, and evaluate secure decentralized solutions for real-world applications.

Course Outcomes:

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

CO1: Explain the fundamental concepts of blockchain technology, its architecture, cryptographic keys, applications, advantages, limitations, and the differences between Blockchain and Bitcoin.

CO2: Analyze blockchain architectures, variants, use cases, shared databases, and various types of cryptocurrencies along with their applications.

CO3: Illustrate the concepts of double spending, hashing, mining, proof of work, Merkle trees, payment verification, conflict resolution, and block creation in blockchain networks.

CO4: Demonstrate the working principles of Bitcoin and Ethereum, including wallets, transactions, cryptocurrency conversion, forks, SegWit, and smart contracts.

CO5: Evaluate the advantages, limitations, legal and regulatory aspects of blockchain technologies and smart contract-based solutions through real-world case studies.

UNIT-I	**12 Hrs.**

Introduction to Blockchain:
Introduction to Block chain, How Block chain works, Block chain vs Bit coin, Practical applications,public and private key basics, pros and cons of Blockchain, Myths about Bitcoin.

UNIT-II	**10 Hrs.**

Blockchain:
Architecture, versions, variants, use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to crypto currencies, Types, Applications.

UNIT-III	**10 Hrs.**

Concept of Double Spending:
Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy,payment verification , Resolving Conflicts , Creation of Blocks.

UNIT-IV	**10 Hrs.**

Introduction to Bitcoin and Ethereum:

Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency. Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs Bitcoin, Introduction to Smart Contracts, usage, application, working principle, Law and Regulations. Case Study.

Text Books:

1. Imran Bashir, “Mastering Blockchain”, Packt Publishing, 4th Edition, 2023.
2. Daniel Drescher, “Blockchain Basics: A Non-Technical Introduction in 25 Steps”, Apress, 2nd Edition, 2023.

Reference Books:

1. Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions by Arshdeep Bikramaditya Signal, GautamDhameja (PriyansuSekhar Panda., APress.
2. Blockchain Applications: A Hands-On Approach by Bahga, Vijay Madisetti.

Course Outcomes	Programme Outcomes							
	1	2	3	4	5	6	7	8
CO1	3	2	-	-	-	-	-	2
CO2	2	3	2	2	-	-	-	2
CO3	2	3	2	3	-	-	-	2
CO4	2	2	3	3	1		2	2
CO5		3	2	2	1	1	3	3

Course Code		:	2PCAA205E	QUANTUM COMPUTING	Semester	:	II
L:T:P		:	04:00:00		Course Type	:	Theory
Hours/Sem.	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	90 Hrs		Credits	:	03

Course Objectives: To introduce the fundamentals of quantum computing, the problem-solving approach

UNIT-I	12 Hrs.
History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations	
UNIT–II	**10 Hrs.**
Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements. Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)	
UNIT–III	10 Hrs.
Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes.	
UNIT–IV	10 Hrs.
Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation	
Text Books / Reference Books *	
1. Quantum Computation and Quantum Information, Nielsen M. A., Cambridge 2. Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, NicHarrigan, Mercedes Ginemo, Segovia, Oreilly **<u>Reference Books</u>** 1. Quantum Computing for Computer Scientists, Noson S. Yanofsk, Mirco A. Mannucci 2. Principles of Quantum Computation and Information,Benenti G., Casati G. and Strini G., Vol.I: Basic Concepts, Vol II 3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms	