Savitribai Phule Pune University, Pune

Maharashtra, India

Faculty of Science and Technology

Curriculum Structure and Syllabus

SY MCA (Under Engineering) (2025 Pattern)

Master of Computer Applications (Under Engineering)

(With effect from Academic Year 2026-27)

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Preface by Board of Studies

Dear Students and Teachers,

We, the members of Board of Studies Computer Engineering, are very happy to present Second Year Master of Computer Applications (MCA) syllabus effective from the AY Year 2026-27.

Master of Computer Applications (MCA) have emerged as transformative forces reshaping industries, driving innovation, and impacting our daily lives. Recognizing the growing importance and pervasive nature of these fields, we have designed this comprehensive syllabus to equip students with the foundational knowledge, practical skills. This curriculum is meticulously crafted to provide a holistic learning experience, blending theoretical concepts with hands-on applications. It aims to foster critical thinking, problem-solving abilities, enabling graduates to contribute meaningfully to the advancement and responsible deployment of Computer Applications. The revised syllabus falls in line with the objectives of NEP-2020, Savitribai Phule Pune University, AICTE New Delhi, UGC, and various accreditation agencies by keeping an eye on the technological developments, innovations, and industry requirements.

Learners are now getting sufficient time for self-learning either through online courses or additional projects for enhancing their knowledge and skill sets. Learners can be advised to take up online courses, on successful completion they are required to submit certification for the same. This will definitely help learners to facilitate their enhanced learning based on their interest. We believe that this well-structured and comprehensive syllabus will serve as a robust foundation for aspiring Computer Applications professionals, enabling them to contribute significantly to the technological progress and address the challenges of the 21st century.

We would like to place on record our gratefulness to the faculty, students, industry experts and stakeholders for having helped us in the formulation of this syllabus.

Dr. Nilesh Uke
Chairman - Board of Studies (Computer Engineering)
Savitribai Phule Pune University

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Program Specific Outcomes (PSO)

- **PSO1:** Demonstrate proficiency in essential concepts of computer science and programming solutions.
- **PSO2:** Formulate robust software design, execution, and testing strategies employing a software paradigms and Computer Application knowledge to solve real word problems.
- **PSO3:** Adapt and exhibit expertise in evolving areas of computer science and technology.

Programme Educational Objectives (PEO)

Program Educational Objectives (PEOs): Program Educational Objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

PEO	PEO Focus	PEO Statements
PEO1	Core competence	To prepare globally competent post graduates with enhanced domain knowledge and skills attaining professional excellence and updated with modern technology to provide effective solutions for engineering and research problems.
PEO2	Problem solving skills and Ethics	To prepare the post graduates to work as a committed professionals with strong professional ethics and values, sense of responsibilities, understanding of legal, safety, health, societal, cultural and environmental issues.
PEO3	Professionalism and Lifelong Learning	To prepare motivated post graduates with research attitude, lifelong learning, investigative approach, and multidisciplinary thinking to succeed in the career in industry/academia/research.
PEO4	Team Building	To prepare post graduates with strong managerial and communication skills to work effectively as an individual as well as in teams.

Knowledge and Attitude Profile (WK)

A Knowledge and Attitude Profile (KAP), often represented as WK (Knowledge and Attitude Profile) in some contexts, is a framework or assessment tool used to evaluate an individual's knowledge and attitudes related to a specific area, topic, or domain.

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Programme Outcomes (PO)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability attitude and behaviour that students acquire through the program. The POs essentially indicates what the students can do from course-wise knowledge acquired by them during the program. As such, POs define the professional profile of a graduate of MCA Program.

NBA has defined the following eight POs for a graduate of MCA Program:

PO1	Foundation Knowledge	Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving
PO2	Problem analysis	Identify, review, formulate and analyze problems for primarily focusing on customer requirements using critical thinking frameworks.
PO3	Development of Solutions	Design, develop and investigate problems with as an innovative approach for solution incorporating ESG/DSG goals
PO4	Modern Tool Usage	Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
PO5	Individual and Teamwork	Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
PO6	Project Management and Finance	Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.
PO7	Ethics	Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware
PO8	Life-long learning	Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

General Rules and Guidelines

- **Course Outcomes (CO):** Course Outcomes are narrower statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.
- **Assessment:** Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of Program Educational Objectives and Program Outcomes.
- **Evaluation:** Evaluation is one or more processes, done by the Evaluation Team, for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which Program Educational Objectives or Program Outcomes are being achieved, and results in decisions and actions to improve the program.

Guidelines for Examination Scheme

Theory Examination: The theory examination shall be conducted in two different parts Comprehensive Continuous Evaluation (CCE) and End-Semester Examination (ESE).

Comprehensive Continuous Evaluation (CCE) of 50 marks based on all the Units of course syllabus to be scheduled and conducted at institute level. To design a Comprehensive Continuous Evaluation (CCE) scheme for a theory subject of 50 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr.	Parameters	Marks	Coverage of Units
1	Unit Test	20 Marks	Units 1 & Unit 2 (10 Marks/Unit)
2	Assignments / Case Study	20 Marks	Units 3 & Unit 4 (10 Marks/Unit)
3	Seminar Presentation / Open Book Test/ Quiz	10 Marks	Unit 5

Format and Implementation of Comprehensive Continuous Evaluation (CCE)

- **Unit Test:**
  - **Format :** Questions designed as per Bloom's Taxonomy guidelines to assess various cognitive levels (Remember, Understand, Apply, Analyze, Evaluate, Create).
  - **Implementation**: Schedule the test after completing Units 1 and 2. Ensure the question paper is balanced and covers key concepts and applications.
- **Sample Question Distribution:**
  - **Remembering (4 Marks):** Define key terms related to [Topic from Units 1 and 2].
  - **Understanding (4 Marks):** Explain the principle of [Concept] in [Context].
  - **Applying (4 Marks):** Demonstrate how [Concept] can be used in [Scenario].
  - **Analyzing (4 Marks):** Compare & contrast [Two related concepts] from Units 1 and 2.

- **Evaluating (4 Marks):** Evaluate the effectiveness of [Theory/Model] in [Situation].

- **Assignments / Case Study:** Students should submit one assignment or one Case Study Report based on Unit 3 and one assignment or one Case Study Report based on Unit 4.
  - **Format:** Problem-solving tasks, theoretical questions, practical exercises, or case studies that require in-depth analysis and application of concepts.
  - **Implementation:** Distribute the assignments or case study after covering Units 3 and 4. Provide clear guidelines and a rubric for evaluation.

- **Seminar Presentation:**
  - **Format:** Oral presentation on a topic from Unit 5, followed by a Q&A session.
  - **Deliverables:** Presentation slides, a summary report in 2 to 3 pages, and performance during the presentation.
  - **Implementation:** Schedule the seminar presentations towards the end of the course. Provide students with ample time to prepare and offer guidance on presentation skills.

- **Open Book Test:**
  - **Format:** Analytical and application-based questions to assess depth of understanding.
  - **Implementation:** Schedule the open book test towards the end of the course, ensuring it covers critical aspects of Unit 5.

- **Quiz:**
  - **Format:** Quizzes can help your students practice existing knowledge while stimulating interest in learning about new topic in that course. You can set your quizzes to be completed individually or in small groups.
  - **Implementation:** Online tools and software can be used create quiz. Each quiz is made up of a variety of question types including multiple choice, missing words, true or false etc.

- **Term Paper/Conference Paper Publication**
  - **Format:** Prepare a research paper on a course-related topic in IEEE format (Abstract, Introduction, Methodology, Results, Conclusion, References). Aims to build research and writing skills.
  - **Implementation:** Students will choose a topic (with faculty approval) and conduct literature review, data collection/analysis, and structured writing as per IEEE guidelines. Papers can be prepared individually or in pairs. Final submissions is evaluated internally and submitted to reputed conferences or journals for publication consideration.

- **Example Timeline for conducting CCE:**
  - Weeks 1-4 : Cover Units 1 and 2

- Week 5 : Conduct Unit Test (20 marks)
- Weeks 6-8 : Cover Units 3 and 4
- Week 9 : Distribute and collect Assignments / Case Study (20 marks)
- Weeks 10-12 : Cover Unit 5
- Week 13 : Conduct Seminar Presentations or Open Book Test or Quiz (10 marks)

- **Evaluation and Feedback:**
  - **Unit Test:** Evaluate promptly and provide constructive feedback on strengths and areas for improvement.
  - **Assignments / Case Study:** Assess the quality of submissions based on the provided rubric. Offer feedback to help students understand their performance.
  - **Seminar Presentation:** Evaluate based on content, delivery, and engagement during the Q&A session. Provide feedback on presentation skills and comprehension of the topic.
  - **Field Project / Major Project :** Evaluation shall be carried out as per the guidelines specified in the syllabus.
  - **Open Book Test**: Evaluate based on the depth of analysis and application of concepts. Provide feedback on critical thinking and problem-solving skills.

By following this scheme, you can ensure a structured and comprehensive evaluation of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.

End-Semester Examination (ESE)

End-Semester Examination (ESE) of 50 marks written theory examination based on all the unit of course syllabus scheduled by university. Question papers will be sent by the University through QPD (Question Paper Delivery). University will schedule and conduct ESE at the end of the semester.

The paper setting, conduct of examination, and assessment for the End-Semester Examination of the Second Year (Semester-IV) subject Elective IV shall be carried out by the respective college as per the schedule prescribed by Savitribai Phule Pune University. The Director/Principal shall approve the panel of paper setters in consultation with the Head of the Department. Out of the three sets of question papers prepared, the Director/Principal shall select any one question paper for distribution to the students on the day of the examination.

Format and Implementation:

- **Question Paper Design** : Below structure is to be followed to design an End-Semester Examination (ESE) for a theory subject of 50 marks on all 5 units of the syllabus with questions set as per Bloom's Taxonomy guidelines and 10 marks allocated per unit.
- **Balanced Coverage**: Ensure balanced coverage of all units with questions that assess different cognitive levels of Bloom's Taxonomy: Remember, Understand, Apply, Analyze, Evaluate, and Create. The questions should be structured to cover:

- Remembering: Basic recall of facts and concepts.
- Understanding: Explanation of ideas or concepts.
- Applying: Use of information in new situations.
- Analyzing: Drawing connections among ideas.
- Evaluating: Justifying a decision or course of action.
- Creating: Producing new or original work (if applicable).

- **Detailed Scheme:** Unit-Wise Allocation (10 Marks per Unit): Each unit will have a combination of questions designed to assess different cognitive levels. By following this scheme, you can ensure a comprehensive and fair assessment of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.

End Semester Examination Guidelines:

Question Paper :

One section with five questions (10 marks each). Each has an alternate from the same unit.

Framing of questions should be according to Anderson/Revised Bloom's Taxonomy and disseminated through the question papers with a mention of course outcomes as well.

Assessment

Assessment will be done at the centralized assessment programme (CAP) Centre of the College by the Expert who is appointed as an examiner for the courses as per 48(3) panel of Maharashtra public university act 2016.

Moderation will be done at the CAP Centre designated by the University by the Expert who is appointed as an examiner for the subject as per 48(3) panel.

Monitoring of CCE

Periodic monitoring of CCE will be done by respecting board of studies members, whenever required.

Colleges should maintain all the records related to CCE with CEO for verification.

Staff members should keep all the records of Unit Tests, Assignments / Case Study, Seminar Presentation / Open Book Test/ Quiz duly signed by head of the institute with College Examination officer.

General Guidelines for Laboratory Subject

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual needs to include prologue (about University/program/ institute/ department/foreword/ preface etc), copy of curriculum, conduction & Assessment guidelines, topics under consideration-concept,objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept in brief, features of tool/framework/language used, Design, test cases, conclusion. Program codes with sample output of all performed assignments are to be submitted as softcopy.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journals may be avoided. Use of Drive containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of students. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Laboratory Conduction

List of laboratory assignments is provided below for reference. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy should address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute them among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of coding style, proper indentation and comments.

Use of open source software and recent versions is to be encouraged.

In addition to these, instructors may assign one real life application in the form of a mini-project.

Based on the concepts learned. Instructors may also set one assignment or mini-project that is suitable to each branch beyond the scope of the syllabus.

Second Year MCA (Under Engineering) (2025 Pattern) – Master of Computer Applications

Curriculum Structure - Semester III

Course Code	Course Type	Course Name	Teaching Scheme			Examination Scheme and Marks						Credits			
			Theory	Tutorial	Practical	CCE*	End-Sem	Term Work	Practical	Oral/ Present.*	Total	Theory	Tutorial	Practical	Total
PCC-601-MCA	Programme Core Course	Software Testing and Quality Assurance	3	-	-	50	50	-	-	-	100	3	-	-	3
PCC-602-MCA	Programme Core Course	Data Science	3	-	-	50	50	-	-	-	100	3	-	-	3
PCC-603-MCA	Programme Core Course	Web Technology	3	-	-	50	50	-	-	-	100	3	-	-	3
PCC-604-MCA	Programme Core Course	Cyber Security	3	-	-	50	50	-	-	-	100	3	-	-	3
PEC-620-MCA	Programme Elective Course (Elective –III)	Elective-III	3	-	-	50	50	-	-	-	100	3	-	-	3
PCC-605-MCA	Programme Core Course	Lab Practice-I	-	-	2	-	-	-	50	-	50	-	-	1	1
PCC-606-MCA	Programme Core Course	Web Technology Laboratory	-	-	2	-	-	25	-	25	50	-	-	1	1
PCC-607-MCA	Programme Core Course	Cyber Security Laboratory	-	-	2	-	-	25	-	-	25	-	-	1	1
PCC-608-MCA	Programme Core Course	Corporate Communication and Aptitude Skill Development	-	1	-	-	-	25	-	-	25	-	1	-	1
RPR-631-MCA	Research Project	Research Project			6	-	-	50	-	50	100	-	-	3	3
Total			15	1	12	250	250	125	50	75	750	15	1	6	22

List of Elective III Courses:

PEC-620A-MCA	Deep Learning
PEC-620B-MCA	Block Chain
PEC-620C-MCA	Bussiness Intelligence

CCE*: Comprehensive Continuous Evaluation

Present.*: Presentation

Second Year MCA (Under Engineering) (2025 Pattern) – Master of Computer Applications

Curriculum Structure - Semester IV

Course Code	Course Type	Course Name	Teaching Scheme			Examination Scheme and Marks						Credits			
			Theory	Tutorial	Practical	CCE*	End-Sem	Term Work	Practical	Oral/ Present.*	Total	Theory	Tutorial	Practical	Total
PEC-670-MCA	Programme Elective Course (Elective –IV)	Elective - IV	3	-	-	50	50	-	-	-	100	3	-	-	3
SEM-680-MCA	Seminar	Technical Seminar	-	-	4	-	-	-	-	50	50	-	-	2	2
OJT-681-MCA	Internship/OJT (IN/OJT)	Field Project/Major Project	-	-	28	-	-	200	-	150	350	-	-	15	15
Total			3	-	32	50	50	200	-	200	500	3	-	17	20

List of Elective IV Courses:

PEC-670A-MCA	Generative AI and Prompt Engineering
PEC-670B-MCA	Dev Ops
PEC-670C-MCA	Cloud Computing

CCE*: Comprehensive Continuous Evaluation
Present.*: Presentation

Savitribai Phule Pune University, Pune

Maharashtra, India

Master of Computer Applications (Under Engineering) (2025 Pattern)

Semester III

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PCC-601-MCA : Software Testing and Quality Assurance		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Software Engineering and Project Management (PCC-553-MCA)

Companion Course:

- Lab Practice-I(PCC-605-MCA)

Course Objectives: The course aims to:

1. Understand the fundamentals of software quality, QA, QC, and SQA.
2. Learn the principles and life cycle of software testing.
3. Apply various software testing techniques for defect detection.
4. Understand different testing strategies and levels.
5. Gain knowledge of automation testing and tools like Selenium..

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Explain** software quality concepts, SQA components, and quality assurance models.
- **CO2: Describe** software testing principles, test planning, and defect management process.
- **CO3: Apply** white-box and black-box testing techniques to design effective test cases.
- **CO4: Analyze** various testing strategies and levels for different software systems.
- **CO5: Evaluate** automation tools and frameworks to improve software testing efficiency.

Course Contents

Unit I - Fundamentals of Software Quality Assurance - (09 Hours)

Fundamentals Of Software Quality: Definition of Quality, QA, QC, SQA, SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.

Quality Assurance Models: Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM SOFTWARE QUALITY ASSURANCE TRENDS: Software Process- PSP and TSP, OO Methodology, Clean-room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their effect on Software Quality.

Testing Software System Security: Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality.

 # Exemplar /Case Studies: Online Banking System Quality Improvement.

Unit II - Essentials of Software Testing - (10 Hours)

Software Testing Basics: Definition & Objectives of testing, testing life cycle, Software testing principles, The tester's role in a software development organization

Test Plan And Test Cases: Preparation, Management and execution of Test Plan, Definition, Test Case Designing of Test Cases, prepared Test report.

Defect Management: Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.

#Exemplar/Case Studies: E-commerce Website Testing.

Unit III -Software Testing Techniques - (09 Hours)

White-Box Testing Methodologies: Static testing: by humans, using static analysis tools, Structural Testing: unit/code functional testing, Code coverage Testing, Code Complexity testing, Mutation Testing

Black - Box Testing Methodologies: Requirement based testing, Positive and negative testing, Boundary Value

analysis, Equivalence Partitioning, State based or Graph-based Testing, Compatibility Testing, User Documentation Testing, Domain Testing

#Exemplar/Case Studies: ATM Software Testing.

Unit IV -Testing Strategies - (08 Hours)

Testing Levels -Integration testing, System and Acceptance testing,

Testing Approaches -Scenario testing, Performance Testing, Regression testing, Ad hoc Testing,

Specialized Testing -Usability and Accessibility Testing, GUI testing, Validation testing, Specification-based testing, Testing Object Oriented Software, Testing Web Based Applications, Database Testing

#Exemplar/Case Studies : Hospital Management System.

Unit V - Software Test Automation - (09 Hours)

Introduction To Automation Testing: Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging, Difference between manual testing and automated testing, UI Automation Tools : Cypress, Testcafe, Protractor, Case studies of automation testing. Selenium Tools-Introduction of Selenium,Brief History pf the selenium project,Selenium's tool suite,Selenium IDE,Selenium RC, Selenium WebDriver,Selenium Grid,Test design considerations.

#Exemplar/Case Studies : Web Application Automation Using Selenium.

Learning Resources

Text Books:

1. Srinivasan Desikan, Gopalaswamy Ramesh,Software Testing: Principles and Practices Pearson. ISBN: 9788177581218
2. Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley, ISBN: 0201 70945 7
3. Tamres L, “Introducing Software Testing”, Pearson Education, ISBN:978-0201719741

Reference Books:

1. Ron Patton, “Software Testing”, Pearson, Second edition, ISBN:9788177580310.
2. Rajani & Oak, “Software Testing: Methodology, Tools and Processes”, Tata McGraw-Hill, 2007, ISBN-10: 0070583528.
3. Dr.K.V.K. K Prasad, “Software Testing Tools”, Dreamtech Press, ISBN-13. 978-8177225327.
4. Software Engineering: A Practitioner’s Approach. 9th Edition. By Roger S. Pressman, Bruce R. Maxim. © 2024, ISBN: 978-9355325044
5. Software Testing and Quality Assurance – Theory and Practice, Kshirasagar Naik, Priyadashi Tripathy,Wiley India, 2010, ISBN-13: 978-8126525935

e-Books:

1. Selenium 1.0 Testing Tool beginners guide by David Burns, ISBN: 1849510261, ISBN 13: 9781849510264.
2. Burnstein, “Practical Software Testing”, Springer International Edition, ISBN 81- 8128-089-X.

MOOC Courses:

1. https://onlinecourses.nptel.ac.in/noc25_cs66/prev
2. https://www.my-mooc.com/en/mooc/software-testing-fundamentals/
3. https://nptel.ac.in/course/106/105/106105150/
4. https://nptel.ac.in/courses/106/105/106105150/

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PCC-602-MCA : Data Science		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Mathematical foundation for Computer Applications (PCC-501-MCA)
- Data Structures And Algorithms (PCC-502-MCA)

Companion Course:

- Lab Practice-I (PCC-605-MCA)

Course Objectives: The course aims to:

1. Study the need and real-world uses of data science.
2. Understand the importance of data preprocessing techniques in data science.
3. Learn classification algorithms useful in data science..
4. Use clustering and association rule mining algorithms in data science.
5. Acquire skills to visualize data and use for communicating stories from data.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Explain** core concepts of data science and its practical applications.
- **CO2: Use** various data preprocessing techniques and elaborate data warehouse concepts.
- **CO3: Apply** classification and regression methods for real life problems.
- **CO4:Implement** standard clustering and association rule mining methods for commercially available datasets.
- **CO5: Apply** different data visualization techniques to understand the data.

Course Contents

Unit I - Fundamentals of Data Science - (09 Hours)

Importance of data science, Types of data: structured, semi-structured, unstructured, Scales of measurement: nominal, ordinal, interval, ratio, Data formats: CSV, JSON, XML, SQL tables, Big data vs Data Science, Data science life cycle, Process model: CRISP-DM, TDSP, SEMMA

Applications of data science, Distinction between Data Science, Machine Learning, and Artificial Intelligence, Roles in Data Science: Data Analyst, Data Scientist, Data Engineer, Machine Learning Engineer

Importance of mathematical statistics in data science

 # Exemplar /Case Studies: Study the role of data scientist in Customer recommendation system (E-Commerce)

OR

Study the role of data scientist in Traffic prediction in smart cities

Case study: For a retail company dataset identify the different types of data (categorical, numerical etc)

Unit II - Data Pre processing and Data Warehouse - (09 Hours)

Data pre-processing, Need of data pre processing, Data pre processing techniques: data cleaning, data integration and transformation, data reduction

Data warehouse: characteristic of data warehouse, data warehouse architecture, ETL process, data warehouse modeling: fact and dimension tables, star schema, snowflake schema, OLAP vs OLTP.

#Exemplar/Case Studies: Read data from file, identify missing values, removing duplicate data and view summary statistics using any tools like WEKA / R/ Excel/ Python.

Unit III - Classification - (09 Hours)

Applications of classification, Machine learning: Types (supervised, unsupervised, reinforcement), Supervised algorithms: linear regression, logistic regression, Naïve bayes classifier, K- nearest neighbor, Decision trees, Support vector machine

Metrics for model evaluation: Confusion matrix, accuracy, precision, recall, ROC-AUC, F1 score, MAE, MSE, RMSE, R-squared.

#Exemplar/Case Studies: Student activity: To learn model evaluation- students can compute accuracy, precision, recall, confusion matrix and compare the model performance.

Case study: A retail company wants to predict its future sales revenue based on various factors such as product pricing, marketing spend, seasonal trends, and customer demographics. The company aims to use regression and classification models to analyze historical sales data, identify trends, and make data-driven decisions to enhance profitability and optimize resource allocation. Justify how does the choice between regression and classification models affect sales predictions

Unit IV - Clustering and Association rule mining - (09 Hours)

Distance Based Models: Euclidean, Hamming, Manhattan, cosine similarity and Minkowski

Clustering algorithms: K means, k-medoid algorithm, Hierarchical clustering: divisive and agglomerative , Evaluation metrics : elbow method

Association rule mining: Market basket analysis, , Apriori algorithm, FP Growth, Performance Measures – Support, Confidence.

#Exemplar/Case Studies : Case study: An online platform wants to recommend products to users, choose appropriate techniques

Student activity: Discussions on selection of best model for 'Fraud detection dataset'.

Unit V - Data visualization and Emerging trends - (09 Hours)

Introduction to data visualization, challenges of data visualization, Definition of Dashboard and their type, Evolution of dashboard, Dashboard design and principles, Display media for dashboard

Types of Graphs: Bar graph, Stacked bar chart, Pie chart, Doughnut chart, Line Chart, Area chart, Treemap chart, Heatmap, Waterfall chart, Scatter Plot, Histogram, Box plot

Data Visualization Tool : Tableau, Power BI

Reinforcement learning: Key elements, steps and types of reinforcement learning

Introduction to Generative learning, Deep learning and Explainable AI

#Exemplar/Case Studies : Students can represent the dataset using multiple charts- bar chart, line chart, pie chart etc

Learning Resources

Text Books:

1. Jiawei Han, Micheline Kamber, and Jian Pie, "Data mining: concepts and techniques", Elsevier Publisher, Third edition, ISBN:9780123814791, 9780 123814807.
2. Vijay Kotu, Bala Deshpande, "Data Science Concepts and Practice", 2nd Edition, Morgan Kaufmann, ISBN 978-0-12-814761-0.
3. Data science from scratch, Joel Grus, Orielly publication, ISBN: 9781492041139, May 2019.

Reference Books:

1. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, "Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", 1st Edition, Dreamtech Press, ISBN 978-1-63343-003-7.
2. Arockia Liborious, Rik Das, "Fun with Machine Learning", 1st Edition, BPB Publications, ISBN 978-93-555-1785-2.
3. Dirk P. Kroese et.al.,"Data Science and Machine Learning: Mathematical and Statistical Methods", 1st Edition, CRC Press, ISBN 978-1-138-49253-0.
4. Chirag Shah,"A Hands-On Introduction To Data Science, Cambridge University Press (2020), ISBN: 978-1-108-47244-9.

e-Books:

1. Johan Perols (2011) Financial Statement Fraud Detection: An Analysis of Statistical and Machine Learning Algorithms. AUDITING: A Journal of Practice & Theory: May 2011, Vol. 30, No. 2, pp. 19-50.
2. https://people.smp.uq.edu.au/DirkKroese/DSML/DSML.pdf.

3. Python for everybody: http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf
4. Scikit Learn Tutorial https://scikit-learn.org/stable/

MOOC Courses:

1. MOOC Courses: https://onlinecourses.nptel.ac.in/noc22_cs32/preview
2. NPTEL Courses: https://nptel.ac.in/courses/106106179

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PCC-603-MCA : Web Technology		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Operating System and Network Fundamentals (PCC-551-MCA)

Companion Course:

- Web Technology Laboratory (PCC-606-MCA)

Course Objectives: The course aims to:

1. Learn the web essentials and mark-up languages
2. Understand the concepts of JavaScript and framework of bootstrap for responsive web pages.
3. Comprehend concepts of PHP programming and server-side web development.
4. Study the fundamentals of ASP.NET.
5. Apply concepts of AngularJS for developing dynamic web applications..

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Make** use of HTML and CSS in web pages.
- **CO2: Develop** the responsive web pages using JavaScript and Bootstrap.
- **CO3: Create** dynamic web pages using PHP and basic Code Igniter framework.
- **CO4: Analyze** the Web services and frameworks.
- **CO5: Build** the maintainable and scalable web applications using ANGULAR JS.

Course Contents

Unit I - HTML and XML - (09 Hours)

HTML- Introduction to Web Technology, internet and www, Web Servers, Website planning and design issues, HTML: structure of html document, HTML elements: headings, paragraphs, line break, colors & fonts, links, frames, lists, tables, images and forms, Difference between HTML and HTML5. CSS: Introduction to Style Sheet, Inserting CSS in an HTML page, CSS selectors.

XML- XML: Introduction to XML, Features and applications of XML, XML key component, XML DTD, XML Schema, elements, attributes, XML Namespaces, Transforming XML into XSLT.

 # Exemplar /Case Studies: Create a style sheet suitable for blogging applications using HTML and CSS.

Unit II - JAVA SCRIPT - (09 Hours)

JavaScript: Overview of JavaScript:need/why JavaScript, applications, advantages, limitations, using JS in an HTML:Embedded, External, variables/ Data types, Control Structures: if.. Else, switch case, Loop Controls: for, while, for, Functions and Dialog Boxes, page redirect, cookies, events.JS objects: JavaScript-Object Properties, Methods, JavaScript-Number Properties, Methods, JavaScript-String Properties, Methods, JavaScript-Array Properties, Methods, JavaScript-Math Properties, Methods, Temporal, Java script- Asynchronous: Timeout, Callback, promises, await

Introduction to Bootstrap -need/why Bootstrap advantages of bootstrap, how to use bootstrap.

#Exemplar/Case Studies: Create a responsive web page for student registration.

Unit III - PHP - (09 Hours)

What is PHP, PHP variables and operators, taking user inputs and generating outputs, Formatting String, library function for string manipulation Array fundamentals, Single-Dimensional Arrays, Multidimensional Arrays, Associative arrays, library functions for array manipulation, Dates and Times function, User- defined functions, Object oriented programming using PHP, File Handing in PHP, cookie and session. PHP Forms: Handling, Validation, Introduction to CodeIgniter.

#Exemplar/Case Studies: Create a web page for student registration.

Unit IV - ASP. net - (09 Hours)

Introduction to ASP.NET,ASP.NET Environment Setup,ASP.NET Web Forms, Types of ASP.NET Controls,ASP.NET State Management :Introduction, View State, Session State, Application State, Cookies and Query Strings, Server Transfer and Response Redirect, ASP.NET Data Access :Introduction to ADO.NET, Database Connectivity, Validation controls and security : Required Field Validator, Range Validator, Compare Validator, Basic Security Concepts.

#Exemplar/Case Studies : Create a login page that validates username and password.

Unit V - ANGULAR JS - (09 Hours)

Introduction to JavaScript Frameworks ,Introduction to AngularJS :Overview of AngularJS, Features of AngularJS, Advantages of AngularJS, MVC Architecture in AngularJS, Applications of AngularJS,AngularJS Expressions and Directives ,AngularJS Modules and Controllers ,AngularJS Forms and Validation :Form handling in AngularJS, Two-way data binding, Validation directives, Introduction to Next.js:Overview of Next.js, Why Next.js? Key Features.

#Exemplar/Case Studies : Create Login Form with AngularJS Validation.

Learning Resources

Text Books:

1. H. Schildt, The Complete Reference HTML, 4th ed. New Delhi, India: Tata McGraw-Hill, 2002, ISBN-13: 978-0072224412

2. A. Godbole, Web Technologies, 2nd ed. New Delhi, India: Tata McGraw-Hill, 2005, ISBN-13: 978-0070669055

Reference Books:

1. E. Meyer, CSS: The Definitive Guide. Sebastopol, CA, USA: O'Reilly Media, 2006, ISBN-13: 978-0596527334

2. R. Nixon, Learning PHP, MySQL and JavaScript with jQuery, CSS & HTML5. Sebastopol, CA, USA: O'Reilly Media, 2014, ISBN-13: 978-1491918661

3. S. Panda, AngularJS: Novice to Ninja, 1st ed. Sydney, Australia: SitePoint (SPD), 2014, ISBN13: 978-0992279455

e-Books:

1. W3Schools, "W3Schools Online Web Tutorials." Link: https://www.w3schools.com.

2. TutorialsPoint, "AngularJS Tutorial." Link: https://www.tutorialspoint.com/angularjs/index.htm.

3. TutorialsPoint, "JavaScript Tutorial." Link: https://www.tutorialspoint.com/javascript/index.htm.

4. Bootstrap, "Bootstrap Official Website." Link: https://getbootstrap.com/.

MOOC Courses:

1. https://onlinecourses.swayam2.ac.in/e-learning/preview/aic20_sp11

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PCC-604-MCA : Cyber Security		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Operating System and Network Fundamentals (MJC-506-MCA)

Companion Course:

- Cyber Security Laboratory (PCC-607-MCA)

Course Objectives: The course aims to:

1. Learn fundamental concepts of cyber security.
2. Describe different types of threats and cyber-crimes.
3. Understand the basics cyber forensics, network forensics, Email forensics, web forensics.
4. Explain digital forensics concepts and techniques for examining and investigating digital devices.
5. Apply appropriate defense strategies and preventive measures to protect against social engineering attacks, including insider threat mitigation.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Explain** the fundamental concepts and principles of cyber security.
- **CO2: Classify** different types of cyber threats, cyber-attacks, and cyber-crimes based on their characteristics and impact.
- **CO3: Analyze** cyber forensic techniques and investigation processes to identify digital criminal activities.
- **CO4: Apply** digital forensic tools and techniques to recover, preserve, and validate digital evidence.
- **CO5: Analyze** social engineering techniques and identify vulnerabilities in real-world scenarios.

Course Contents

Unit I - Introduction to Cyber Security - (09 Hours)

Introduction to Cyber Security, Need, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber-warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security - Organizational Implications, Need for a Comprehensive Cyber Security Policy and governance, Need for a Nodal Authority, Need for an International convention on Cyberspace, Introduction to Cyber Laws, Key Principles, Information Technology Act 2000, Overview and Provisions, Amendments to IT Act 2000.

 # Exemplar /Case Studies: Case Study on Cyber Security Challenges and Threats in Modern Cyberspace.

Unit II - Cybercrimes and Hacking - (09 Hours)

Overview of Cyber-Attacks and Vulnerabilities, Types of Threats – Malware, spyware, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors. Types of Cyber Crime - cyber stalking, software piracy, cyber terrorism, phishing, computer hacking, spamming, cross site scripting, online auction fraud, logic bombs, web jacking, internet time thefts, DoS attack, salami attack, data diddling, email spoofing. Types of Hacker Hacking and Cracking, Hacking: Ethical issues, Ethical Hacking.

#Exemplar/Case Studies: Case Study on Phishing Attack and Unauthorized Access to Student Email Account

Unit III - Cyber Forensics - (09 Hours)

Introduction to Cyber Forensics, cyber forensics investigation process, digital evidences, challenges in cyber forensics; Web Attack Forensics: Intrusion forensics, database forensics, preventive forensics; Anti- forensics practices, Anti-forensics detection techniques, Network forensics analysis tools; Malware Forensics: Malware types, Malware Analysis, Tools for analysis; Email Forensics: e-mail Protocols, e-mail crimes.

#Exemplar/Case Studies: Analysis of Cyber Forensics: From Digital Evidence to Investigation Report.

Unit IV - Digital Forensics - (09 Hours)

Introduction to Digital Forensics, Cyber Forensics vs Digital Forensics, the role of digital forensics and its environment, Forensic Software and Hardware, properties of digital evidence, recovering and preserving digital evidence, Advanced forensic Tools, selecting and analyzing digital evidence, validating the evidence, Forensic Technology and Practices.

#Exemplar/Case Studies : Case study: Digital Forensics Investigation of Data Theft in an Organization.

Unit V - Social Engineering - (09 Hours)

Introduction of social engineering and cyber security, social engineering conceptual evolution, defining social engineering-categories, Phases, attack spiral model, Attack Vendors-social approach, socio-technical approach. Advanced social engineering attack, Phishing Attack, Insider Attack, Identity Theft, Preventing Insider Threats, Social Engineering Targets and Defense Strategies.

#Exemplar/Case Studies : Case Study: Phishing and Identity Theft in Online Banking Scam.

Learning Resources

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA. ISBN 978-81-265-2179-1.
2. Practical Cyber Forensics an Incident-Based Approach to Forensic Investigations, Niranjan Reddy, A press, ISBN-13: 978-1-4842-4459-3
3. Practical Digital forensics – Richard Boddington, PACKT Publishing ISBN 978-1-78588-710-9.

Reference Books:

1. William Stallings, Computer Security: Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13- 335469-0.
2. Bernard Menezes, Network Security and Cryptography, Cengage Learning, ISBN-978-81- 315-1349- 1.
3. Dr. V.K. Pachghare, Cryptography & Information security, PHI, Second edition, ISBN- 978- 81-203-5082-3.

e-Books:

1. Computer Network Security and Cyber Ethics

   https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf

MOOC Courses:

1. https://swayam.gov.in/nd2_cec20_cs15/preview
2. Internet Crimes and Cyber Security - Course
3. Preview: Introduction to Cyber Security | SWAYAM

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PEC-620A-MCA : Elective III-Deep Learning		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Machine Learning (MEC-522A-MCA)

Companion Course:

- Data Science (MJC-602-MCA)

Course Objectives: The course aims to:

1. Build a strong foundation in deep learning concepts including artificial neural networks, perceptron's, and multilayer architectures.
2. Explore and understand various deep learning architectures such as CNNs, RNNs, LSTMs, GRUs, and GANs.
3. Gain an understanding of deep learning model development processes including data preprocessing, training, evaluation, and deployment.
4. Familiarize with advanced deep learning techniques such as autoencoders, reinforcement learning basics, and explainable AI.
5. Stay informed about real-world applications and emerging trends of deep learning in areas like computer vision, natural language processing, and healthcare.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Apply** fundamental deep learning concepts such as backpropagation, optimization algorithms, and regularization techniques to build basic neural network models.
- **CO2: Design** deep learning architectures like CNNs and RNNs for solving problems in image processing and sequential data analysis.
- **CO3: Evaluate** deep learning models using appropriate metrics and handle challenges such as overfitting and imbalanced datasets.
- **CO4: Analyze** advanced deep learning methods including autoencoders, GANs, and basic reinforcement learning for complex problem-solving.

- **CO5: Implement** deep learning solutions for real-world applications and assess their performance, ethical implications, and interpretability.

Course Contents

Unit I - Introduction to Neural Network and Fundamentals of Deep Learning - (09 Hours)

Introduction to Artificial Intelligence and Machine Learning, Basics of Neural Networks; Difference between Machine Learning and Deep Learning, Historical context and motivation for deep learning; basic supervised classification task, optimizing logistic classifier using gradient descent, stochastic gradient descent, momentum, and adaptive sub-gradient method, Introduction to Artificial Neural Networks (ANNs), Perceptrons and Multilayer Perceptrons (MLPs), Activation Functions (Sigmoid, Tanh, ReLU, Leaky ReLU), Backpropagation Algorithm, Optimization Algorithms (Gradient Descent, Stochastic Gradient Descent, Adam), Regularization Techniques (Dropout, L1/L2 Regularization)

 # Exemplar /Case Studies: End-to-End Student Performance Prediction

Unit II - Deep Learning Models and Real-World Applications - (09 Hours)

Introduction to Convolutional Neural Networks (CNNs): Architectures (LeNet, AlexNet, ResNet, Inception), Applications (Image Classification, Object Detection, Image Segmentation), Introduction to Recurrent Neural Networks (RNNs): Architectures (Vanilla RNN, LSTM, GRU), Applications (Natural Language Processing, Time Series Analysis), Long Short-Term Memory (LSTM) Networks and Gated Recurrent Units (GRUs), Generative Adversarial Networks (GANs).

#Exemplar/Case Studies: Image Classification with CNN or Face Recognition System: Identify or verify a person using facial images

Unit III - Deep Learning Model Design and Implementation - (09 Hours)

Data Preprocessing for Deep Learning, Model Selection, Training Strategies, and Hyperparameter Tuning, Evaluation Metrics for Deep Learning Models (Accuracy, Precision, Recall, F1-Score, AUC ROC), Model Deployment and Monitoring, Techniques for handling imbalanced datasets in deep learning, Introduction to transfer learning.

#Exemplar/Case Studies: Diabetic Retinopathy Detection from Fundus Images

Unit IV - Advanced Methods in Deep Learning - (09 Hours)

Autoencoders: Under complete Autoencoders, Regularized Autoencoders-Sparse Autoencoders, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Autoencoders, Applications of Autoencoders. Ensemble Methods in Deep Learning, Autoencoders and Variational Autoencoders (VAEs), Deep Reinforcement Learning, Explainable AI (XAI) and its role in DL, Ethical considerations in deep learning.

#Exemplar/Case Studies : Image Denoising: blur, distortion, random pixels.

Unit V - Practical Applications of Deep Learning in Computing - (09 Hours)

Deep Learning applications in Computer Vision, Natural Language Processing, and other relevant fields, Image Classification, Social N/w/ analysis, Speech Recognition, Recommender system, Case studies on the application of Deep Learning in areas such as robotics, signal processing, and health care, Current trends in deep learning.

#Exemplar/Case Studies : Multimodal Deep Learning for Smart Healthcare Monitoring Using Vision, Speech, and Data.

Learning Resources

Text Books:

1. J. Patterson and A. Gibson, Deep Learning: A Practitioner's Approach. Sebastopol, CA, USA: O'Reilly Media, Inc., 2017, ISBN: 978-1491914250.
2. I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. Cambridge, MA, USA: MIT Press, 2016, ISBN: 978-0262035613.
3. N. Buduma, J. Papa, and N. Locascio, Fundamentals of Deep Learning. Sebastopol, CA, USA: O'Reilly Media, Inc., 2022, ISBN: 978-9355420121.

Reference Books:

1. F. Chollet, Deep Learning with Python. Shelter Island, NY, USA: Manning Publications, 2017, ISBN-13: 978-1617294433
2. A. Zhang, Z. C. Lipton, M. Li, and A. J. Smola, Dive into Deep Learning. Cambridge, U.K.: Cambridge University Press, 2023, ISBN-13: 978-1009389433

e-Books:

1. M. Nielsen, Neural Networks and Deep Learning. Determination Press, 2015.
2. A. Gulli and A. Kapoor, TensorFlow 1.x Deep Learning Cookbook. Birmingham, U.K.: Packt Publishing, 2017.

MOOC Courses:

1. Deep Learning – IIT Ropar," NPTEL Online Course, SWAYAM. Link: https://onlinecourses.nptel.ac.in/n
2. Deep Learning," NPTEL Online Course, SWAYAM. [Online]. Linke: https://onlinecourses.nptel.ac.in/n

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PEC-620B-MCA : Elective III-Block Chain		
Data warehouse	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Operating System and Network Fundamentals (PCC-551-MCA)

Companion Course: NA

Course Objectives: The course aims to:

1. Explore basics of Blockchain applications.
2. Understand mining process in blockchain.
3. Determine the security for blockchain.
4. Develop blockchain applications.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1:Illustrate** basic concepts of blockchain.
- **CO2: Analyze** the Bitcoin blockchain, including its scripting, consensus mechanisms.
- **CO3: Apply** asymmetric key cryptography concepts, including AES structure and analysis.
- **CO4: Understand** and analyze alternative blockchain platforms.
- **CO5: Examine** permissioned blockchain platforms.

Course Contents

Unit I - Introduction to Block chain- (09 Hours)

Introduction – Basic ideas behind Block chain, Types of Block chain, introduction to cryptographic concepts required, Hashing, public key cryptosystems, private vs public, Block chain and use cases, Hash Puzzles, Foundation of block chain: Merkle trees, Introduction to Bitcoin Block chain, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy

 # Exemplar /Case Studies: Healthcare Records Management- Block chain ensures secure sharing of patient records using encryption and hashing, maintaining privacy and data integrity.

Unit II - Bitcoin Block chain, Scripting, and Mining Mechanisms - (09 Hours)

Bitcoin blockchain: Bitcoin Block chain and scripts, Consensus in Bitcoin, Proof-of-Work (PoW), Proof-of-Burn (PoB), Proof-of-Stake (PoS) and Proof-of-Elapsed Time (PoET), Life of a miner, Mining difficulty, Mining pool and its methods Use cases of Bitcoin Block chain scripting language in micropayment, escrow etc Downside of Bitcoin – mining: Mining explained, The Bitcoin network, The Bitcoin Minning Process, Mining Developments.

#Exemplar/Case Studies: Payment Channels (e.g., Lightning Network) - Shows how off-chain solutions improve scalability and enable fast, low-cost transactions using Bitcoin scripting.

Unit III - Cryptographic Algorithms and Public Key Infrastructure - (09 Hours)

Asymmetric key cryptography: AES structure, Analysis of AES, Hybrid Cryptography, Elliptic Curve Cryptography (ECC), Post-Quantum Cryptography, Zero-Knowledge Proofs (ZKP), Homomorphic Encryption.

Key distribution Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Analysis of RSA, Diffie-Hellman Key exchange.

#Exemplar/Case Studies: Digital Signatures for Authentication-Demonstrates how asymmetric cryptography ensures integrity and non-repudiation in documents and transactions.

Unit IV - Advanced Block chain: Altcoins, Smart Contracts, and Consensus Mechanisms - (09 Hours)

Alternative coins – Ethereum and Smart contracts, Alternative coins – Ethereum continued, IOTA, GHOST, DAO, The real need for mining – consensus – Byzantine Generals Problem, and Consensus as a distributed coordination problem – Coming to private or permissioned block chains, AI for Blockchain Optimization.

#Exemplar/Case Studies : Supply Chain using IOTA (Tangle Technology)-Demonstrates how IOTA is used in IoT-based systems for feeless, scalable transactions without traditional mining.

Unit V - Enterprise Block chain and Public Sector Applications - (09 Hours)

Introduction to Hyperledger, Permissioned Block chain and use cases – Hyperledger, Integration with Existing Systems, Governance Model, Corda Uses of Block chain in E-Governance, Land Registration, Medical Information Systems and others, Digital Identity Management, Supply Chain Transparency, Public Distribution System, Decentralized Artificial Intelligence, Data Security and Privacy in AI using Blockchain.

#Exemplar/Case Studies : Medical Information Systems-Demonstrates secure sharing of patient records using permissioned block chain while maintaining privacy and data integrity.

Learning Resources

Text Books:

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos, ISBN-13: 978-1449374044

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016). ISBN-13: 978-0691171692

3. Mastering Blockchain: First published by Packt Publishing in 2017, ISBN-13: 978-1787125445

Reference Books:

1. The Book of Satoshi: The Collected Writings of Bitcoin Creator Satoshi Nakamoto by Phil Champagne, ISBN-13: 978-0996061315

2. Blockchain Applications: A Hands-on Approach by ArshdeepBahga and Vijay K. Madisetti, ISBN13: 978-0996025560

3. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts, ISBN-13: 978-3-662-54455-6

4. Mastering Bitcoin: Programming The Open Blockchain, Andreas M. Antonopoulos, O'Reilly, ISBN-13: 978-1491954386

5. Matthew Connor, "Blockchain: UltimateBeginner's Guide to Blockchain Technology- Cryptocurrency, Smart Contracts, Distributed Ledger, Fintech, and Decentralized Applications" Kindle Edition,2017, ISBN-13: 978-1986007580

e-Books:

1. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric

2. https://nptel.ac.in/content/syllabus_pdf/106104220.pdf

3. https://www.coursera.org/courses?query=blockchain&page=1

MOOC Courses:

1. https://www.coursera.org/specializations/blockchain

2. https://www.coursera.org/learn/blockchain-basics

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PEC-620C-MCA : Elective III-Business Intelligence		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Machine Learning (PEC-570A-MCA)
- Data Mining and Data Warehousing (PEC-570C-MCA)
- Data Analytics (PEC-520C-MCA)

Companion Course: NA

Course Objectives: The course aims to:

1. Introduce the concepts and architecture of Business Intelligence systems.
2. Understand data warehousing concepts and ETL processes for analytical data management.
3. Study multidimensional data models and Online Analytical Processing (OLAP).
4. Understand business metrics, KPI frameworks and temporal data analysis.
5. Apply data visualization techniques using modern BI tools for decision support..

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Explain** the concepts, architecture and applications of Business Intelligence systems.
- **CO2: Explain** data warehousing concepts, ETL processes and data preparation techniques.
- **CO3: Apply** multidimensional data modeling techniques and OLAP operations for analytical processing.
- **CO4: Analyze** business performance using metrics, KPIs and temporal data analysis.
- **CO5: Create** dashboards and visual analytical reports using modern BI visualization tools.

Course Contents

Unit I - Introduction to Business Intelligence - (09 Hours)

Introduction to Business Intelligence (BI), Evolution of BI and decision support systems ,Data-driven decision making in organizations ,Components of Business Intelligence architecture, Role of databases,

data warehouses and analytics in BI , Applications of BI in business domains such as finance, healthcare, retail and education ,Benefits and challenges of implementing BI systems. Introduction to Generative AI and Large Language Models (LLMs) in Business Intelligence.

 # Exemplar /Case Studies: 1.BI applications in retail and enterprise decision making.

2.BI-based customer segmentation and targeted marketing in e-commerce platforms.

Unit II - Data Warehousing and Data Preparation - (09 Hours)

Operational Databases vs Data Warehouses, Characteristics of Data Warehouses , Data Warehouse Architecture (three-tier architecture) , ETL Process: Extraction, Transformation and Loading , Data Cleaning Techniques.

Data Integration from heterogeneous sources, Metadata: Types and importance , Data Quality concepts and challenges , Role of AI/LLMs in data preparation, data cleaning and automated ETL processes.

#Exemplar/Case Studies: 1. Designing a simple sales data warehouse. 2. Data integration and ETL process for healthcare patient records from multiple hospitals.

Unit III - Multidimensional Data Modeling and OLAP - (09 Hours)

Multidimensional Data Models , Fact Tables and Dimension Tables , Measures and Dimensions , Star Schema ,

Snowflake Schema , Schema comparison: Star vs Snowflake.

Introduction to Online Analytical Processing (OLAP): OLAP Architecture and types of OLAP systems (ROLAP, MOLAP, HOLAP)

OLAP Cube concept, OLAP Operations: Roll-up, Drill-down, Slice Dice Pivot (Rotation)

OLAP vs OLTP systems, Applications of OLAP in business analysis

#Exemplar/Case Studies: 1. OLAP-Based Sales Analysis using Data Cubes. 2. Multidimensional analysis of banking transactions using OLAP for fraud detection.

Unit IV -Business Analytics and Temporal Data - (09 Hours)

Business Metrics and Key Performance Indicators (KPIs) , Importance of KPIs in organizational decision making , Performance measurement and analytical reporting, Introduction to Temporal Data ,Valid Time and Transaction Time , Temporal Attributes and Timestamps, Time-based Data Analysis ,Trend Analysis and Historical Data Tracking in BI systems

#Exemplar/Case Studies : 1. Time-Series and Temporal Pattern Analysis in Digital Platforms. 2. KPI-based performance analysis and trend forecasting in manufacturing industries.

Unit V - Data Visualization and BI Tools - (09 Hours)

Introduction to Data Visualization , Principles of effective data visualization , Types of charts and visual representations , Dashboard design principles , Interactive reporting and visual analytics ,Introduction to Business Intelligence tools (Power BI / Tableau) , Creating dashboards and visual reports using BI tools , Role of visualization in business decision making, AI-assisted data visualization and use of LLMs for automated dashboard generation and natural language reporting.

#Exemplar/Case Studies : 1. Creating a business dashboard using Power BI. 2. AI-assisted interactive dashboard creation for sales and business performance monitoring.

Learning Resources

Text Books:

1. W. Grossmann and S. Rind, Fundamentals of Business Intelligence, Cham, Switzerland: Springer, 2016. ISBN: 978-3-319-43860-7.

2. D. Sharda, D. Delen, and E. Turban, Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th ed. Pearson, 2018. ISBN: 978-0134633282.

Reference Books:

1. J. Han, M. Kamber, and J. Pei, Data Mining: Concepts and Techniques, 3rd ed. Burlington, MA, USA: Morgan Kaufmann, 2011. ISBN: 978-0123814791.

2. R. Kimball and M. Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, 3rd ed. Hoboken, NJ, USA: Wiley, 2013. ISBN: 978-1118530801.

3. C. Imhoff, N. Galemmo, and J. G. Geiger, Mastering Data Warehouse Design: Relational and Dimensional Techniques, Indianapolis, IN, USA: Wiley, 2003. ISBN: 978-0764532450

e-Books:

1. Arshad Khan, Business Intelligence & Data Warehousing Simplified, Mercury Learning.

2. Ralph Kimball and Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley.

3. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence, Analytics, and Data Science, Pearson.

4. Oracle Corporation, Oracle Data Warehousing Guide (online documentation).

MOOC Courses:

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_cs65

2. https://nptel.ac.in/courses/106106361

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025Pattern)		
PCC-605-MCA : Lab Practice-I		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical: 02 Hours/Week	01	**Practical** : 50 Marks

Prerequisite Courses:

- Mathematical foundation for Computer Applications(PCC-501-MCA).

Companion Course:

- Data Science (PCC-602-MCA)

Course Objectives: The course aims to:

1. Apply data analytics techniques such as data preprocessing, classification and clustering using appropriate tools to discover data patterns.
2. Understand association rule mining and data visualization techniques for effective data analysis.
3. Describe the fundamentals of software testing and the process of designing test plans and test cases.
4. Make use of manual and automated testing methods and defect tracking tools to improve software reliability and quality.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Apply** data preprocessing, classification, and clustering techniques using suitable tools to discover meaningful data patterns.
- **CO2: Analyze** datasets using association rule mining and visualization techniques to interpret patterns and relationships.
- **CO3: Determine** test plans,test cases, and manual testing techniques for software applications.
- **CO4: Evaluate** software quality by performing automated testing and managing defect tracking using appropriate tools.

List of Laboratory Experiments/Assignments

Part A - Data Science	
Sr. No.	**Practical Assignments**

1	Write a Python program to perform the following tasks: Read Data: • Read a dataset from a CSV file. • Read a dataset from a JSON file. Display Basic Information: • Display the number of records in each dataset. • Display the data types of each column. Data Preprocessing: • Handle missing values using appropriate techniques e.g., removal or imputation • Convert categorical data into numeric form using encoding techniques.
2	Implement any 2 Classification techniques using any data analytics tool.
3	Implement any 2 Clustering techniques using any data analytics tool.
4	Implement any 2 Association Rule Mining techniques using any data analytics tool.
5	Visualize all the statistical measures mean, mode, median, range, inter quartile range, etc. using Histograms, Boxplots, scatter plots, etc.
Part B - Software Testing and Quality Assurance	
6	Prepare a Test Plan for an identified Mobile Application, including scope, objectives, testing strategy, resources, and schedule.
7	Design Test Cases for any E-Commerce website covering major functionalities such as user registration, login, product search, add to cart, and checkout process.
8	Manual Testing 1. Write Black Box Test Cases for an application using the Test Director tool. 2. Perform White Box Testing by calculating Cyclomatic Complexity and applying Data Flow Testing and Control Flow Testing techniques.
9	Automated Testing Perform Black Box Testing using an automated testing tool on an application. Testing points should include: • Data-Driven Testing • Parameterization • Exception Handling

10	Defect Tracking 1. Log the test results using Test Director. 2. Prepare a Defect Tracking / Bug Report using MS-Excel or a defect tracking tool such as BugZilla and Selenium.

Mini Project Topic (Any one project/ concept)

1. Student Performance Analysis : Develop a mini project to analyze student marks using basic data science techniques. Use a dataset containing marks of students in five subjects. Calculate total marks, percentage, and assign grades. Perform analysis such as class average, highest and lowest scorer, and number of students in each grade category. Display the results using simple tables or charts to understand basic data analysis and visualization.

2. Sales Data Analysis and Prediction : Create a mini project to analyze monthly sales data of a shop. The dataset should include month, product, quantity sold, and revenue. Perform data cleaning, generate a monthly sales summary, and identify the best-selling product. Display sales trends using simple charts. Predict next month's sales using basic average or trend analysis.

3. Testing of Online Student Registration System:Design a testing project for an Online Student Registration System. Create test cases for modules such as login, registration form validation, password rules, and email validation. Perform functional testing, boundary value testing, and negative testing. Prepare documents including test cases, execution reports, and bug reports. This helps in understanding software testing processes and defect reporting.

4. Software Quality Testing for Online Shopping Cart:Test an Online Shopping Cart application to ensure software quality. Identify modules such as product search, add to cart, remove item, and checkout process. Prepare a test plan, test cases, and test scenarios for these modules. Perform functional testing, usability testing, and basic performance testing. This project helps students learn software quality assurance and testing strategies.

Learning Resources

Text Books:

1. Jiawei Han, Micheline Kamber, "Data mining: concepts and techniques", Morgan Kaufmann Publisher, second edition,ISBN 13: 978-1-55860-901-3.

2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1,Cambridge University Press, ISBN-13: 978-1107077232

3. Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley,ISBN 0201 70945 7

Reference Books:

1. Bharti Motwani, “Data Analytics with R”, Wiley 2019 ISBN: 978-81-265-7646-3

2. Tom Mitchell, Machine Learning. McGraw-Hill, 1997, ISBN-13: 978-0070428072

3. Software Testing and Quality Assurance – Theory and Practice, Kshirasagar Naik, Priyadashi Tripathy,Wiley India, 2010,ISBN 978-0-471-78911-6

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025Pattern)		
PCC-606-MCA : Web Technology Laboratory		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical: 02 Hours/Week	01	**Term Work** : 25 Marks **Oral** : 25 Marks

Prerequisite Courses:

- Operating System and Network Fundamentals (PCC-551-MCA)
- Web technology (PCC-603-MCA).

Companion Course: NA

Course Objectives: The course aims to:

1. Create the web page design.
2. Develop interactive web pages using JavaScript and client-side scripting techniques..
3. Make use of server-side programming.
4. Establish database connectivity using MySQL for dynamic web applications. .
5. Gain hands-on experience in integrating frontend and backend technologies

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Design** the static web pages using client-side scripting..
- **CO2:** Create the server-side applications using PHP with Object-Oriented Programming concepts.
- **CO3:** Build dynamic web applications using ASP.NET.
- **CO4:** Create Single Page Applications (SPA) using AngularJS.
- **CO5:**Develop mini project with CRUD operations in full-stack application in real-world problems.

List of Laboratory Experiments (Any 6 to 8 laboratory experiments)

Sr. No.	Practical Assignments

1	Design a static web page for a College Information Portal using HTML and CSS that includes: 1. Proper HTML5 document structure 2. Use of: • Headings • Paragraphs and line breaks • Lists -ordered & unordered • Hyperlinks -internal/external • Images -college campus or logo • Tables -courses, departments, faculty details • Frames or iframe -optional section like map/video • Forms: Student registration form,Fields: Name, Email, Gender, Course, Submit button Apply CSS using: • Inline, Internal, and External CSS • CSS Selectors • Styling features
2	Create an XML document for a Library Management System and validate it using DTD/Schema and transform the XML data into an HTML page using XSLT.
3	Develop an interactive Student Information Web Page using JavaScript to perform validation, calculations, and event handling. • Add Embedded-internal and external JavaScript • Implement: Variables and data types, Operators • Use Control Structures and loops • Create Functions & Dialog Boxes • Implement events.
4	Design a responsive Online Food Ordering Web Page using Bootstrap and JavaScript.
5	Create a dynamic web application using PHP demonstrating variables, operators, form handling, arrays, string functions, cookies, and sessions.

6	Build the dynamic web application using PHP OOP concepts with efficient database connectivity -MySQL, and implement it using the CodeIgniter framework.
7	Create a Student Registration Form using ASP.NET. Create a form with different fields. Apply appropriate validation controls whenever required.
8	Construct a Login Module using ASP.NET. Create a Login page with Username, Password.
9	Develop a web application using AngularJS demonstrating expressions, directives, modules, controllers, and form validation with two-way data binding.
10	Implement AngularJS MVC architecture and understand the basic concepts and features of Next.js framework.

Mini Project Topic (Any one project/ concept)

1. Online Examination System
2. Feedback Management System
3. Expense Tracker with Graphs
4. Doctor Appointment System.

Learning Resources

Text Books:

1. H. Schildt, The Complete Reference HTML, 4th ed. New Delhi, India: Tata McGraw-Hill, 2002, ISBN-13: 978-0070584440
2. A. Godbole, Web Technologies, 2nd ed. New Delhi, India: Tata McGraw-Hill, 2005, ISBN-13: 978-0070472983

E-Books Links

1. W3Schools, "W3Schools Online Web Tutorials." Link: https://www.w3schools.com.
2. TutorialsPoint, "AngularJS Tutorial." Link: https://www.tutorialspoint.com/angularjs/index.htm.
3. TutorialsPoint, "JavaScript Tutorial." Link: https://www.tutorialspoint.com/javascript/index.htm.
4. Bootstrap, "Bootstrap Official Website." Link: https://getbootstrap.com/.

MOOC Courses:

1. www.w3schools.com
2. https://www.tutorialspoint.com/angularjs/index.htm
3. https://www.tutorialspoint.com/javascript/index.htm
4. https://www.programiz.com/javascript/examples

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025Pattern)		
PCC-607-MCA : Cyber Security Laboratory		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical: 02 Hours/Week	01	**Term Work** : 25 Marks

Prerequisite Courses:

- Operating System and Network Fundamentals (MJC-506-MCA)

Companion Course:

- Cyber Security (PCC-604-MCA)

Course Objectives: The course aims to:

1. Explain and demonstrate the placement and working of packet sniffers in networking and internetworking environments.
2. Design and implement basic cyber-attacks in a controlled environment to understand their behavior and impact.
3. Develop and analyze email spam detection techniques for enhancing network security.
4. Evaluate cyber security mechanisms by integrating packet analysis, attack techniques, and defense strategies.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1:** Apply packet sniffing techniques using tools like Wireshark to capture and analyze network traffic.
- **CO2:** Analyze various cyber-attacks such as DoS, DDoS, IP spoofing, DNS attacks, and SQL injection.
- **CO3:** Develop and evaluate email spam filtering techniques for enhancing network security.
- **CO4:** Evaluate network security solutions by integrating packet analysis, attack simulation, and vulnerability mitigation techniques.

List of Laboratory Experiments/Assignments based on theory

Sr. No.	Practical Assignments
1	Install and explore Wireshark (V4.6.4) for packet Sniffing and traffic analysis.
2	Write a program to sniff packet sent over the local network and analyze it.
3	Create an attack using python script and implement attack and analyze the effect of DOS and DDOS Attack.

4	Create an attack using python script and implement attack and analyze the effect of IP spoofing.
5	Create an attack using python script and implement attack and analyze the effect of DNS.
6	Write a program in python script for Spam Mail Detection.
7	To understand and demonstrate SQL Injection vulnerability using DVWA on a local system.

Learning Resources

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA. ISBN 978-81-265-2179-1.
2. Practical Cyber Forensics an Incident-Based Approach to Forensic Investigations, Niranjan Reddy, A press, ISBN-13: 978-1-4842-4459-3.
3. Practical Digital forensics – Richard Boddington, PACKT Publishing ISBN 978-1-78588-710-9.

Reference Books:

1. William Stallings, Computer Security: Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13- 335469-0.
2. Bernard Menezes, Network Security and Cryptography, Cengage Learning, ISBN-978-81- 315-1349- 1.
3. Dr. V.K. Pachghare, Cryptography & Information security, PHI, Second edition, ISBN- 978- 81-203-5082-3.

E-Books Links

1. https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf
2. Introduction to Cyber Security:https://uou.ac.in/sites/default/files/slm/FCS.pdf

MOOC Courses:

1.https://swayam.gov.in/nd2_cec20_cs15/preview
2. Internet Crimes and Cyber Security - Course
3. Preview: Introduction to Cyber Security | SWAYAM
4. https://onlinecourses.nptel.ac.in/noc20_cs07/preview

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PCC-608-MCA : Corporate Communication and Aptitude Skills Development		
Teaching /scheme	**Credits**	**Examination Scheme**
Tutorial: 1 Hours/Week	01	**Term work:** 25 Marks

Prerequisite Courses: Basic Reasoning skills.

Companion Course: NA

Course Objectives: The course aims to:

1. To develop effective corporate communication skills among students.
2. To enhance written, oral, and presentation skills for professional environments.
3. To prepare students for campus recruitment through aptitude and interview training.
4. To integrate communication, presentation, and analytical skills for overall professional development.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Demonstrate** effective communication techniques in professional and corporate environments.
- **CO2: Develop** professional documents such as resumes, emails, and application letters using appropriate business communication standards.
- **CO3: Analyze** quantitative aptitude and logical reasoning problems related to placement tests and demonstrate appropriate interview skills.
- **CO4: Apply** communication, presentation, and aptitude skills to perform effectively in campus recruitment processes.

Course Contents

Unit I - Corporate Communication Skills - (05 Hours)

Introduction: Corporate Communication. Communication Process and Importance in Organizations. Types of Communication: Verbal, Non-verbal, Written. Barriers to Communication and Methods to Overcome Them. Professional Etiquette: Workplace etiquette, Email etiquette, Digital communication. Listening and Interpersonal Communication Skills.

Class Activity : Role Play Activity, Email Writing Practice, Barrier Identification Exercise

Unit II - Professional Writing and Presentation Skills - (05 Hours)

Business Writing: Business letters, Email writing, Memo and notices. Career Communication: Resume and CV writing, Application letter preparation, LinkedIn profile development. Presentation Skills: Structure of presentation, Visual aids using PowerPoint and Canva. Body language and voice modulation. Group Discussion Techniques.

Class Activity : Building Resume and Application Letter, Conduct of Group Presentations, Development of LinkedIn Profile

Unit III - Aptitude and Interview Skills for Placements - (05 Hours)

Quantitative Aptitude: Percentages, Ratio and proportion, Profit and loss, Averages. Logical Reasoning: Number series, Coding-decoding, Pattern recognition. Interview Preparation: Self-introduction, HR interview questions, Mock interviews.

Class Activity : Daily Aptitude Quiz, Mock Interview Sessions, Self-Intro Drill, Puzzle of the Week

Learning Resources:

Text Books:

1. Meenakshi Raman & Prakash Singh – Business Communication, Oxford University Press, ISBN-13: 978-0195676952
2. Barun K. Mitra – Personality Development and Soft Skills, Oxford University Press, ISBN-13: 978-0198066217

Reference Books:

1. Bovee, Thill & Chatterjee – Business Communication Today, Pearson Education., ISBN-13: 978-8131757994
2. R.S. Aggarwal – Quantitative Aptitude, S. Chand Publications, ISBN-13: 978-9358705010
3. Arun Sharma – A Modern Approach to Logical Reasoning, McGraw Hill, ISBN-13: 978-9360341114

MOOC / NPTEL/YouTube Links:

1. https://nptel.ac.in/courses/109106094
2. https://www.youtube.com/@Indiabix

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025Pattern)		
RPR-631-MCA : Research Project		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical: 06 Hours/Week	03	**Term Work** : 50 Marks **Oral** : 50 Marks

Prerequisite Courses:

- Research Methodology (RM-530-MCA)

Companion Course: NA

Course Objectives: The course aims to:

1. Develop research methodology Skills
2. Enhance Critical Thinking and Analytical Abilities.
3. Improve technical writing and communication, team work, Leadership Qualities.
4. Apply the knowledge for solving realistic problems and justify the use of methods.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Identify** and articulate a relevant research problem in the domain of computer application.
- **CO2:Analyze** and summarize literature to discover research gaps and formulate research questions.
- **CO3: Design** a feasible research methodology with clearly defined objectives and scope
- **CO4: Prepare** a structured research proposal and effectively present the proposed work.

Introduction

The Research Project can be application oriented or focused on innovative work in emerging technologies such as IoT, Cloud Computing, Web Technologies, Artificial Intelligence, Machine Learning, Natural Language Processing, and Theoretical Computer Science fundamentals. In Research Project, students will engage in a project that involves analyzing and designing a system or subsystem in the chosen area of Computer Science and Engineering. This project will ideally be carried out by a group of 3 to 4 students. The group will collaboratively work on and implement the project. The project topic can be selected based on the students' interest , or it can be suggested by a faculty guide, aligning with recent technological trends or industrial applications.

Guidelines for Student

Students are required to choose a topic that is both industry-relevant and aligned with current trends in research. A detailed project proposal, including the title, objectives, methodology, and expected outcomes, must be submitted. Additionally, a comprehensive literature review of relevant sources

is necessary to define the problem scope. Students must provide regular progress updates, which should be documented and reviewed by their faculty guide. Adherence to standard formatting is essential, and plagiarism must be kept below 15%. At the conclusion of the course, students will present their project to a review panel, showcasing their understanding of the topic, problem-solving abilities and communication skills.

Guidelines for Faculty

- Each faculty member will be assigned a specific number of students for project guidance based on departmental norms.
- Faculty should assist students in selecting relevant and research-worthy topics, preferably aligned with current trends or societal needs.
- Guides should ensure the project scope is feasible within the academic timeline and resources available.
- Conduct regular mentoring sessions (weekly or bi-weekly) and maintain a record of meetings and progress.
- Guide students in conducting literature reviews, identifying research gaps, and refining objectives.
- Ensure that students follow a structured research process, including proper documentation and adherence to ethical research standards.
- Monitor student attendance, engagement, and submission of intermediate deliverables like synopsis, progress reports, etc.

Evaluation for submissions based on

- Relevance and clarity of the problem statement.
- Depth of literature review.
- Appropriateness of the methodology.
- Originality and research ethics.
- Guide students in preparing the final report & publish one research paper in reputed Journal / Conferences and ensure proper formatting and citation practices.
- Submit assessment records and remarks to the project coordinator or HOD as per academic calendar deadlines.

Review 1 Synopsis

Synopsis Points to be covered:

The precise problem statement/title based on literature survey and feasibility study.

1. Aim, objectives, and scope of the project.

2. List of required hardware, software, or other equipment for executing the project, test. Environment/tools, cost and software measurement/human efforts in hours.
3. System overview- proposed system and expected outcomes.
4. Architecture and initial phase of design.

Review 2: Requirement and Design Specification Points to be covered

Points to be covered:

1. User and System Requirements.
2. Requirement Analysis / Models.
3. UML/ER Diagrams.
4. Detail architecture / System design/ Algorithms with analysis / Methods / Techniques.
5. Need to discuss Design models and Component level designs.
6. Detailed Design (DFD levels as per the problem statement).
7. At least 30-40% coding documentation with at least 3 to 4 working modules.
8. Test Cases.
9. Final Project Report (Documentation includes-Scope, Diagrams, DB Schema, Screens, Output).
10. User Manual

Evaluation Criteria

Following criteria and weightage is suggested for evaluation of Research Project Oral

1. Originality of Problem Statement: 10% (05 Marks).
2. Depth of Understanding the Problem Statement: 10% (05 Marks).
3. Concrete Literature Survey with identified gaps in all referred papers: 10% (05 Marks).
4. Design and Analysis of Algorithm / Model / Architecture / System: 40% (20 Marks).
5. Representation of results using suitable tools like tabulation, graph etc: 10% (05 Marks).
6. Presentation Skill: 10% (05 Marks).
7. Report preparation and Paper publication: 10% (05 Marks).

Project report contains the details as follows

Project report must have:

Certificate from the institute
Certificate sponsoring organization (If any)
Acknowledgement

Abstract
Contents
List of Abbreviations (As applicable)
List of Figures (As applicable)
List of Graphs (As applicable)
List of Tables (As applicable)

1. Introduction and aims/motivation and objectives.
2. Literature Survey (with proper citation).
3. Problem Statement/definition.
4. Software Requirement Specification (In SRS Documentation only).
5. Flowchart
6. Project Requirement specification.
7. Proposed system Architecture.
8. High level design of the project (DFD, UML, ER Diagrams).
9. System implementation-code documentation: Algorithm style, Description of detailed methodologies, protocols used etc.as applicable.
10. Test cases.
11. Proposed GUI/Working modules/Experimental Results (Module wise if available) in suitable format.
12. Project Plan.
13. Conclusions.
14. Bibliography in IEEE format.

Appendices

A.Plagiarism Report of Paper and Project report from any open-source tool.
B.Base Paper(s) [If any].
C.Tools used / Hardware Components specifications [If any]
D.Published Papers and Certificates. Use appropriate plagiarism tools, reference managers, Latex for efficient and effective project writing

Learning Resources

1. James Rumbaugh, Ivar Jacobson, Grady Booch “The Unified Modeling Language Reference Manual”, ISBN13: 978-0321718952.
2. Sommerville, “Software Engineering”, 10th ed. Boston, MA, USA: Pearson, 2015. ISBN: 978-0133943030.

3. P. C. Jorgensen, “Software Testing: A Craftsman’s Approach”, 4th ed. Boca Raton, FL: CRC Press, 2013. ISBN: 978-1466560680.

4. C. R. Kothari and G. Garg, “Research Methodology: Methods and Techniques”, 4th ed. New Delhi, India: New Age International Publishers, 2019. ISBN: 978-9386649225

Savitribai Phule Pune University, Pune

Maharashtra, India

Master of Computer Applications (Under Engineering) (2025 Pattern)

Semester IV

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PEC-670A-MCA : Generative AI & Prompt Engineering		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Mathematical foundation for Computer Applications (PCC-501-MCA)
- Data science (PCC-602-MCA)

Companion Course:

- Artificial Intelligence (PEC-520A-MCA)
- Machine Learning (PEC-570A-MCA)

Course Objectives: The course aims to:

1. Learn the basic concepts and evolution of Generative AI.
2. Understand the working principles of generative models and LLMs.
3. Understand the concept and importance of prompt engineering.
4. Apply advanced prompt engineering strategies to complex tasks.
5. Explore real-world applications of generative AI across industries.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Explain** the fundamental concepts and evolution of Generative AI systems.
- **CO2: Analyze** the working principles of generative models and large language models (LLMs).
- **CO3: Apply** prompt engineering techniques to generate relevant and meaningful outputs.
- **CO4: Design** and optimize advanced prompts for solving complex tasks for text generation, summarization, and code generation.
- **CO5: Assess** real-world uses of Generative AI, their ethical and practical implications across industries

Course Contents

Unit I - Fundamentals of Generative Artificial Intelligence - (09 Hours)

Introduction to Generative AI: Evolution of Generative AI, Generative vs. Discriminative Models; Text generation, Image generation, Audio and video generation; Applications of Generative AI: Content generation, Chatbots and virtual assistants, Code generation; Advantages and Limitations of Generative AI: Benefits, Challenges and risks.

 # Exemplar /Case Studies:AI-based Content Generation in Digital Marketing. Tools – Dall-e, Sora

Unit II - Generative Models and Large Language Models - (09 Hours)

Generative Models: Autoencoders and Variational Autoencoders (VAE) , Generative Adversarial Networks (GAN); Tokenization, Word embedding, Context and sequence representation; Transformer: Architecture Encoder- decoder , Attention mechanism; Large Language Models: Next word prediction concept, Pre-trained and fine tuning, Prompting vs fine tuning; LLM Strengths -generation, reasoning patterns, Limitations-hallucination, bias, context limits.

#Exemplar/Case Studies: AI-based Code Generation Assistant. Tools – Github Co-pilot, Amazon CodeWhisperer

Unit III - Fundamentals of Prompt Engineering - (09 Hours)

Introduction to Prompt Engineering, Need and importance, Components of a Prompt; Prompt Design Principles: Clarity and specificity, Context inclusion, Zero-shot prompting, One-shot prompting, Few-shot prompting; Prompt Evaluation: Response quality, Output relevance.

#Exemplar/Case Studies: AI-Based Document Question Answering System. Tools - Notion AI

Unit IV -Advanced Prompt Engineering Techniques - (09 Hours)

Chain-of-thought prompting, Role-based prompting; Prompt Applications : Text summarization, Question answering, Code generation, Content creation; Challenges in Prompt Engineering: Ambiguous prompts , Output inconsistency; Prompt Testing and Evaluation; Output quality assessment: Relevance, Accuracy, Completeness, Comparing multiple prompts; Prompt Optimization :Iterative prompt refinement Output control (tone, format, constraints)

#Exemplar/Case Studies : AI-Based Image Generation for Graphic Design. Tools – Canva, Midjourney.

Unit V - Generative AI Applications, Ethics and Future Trends - (09 Hours)

Generative AI Tools, Applications of Generative AI: Education, Healthcare, Business and Marketing, and Software development; Ethical Issues in Generative AI, Bias and fairness, Deepfakes and misinformation; Responsible AI Practices, Ethical guidelines, Data privacy considerations, Future Trends in Generative AI Emerging technologies, Impact on industries.

#Exemplar/Case Studies : AI-Powered Resume and Cover Letter Generator. Tools - Gemini.

Learning Resources

Text Books:

1. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play– David Foster, O'Reilly Media, 2nd Edition, 2023, ISBN-13: 978-1098134181

2. Hands-On Generative AI with Transformers– Utkarsh Sinha, Packt Publishing, 2023, ISBN-13: 978-1784399757

Reference Books:

1. Deep Learning for Natural Language Processing– Palash Goyal, Sumit Pandey, Karan Jain, Apress, 2018, ISBN-13: 978-1484236840
2. GANs in Action: Deep Learning with Generative Adversarial Networks– Jakub Langr, Vladimir Bok, Manning Publications, 2019, ISBN-13: 978-1617295560
3. Building Machine Learning Powered Applications– Emmanuel Ameisen, O'Reilly Media, 2020, ISBN-13: 978-1492045113
4. Transformers for Natural Language Processing– Denis Rothman, Packt Publishing, 2022, ISBN-13: 978-1803247335

MOOC Courses:

1. onlinecourses.swayam2.ac.in/nou25_ma05/preview- Generative AI for Everyday Life
2. onlinecourses.swayam2.ac.in/imb25_mg46/preview- Generative AI and Large Language Models
3. www.coursera.org/learn/prompt-engineering?utm_source=chatgpt.com- Prompt Engineering for ChatGPT
4. www.youtube.com/watch?v=-v9PiM6cqLM- Generative AI Full Course 2025

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PEC-670B-MCA : Dev Ops		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Operating System and Network Fundamentals (PCC-551-MCA)

Companion Course:

- Cloud Computing (PCC-651-MCA)

Course Objectives:

1. To understand DevOps concepts, lifecycle, and culture.
2. To demonstrate version control using Git for collaboration.
3. To analyze configuration management using tools like Chef.
4. To implement containerization and deployment using Docker.
5. To evaluate build automation using Maven and understand the DevOps toolchain.

Course Outcomes: On completion of the course, students will be able to:

- **CO1: Make** use of DevOps concepts, lifecycle, culture, and roles.
- **CO2: Apply** Git for version control and collaboration.
- **CO3: Apply** configuration management tools.
- **CO4: Demonstrate** containerization using Docker.
- **CO5: Utilize** build tools like Maven and DevOps toolchain integration.

Course Contents

Unit I - Introduction to DevOps and Linux Fundamentals - (09 Hours)

Definition of DevOps, What is DevOps, History of DevOps, DevOps Goals and Stakeholders, DevOps Perspective and Terminology, DevOps and Agile, SDLC models, Lean, ITIL, Continuous Integration

and Continuous Deployment, Configuration Management overview, Linux OS introduction, Importance of Linux in DevOps, Linux basic commands, Environment variables, Networking basics, Linux administration, Linux server installation, RPM and YUM installation.

 # Exemplar /Case Studies: Study of DevOps adoption examples in organizations.

Unit II - Version Control System – Git - (09 Hours)

Introduction to Git, Version control systems and types, CVCS vs DVCS, History of Git, Git installation on Linux and Windows, Initial setup, Git command line basics, Creating repositories, cloning, committing, Fetch, pull, remote repositories, Branching, merging, switching branches, Conflict resolution, stashing and rollback techniques.

#Exemplar/Case Studies: Study of Managing project source code using GitHub.

Unit III - Configuration Management using Chef - (09 Hours)

Overview of Chef, Chef architecture (Server, Workstation, Client, Repository), Chef configuration concepts, workstation setup and knife configuration, Organization setup and node management, Node objects and run lists, Environments and roles, Attributes and custom attributes, Data bags creation and management.

#Exemplar/Case Studies: Automating infrastructure configuration using Chef cookbooks.

Unit IV - Containerization using Docker - (09 Hours)

Introduction to Docker, use cases of Docker, Docker vs virtualization, Docker architecture and components, Docker installation on Linux and Windows, Docker commands and provisioning, Docker Hub and container registries, Running containers and multiple containers, Creating and publishing custom images, Docker networking and container routing.

#Exemplar/Case Studies: Deploying a multi-container application using Docker.

Unit V - Build Automation using Maven and DevOps Toolchain - (09 Hours)

Introduction to Maven, Maven installation, Build requirements, Maven POM (pom.xml), Maven build lifecycle, Local and global repositories, Group ID, Artifact ID and snapshots, Maven dependencies and plugins, Overview of DevOps tools: Jenkins, Kubernetes, Ansible, Selenium, Prometheus monitoring, Jira bug tracking, ELK stack logging.

#Exemplar/Case Studies : DevOps implementations in organizations like Spotify and Etsy.

Learning Resources

Text Books:

1. PierluigiRiti, “Pro DevOps with Google Cloud Platform”, Apress, ISBN: 978-1-4842-3896-7.
2. DevOps: A Software Architect’s Perspective ISBN: 978-0133942927
3. Jez Humble and David Farley,“Continuous Delivery”, Pearson Education, ISBN:978–0–321–60191–9

Reference Books:

1. Michael Hüttermann – DevOps for Developers ISBN: 978-1430245698
2. Ingo M. Weber, Len Bass – DevOps: A Software Architect’s Perspective ISBN: 978-0133942927

3. Jennifer Davis, Katherine Daniels – Building a DevOps Culture ISBN: 978-1491926307
4. Joakim Veronal – Practical DevOps ISBN: 978-1788397902
5. Gene Kim – DevOps for Dummies ISBN: 978-1119552222

e-Books:

1. https://www.edureka.co/blog/ebook/devops-ebook?utm_source=chatgpt.com
2. https://www.dbooks.org/devops-wtf-1447/?utm_source=chatgpt.com

MOOC Courses:

1. https://onlinecourses.nptel.ac.in/?utm_source=chatgpt.com
2. https://www.swayam.gov.in/nc_details/NPTEL
3. https://archive.nptel.ac.in/courses/128/106/128106012/
4. https://www.youtube.com/c/nptelhrd

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025 Pattern)		
PEC-670C-MCA : Cloud Computing		
Teaching /scheme	**Credits**	**Examination Scheme**
Theory : 03Hours/Week	03	**CCE** : 50 Marks **End-Semester**: 50 Marks
Comprehensive Continuous Evaluation	**Unit Test (UT)**- 20 Marks **Assignments / Case Study** - 20 Marks **Seminar Presentation / Open Book Test/ Quiz** -10 Marks	

Prerequisite Courses:

- Operating System and Network Fundamentals (PCC-551-MCA)

Companion Course:

- Dev Ops (PEC-670B-MCA)

Course Objectives:

1. To understand the fundamental Principles and Evolution of cloud computing systems.
2. To learn different cloud service models and deployment strategies used in industry.
3. To study modern cloud technologies including virtualization, containerization, and micro services.
4. To explore DevOps practices, automation, and infrastructure management in cloud environments.
5. To study emerging technologies such as serverless computing, edge computing, and AI integration in cloud platforms.

Course Outcomes: Upon successful completion of this course, students will be able to:

- **CO1: Explain** the fundamental concepts, evolution, architecture, and key characteristics of cloud computing systems.
- **CO2: Analyze** different cloud service models and deployment models used in modern IT infrastructure.
- **CO3: Apply** virtualization and containerization technologies, including hypervisors and container tools in cloud environments.
- **CO4: Evaluate** cloud platforms, networking concepts and resource provisioning techniques for efficient cloud deployment.
- **CO5: Analyze** emerging cloud technologies such as serverless computing, microservices architecture, and cloud-native applications.

Course Contents

Unit I - Introduction to Cloud Computing - (09 Hours)

Overview of Cloud Computing: Evolution of Cloud Computing, Distributed Computing vs. Cloud Computing, Characteristics of Cloud Computing i.e Elasticity, Scalability, On-demand resources, multi-tenancy.

Cloud Ecosystem: Cloud service providers, cloud consumers, cloud brokers, cloud auditors.

Cloud Deployment Models: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud.

 # Exemplar /Case Studies: Netflix Cloud Migration- Understand scalability and reliability advantages of cloud computing.

Unit II - Cloud Architecture and Service Models - (09 Hours)

Cloud Architecture: Layered architecture of cloud computing, front-end and back-end architecture, resource abstraction and control layer.

Cloud Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service.

Advanced Service Models: Function as a Service, Backend as a Service.

#Exemplar/Case Studies: Google Workspace-Understand real-world implementation of SaaS model.

Unit III -Virtualization and Containerization - (09 Hours)

Virtualization Concepts: Role of virtualization in cloud computing.

Types of Virtualization: Server virtualization, storage virtualization, network virtualization.
analysis, Equivalence Partitioning, State based or Graph-based Testing, Compatibility Testing, User.

Hypervisors: Type 1 and Type 2 hypervisors, examples such as VMware, KVM, and Xen.

Containerization Technology: Concepts of containers, container architecture.

DockerFundamentals: Docker images, containers, container lifecycle, container networking.

#Exemplar/Case Studies: Data Center Virtualization- Understand how virtualization optimizes hardware resources.

Unit IV -Cloud Platforms and Deployment Models - (09 Hours)

Overview of Major Cloud Platforms: Amazon Web Services, Microsoft Azure, Google Cloud Platform.

Cloud Infrastructure Services: Compute services, storage services, database services.

Cloud Networking: Virtual Private Cloud, subnets, routing, load balancing.

DevOps in Cloud: Continuous Integration and Continuous Deployment, DevOps pipeline in cloud environments.

#Exemplar/Case Studies: A Case Study Secure Enterprise Network using VPC.

Unit V - Emerging Trends in Cloud Computing - (09 Hours)

Serverless Computing: Concepts of Function as a Service, event-driven computing models.

Micro services Architecture: Design principles, service discovery, API gateways.Cloud-native applications and cloud-native architecture.

Future directions in cloud computing: Quantum cloud computing, green cloud computing, autonomous cloud infrastructure.

#Exemplar/Case Studies: A Case Study Image Processing System using Serverless Architecture.

Learning Resources

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski – Cloud Computing: Principles and Paradigms, Wiley ISBN-13:978-0470887998 .
2. Thomas Erl, Ricardo Puttini, Zaigham Mahmood – Cloud Computing: Concepts, Technology & Architecture, Pearson ISBN-13: 978-0133387568.
3. Rajkumar Buyya -Mastering Cloud Computing (2nd Edition – Latest), Elsevier, ISBN: 978-0443404351.

Reference Books:

1. Kai Hwang, Geoffrey Fox, Jack Dongarra – Distributed and Cloud Computing, Morgan Kaufmann, ISBN-13: 978-0123858801
2. Justin Garrison, Kris Nova - Cloud Native DevOps with Kubernetes, O'Reilly, ISBN-13: 978-1492040767.
3. Michael J. Kavis, Architecting the Cloud, Wiley, ISBN-13: 978-0470507971
4. Rajkumar Buyya et al., Mastering Cloud Computing, Elsevier, ISBN: 978-0124114548.

e-Books:

1. http://www.freebookcentre.net/Networking/Cloud-Computing-Books.html

MOOC Courses:

1. NPTEL course on " Cloud Computing " byBy Prof. Soumya Kanti Ghosh , IIT Kharagpur https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://www.udemy.com/course/introduction-to-cloud-computing/

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025Pattern)		
SEM-680-MCA : Technical Seminar		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical: 04 Hours/Week	2	**Oral/Presentation** : 50 Marks

Prerequisite Courses: NA

Companion Course: Major Project /Field Project (OJT-681-MCA)

Course Objectives:

1. To encourage critical thinking.
2. To discover research gaps with the help of literature surveys.
3. To build technical and professional skills by presenting technical content.
4. To develop report writing skills.

Course Outcomes:

- **CO1: Compare** recent topics with emerging trends in computer science and technology.
- **CO2: Evaluate** different methodologies, tools, and frameworks related to the topic.
- **CO3: Propose** future scope for the topic.
- **CO4: Deliver** effective technical presentations using appropriate tools and visual aids.
- **CO5: Develop** a well-structured seminar report.

Guidelines

- Each student will make a presentation on any topic in the area of his Field Project/Major Project preferably keeping track with recent technological trends and development.
- The topic must be selected in consultation with the institute guide. Each student will make the seminar presentation in the term making use of audio/video aids for the duration of 20-25 minutes and submit two copies of the seminar report in a prescribed format provided by the host institution duly signed by the guide and the head of the department /Institution. Plagiarism Check can be done for Seminar reports
- Attendance for all seminars for all students is compulsory. Staff members of the institute will assess the seminars internally and also can consider given evaluation criteria.
- Research articles could be referred from IEEE, ACM, Science direct, Springer, Elsevier, IETE,CSI or from freely available digital libraries like Digital Library of India (dli.ernet.in), National Science Digital Library, Research Gate, worldwidescience.org etc.

Recommended Format of the Seminar Report

- Title page with title of the topic, Name of the candidate with Exam Seat Number / Roll Number, Name of the Guide, Name of the Department, Institution and University & Year.
- Seminar Approval Sheet/Certificate
- Abstract (150 to 250 words) and Keywords (maximum 8 words)
- Acknowledgements
- Table of Contents, List of Figures, List of Tables and Nomenclature.
- Chapters Covering topic of discussion- Introduction with section including organization of the report, Literature Survey/Details of design/technology/Analytical and/or experimental work, if any, Discussions and Conclusions.
- Bibliography/References
- Plagiarism Check report.

Key focus areas and suggestion for the Assessment

Sr. No	Evaluation Criteria	Description	Marks
1	Topic Selection & Relevance	Selection of recent, relevant and meaningful topic in Computer Science / IT aligned with the major project	5
2	Content Quality	Depth of research, clarity of concepts, accuracy of information	5
3	Technical Understanding	Understanding of technical concepts, framework, ability to explain methodology/technology in technical terms	10
4	Presentation Skills	Confidence, clarity of speech, communication skills, body language	10
5	Use of Visual Aids	Quality of PPT slides, diagrams, charts, readability	5
6	Organization & Structure	Logical flow: introduction, literature review, methodology, conclusion	5
7	Time Management	Completion within allotted time	2
8	Question Handling	Ability to answer questions and interact with audience	5
9	Plagiarism check	Duplication check.	3
		Total	50

Learning Resources

Reference Books:

1. Sharon J. Gerson, Steven M. Gerson, Technical Writing: Process and Product, Pearson Education Asia, ISBN :130981745, 4th Edition
2. Andrea J. Ruther foord, Basic Communication Skills for Technology, Pearson Education Asia, 2nd Edition, ISBN-13: 978-8177584073

MOOC Courses:

1. https://www.udemy.com/course/being-an-effective-presenter/
2. https://www.coursera.org/learn/present-with-purpose.
3. https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minute

For effective Presentation and Documentation.

1. https://www.canva.in/
2. https://www.overleaf.com/

Savitribai Phule Pune University Second Year of MCA (Under Engineering) (2025Pattern)		
OJT-681-MCA : Field Project/Major Project		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical: 28 Hours/Week	14	**Term Work** : 200 Marks **Oral :** 150 Marks

Prerequisite Courses:

- Research Methodology (RM-530-MCA)

Companion Course: NA

Course Objectives:

1. Apply knowledge to develop a project, framework.
2. Enhance Research and analytical abilities.
3. Understand real world context.
4. Build Professional Competence.
5. Strengthen Reporting and Documentation Skills.

Course Outcomes: On completion of the course, students will be able to:

- **CO1:** Apply knowledge of programming, databases, and modern technologies to build efficient solutions.
- **CO2:** Develop software or system solution using suitable tools, technologies, and methodologies.
- **CO3:** Analyze project management practices including planning, scheduling, and documentation.
- **CO4:** Evaluate and test the developed system to ensure quality, performance, reliability, and security.
- **CO5:** Justify project outcomes effectively through reports, presentations, and demonstrations.

Introduction

- A field project/Major Project is a vital component of experiential learning, allowing students to bridge the gap between theoretical knowledge and real-world application. It provides an opportunity to observe, analyze, and understand practical situations within a specific environment or community.
- The purpose of this field project/Major Project is to gain detail experience and develop a deeper understanding of the chosen subject area. Through direct interaction, observation, and data collection, the study aims to explore key aspects of the topic, identify challenges, and evaluate existing practices.

- This project also focuses on enhancing critical thinking, problem-solving abilities, and research skills as per latest technologies in market.

Guidelines for Field Project/Major Project

- Field project/Major project shall be carried out individually by the students.
- In this student are encouraged to undergo industrial Internship for a minimum duration of 3 Months.
- In a Major Project with Research project, the student shall work on a real life Research Problem.
- Students shall apply Software Development Life Cycle to projects for Industry Internship/Research Project draw design diagrams using tools, implement the system and test it before deployment.
- The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is duly certified by the concerned guide and head of the Department/Institute.
- Progress of project work is monitored regularly on weekly project slot/project day. Regular interval presentations are to be arranged to review and assess the work.
- Project work is monitored and continuous assessment is done by guides and authorities.
- Recommended performance measure parameters may include-Problem definition and scope of the project, Exhaustive and Rational Requirement Analysis, Research Methodology (applicable to Research Project) Comprehensive Implementation Design, modelling, documentation, Usability, Optimization considerations (Time, Resources, Costing), Thorough Testing, Project Presentation and Demonstration(ease of use and usability), Presentation of work in the form of Project Report(s), Understanding individual capacity, Role & involvement in the project, among other parameters.
- The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.
- Students are encouraged to publish their work either in peer reviewed journal/Scopus/Sci/ACM or conferences.
- Students to be called for review timely for Synopsis submission, Requirement analysis, System Design, Working module satisfying project objective, Test cases, Project report preparation.

Project Documentation

Project report must have:

1. Certificate from the institute
2. Certificate sponsoring organization/Internship completion letter (If any)
3. Acknowledgement

4. Abstract
5. Contents
6. List of Abbreviations (As applicable)
7. List of Figures (As applicable)
8. List of Graphs (As applicable)
9. List of Tables (As applicable)
10. Introduction and aims/motivation and objectives.
11. Literature Survey (with proper citation).
12. Problem Statement/definition.
13. Software Requirement Specification (In SRS Documentation only).
14. Flowchart
15. Project Requirement specification.
16. Proposed system Architecture.
17. High level design of the project (UML Diagrams).
18. System implementation-code documentation: Algorithm style, Description of detailed methodologies, protocols used etc. As applicable.
19. Test cases.
20. Proposed GUI/Working modules/Experimental Results (Module wise if available) in suitable format.
21. Project Plan.
22. Conclusions.
23. Bibliography in IEEE format.

Appendices

1. Plagiarism Report of Paper and Project report from any open-source tool.
2. Base Paper(s) [If any].
3. Tools used / Hardware Components specifications [If any].
4. Published Papers and Certificate

Use appropriate plagiarism tools, reference managers, Latex for efficient and effective project writing.

Learning Resources

Reference Books:

1. R. S. Pressman and B. R. Maxim, "Software Engineering: A Practitioner's Approach", 8th ed., McGraw-Hill Education, 2014.ISBN: 978-0078022128.
2. Bob Hughes, Mike Cotterell, and Rajib Mall, "Software Project Management", 5th ed., McGraw-Hill Education, 2012.ISBN: 978-0071072564.
3. C. R. Kothari and G. Garg, "Research Methodology: Methods and Techniques", 4th ed., New Age International Publishers, 2019.ISBN: 978-9386649220.

Evaluation Criteria :

Following criteria and weightage is suggested for evaluation of Field Project/ Major Project Term Work.

1. Problem Definition and literature Review :20 Marks
2. Methodology & Design : 30 Marks
3. Implementation of Project :50 Marks
4. Innovation & creativity: 20 Marks
5. Report preparation (preferable Paper Publication/Copyright/Patent) : 30 Marks
6. Internal Presentation : 50 marks

Task Force for Curriculum Design and Development

Programme Coordinator

Dr. Suhasini Itkar

Team Members for Course Design

Dr. Amit Bhusari	Trinity Academy of Engineering, Pune
Dr.Atul Newase	Anantrao Pawar College of Engineering and Research, Pune
Prof. Mukta Deshpande	G.S. Moze College of Engineering, Balewadi
Dr. Priyanka Abhang	Sandip Institute of Engineering and Management, Nashik
Prof. Pankaj Sathe	SND College of Engineering & Research Center , Yeola
Prof. Prashant Londhe	PDEA's College of Engineering , Manjari
Prof. P. D. Jadhav	MET's Institute of Engineering, Nashik
Dr. Poonam Choudhary	GES, R.H. Sapat College of Engg, MS & R, Nashik
Prof. Manjusha Khond	MET's Institute of Engineering, Nashik
Prof. Kakade Sameer Bajirao	Trinity Academy of Engineering, Pune
Dr. Kapil Misal	Trinity Academy of Engineering, Pune
Prof. Pramod Jadhao	Trinity Academy of Engineering, Pune
Prof.Priyanka Tushar Yeole	G.S. Moze College of Engineering
Prof.Dipali Amit Bhusari	Trinity Academy of Engineering, Pune
Prof. Pritish Bisne	Trinity Academy of Engineering, Pune
Dr Nita Shinde	MET's Institute of Engineering
Prof Sonali Ajay Mutha	Anantrao Pawar College of Engineering and Research
Prof.Monika Shinde	Trinity Academy of Engineering, Pune
Prof.Pritee Nilesh Fuldeore	MET's college of engineering Nashik
Dr. Prabhanjan Choudhary	S.B. Jain Institute of Tech.
Prof.Sonali L.Vidahte	MET Bhujbal Knowledge City,Institute of Engineering
Prof. Munmun Puranik	Genba Sopanrao Moze College of Engineering Balewadi Pune
Prof.Vibha Upadhya	Trinity Academy of Engineering Pune
Prof.Dhanashree Rajendra Kolpe	Genba Sopanrao Moze, Balewadi Pune
Dr.Rucha Samant	GES R. H. Sapat COE MSR
Prof.Amol Bhagwan Payghan	Trinity Academy of Engineering, Pune
Dr. Nishant Pachpor	Vishwakarma Mahavidyalaya, Talegaon Dabhade
Prof.Mangesh Dasharath Kadam	Nutan Maharashtra Institute of Engineering and Technology
Prof.Pranjali Deshmukh	GES R. H. Sapat COE MSR
Prof.Vairal Dada Bhaskar	SND College of Engineering and Research Center,Babhulgaon
Prof.Javed Rauf Attar	MET's Institute of Engineering Nashik
Prof.Sujata Rangarao Patil	Trinity Academy of Engineering, Pune
Prof.Manisha Patil	Trinity Academy of Engineering, Pune

Prof.Sonali Ajay Mutha	Anantrao Pawar College of Engineering and Research

Chairman

Dr. Nilesh Uke - Board of Studies Computer Engineering

Savitribai Phule Pune University, Pune

Dean

Dr. Raosaheb Latpate - Dean – Science and Technology

Savitribai Phule Pune University, Pune