

**Progressive Education Society's**  
**MODERN COLLEGE OF ENGINEERING, PUNE-05.**  
**An Autonomous Institute Affiliated to Savitribai Phule Pune University**

**Approved by AICTE & Government of Maharashtra**  
**Accredited by NAAC (A++)**



**First Year - Master of Computer Applications (F.Y.MCA)**  
**National Education Policy (NEP)-2020 Compliant Curriculum**

**(w.e.f. A.Y. 2024 - 2025)**

[www.moderncoe.edu.in](http://www.moderncoe.edu.in)

*\*(Recommended by the Board of Studies and Approved by Academic Council)*



**Acronym,**

<b>Acronym of Course Type*</b>	<b>Course Type</b>
MJ	Major /Professional Core Courses
PE	Professional Elective Courses
SI	Summer internship/ Internship in industry
RP	Research Project/ Project work
VA	Value added course / Mandatory courses
SE	Skill Enhancement Courses

*\* Acronym of courses as per NEP Verticals and AICTE Domains.*

<b>Acronym of Scheme Type</b>	<b>Scheme Type</b>
TH	Theory
PR	Practical/ Laboratory
OR	Oral
CIE	Cumulative Internal Examination
SEE	Semester End Examination
L	Lecture
P	Practical



<b>First Year MCA (2024 Pattern)</b>		
<b>(with effect from 2024-2025)</b>		
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<b>First Year MCA</b>		
<b>Program Outcomes (POs)</b>		
<b>At the end of the program graduates will be able to,</b>		
<b>PO1</b>	<b>Foundation Knowledge</b>	Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.
<b>PO2</b>	<b>Problem Analysis</b>	Identify, review, formulate and analyze problems for primarily focusing on customer requirements using critical thinking frameworks.
<b>PO3</b>	<b>Development of Solutions</b>	Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.
<b>PO4</b>	<b>Modern Tool Usage</b>	Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
<b>PO5</b>	<b>Individual and Teamwork</b>	Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
<b>PO6</b>	<b>Project Management and Finance</b>	Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.
<b>PO7</b>	<b>Ethics</b>	Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware
<b>PO8</b>	<b>Life-long learning</b>	Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

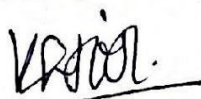


**First Year MCA: Curriculum Structure (w.e.f. 2024-2025) (2024 Pattern)**

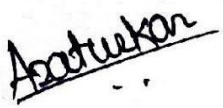
Semester- I												
Course Type	Course Code	Course Title	Teaching Scheme (Hours / Week)		Examination / Evaluation Scheme and Marks					Credit Scheme		
			L	P	CIE	SEE	TW	PR	Total	L	P	Total
MJ	MCA01501	Mathematical Foundations	3	-	40	60	-	-	100	3	-	3
MJ	MCA01502	Software Development Methodologies	3	-	40	60	-	-	100	3	-	3
MJ	MCA01503	Data Structures and Algorithms	3	-	40	60	-	-	100	3	-	3
VA	RMT06501	Research Methodology	4	-	40	60	-	-	100	4	-	4
PE	MCA10501	Elective - I	3	-	40	60	-	-	100	3	-	3
MJ	MCA01504	Python Programming Laboratory	-	4	-	-	25	25	50	-	2	2
MJ	MCA01505	Data Structures and Algorithms Laboratory	-	4	-	-	25	25	50	-	2	2
PE	MCA10502	Laboratory Practice-I	-	2	-	-	25	-	25	-	1	1
VA	HRT04501	Human Rights -I	-	2	-	-	25	-	25	-	1	1
Total Hours/week, Marks, Credits			16	12	200	300	100	50		16	6	22
<b>TOTAL</b>			28 Hrs/week		500 Marks (TH)		150 Marks (PR)		650	22 Credits		

List of Elective-I Courses

PE	MCA10501A - AI	Artificial Intelligence
PE	MCA10501B - IoT	Internet of Things
PE	MCA10501C - DMBI	Data Mining and Business Intelligence

  
(Prof. Dr. Mrs. Katyani R. Joshi)  
Principal, PESMCOE



  
(Dr. Mrs. Aparna P. Laturkar)  
Dean Academics



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**First Year MCA: Curriculum Structure (w.e.f. 2024-2025) (2024 Pattern)**

Semester- II												
Course Type	Course Code	Course Title	Teaching Scheme (Hours / Week)		Examination / Evaluation Scheme and Marks					Credit Scheme		
			L	P	CIE	SEE	TW	PR	Total	L	P	Total
MJ	MCA01551	Operating Systems and Computer Networks	3	-	40	60	-	-	100	3	-	3
VA	CYS06551	Introduction to Cyber Security	4	-	40	60	-	-	100	4	-	4
MJ	MCA01552	Java Programming	3	-	40	60	-	-	100	3	-	3
MJ	MCA01553	Database Systems	3	-	40	60	-	-	100	3	-	3
PE	MCA10551	Elective -II	3	-	40	60	-	-	100	3	-	3
MJ	MCA01554	Java Programming Laboratory	-	4	-	-	25	25	50	-	2	2
MJ	MCA01555	Database Systems Laboratory	-	4	-	-	25	25	50	-	2	2
PE	MCA10552	Laboratory Practice-II	-	2	-	-	25	-	25	-	1	1
VA	HRT04551	Human Rights -II	-	2	-	-	25	-	25	-	1	1
Total Hours/week, Marks, Credits			16	12	200	300	100	50		16	6	22
<b>TOTAL</b>			28 Hrs/week		500 Marks (TH)		150 Marks (PR)		650	22 Credits		

**List of Elective-II Courses**

PE	MCA10551A - ML	Machine Learning
PE	MCA10551B - ARVR	Augmented Reality and Virtual Reality
PE	MCA10551C - BDA	Big Data Analytics

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PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01501</b>		<b>Course Name: Mathematical Foundations</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> Cumulative Internal Examination(CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Prerequisite:</b> Basic knowledge of Mathematics.		
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>• To study set component, propositional logic, relations and functions.</li> <li>• To determine the number of logical possibilities of events.</li> <li>• To learn basic ideas of statistical inference and random variables.</li> <li>• To study tree and graph concepts and its operations.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO501.1: Solve</b> mathematical problems using set and propositional logic.		Unit I
<b>CO501.2: Find</b> relations between sets using various techniques.		Unit II
<b>CO501.3: Calculate</b> possible outcomes for computational processes using permutation and combinations.		Unit III
<b>CO501.4: Predict</b> the occurrence of events using statistical concepts.		Unit IV
<b>CO501.5: Select</b> appropriate tests of significance on sample data for decision making.		Unit V
<b>CO501.6: Apply</b> graph theory and tree concept for real world applications.		Unit VI
Course Contents		
Unit I	Set Theory and Logic	07 Hours
<b>Set Theory:</b> Basic concepts of set theory, finite and infinite sets, unaccountably infinite sets, power set, multiset, operations on set, principle of inclusion and exclusion, Venn diagram. <b>Mathematical Logic:</b> Introduction, propositions, logical connectives, conditional and bi-conditionals, logical equivalences, predicate calculus, mathematical induction.		
Unit II	Relations and Functions	07 Hours
<b>Relations:</b> Introduction to Relations and their properties, n-ary relations and their applications, representing relations, closures of relations, equivalence relations, partial orderings, Hasse diagram, Lattice. <b>Functions:</b> The concept of functions, surjections, injections and bijections, composition of function.		
Unit III	Permutations and Combinations	07 Hours
<b>Introduction to Permutations and Combinations:</b> The rule of sum and product, Permutations and combinations, generations of permutations and combinations.		
Unit IV	Introduction to Probability	07 Hours
<b>Introduction:</b> Mathematical or Apriori probability, statistical probability, axiomatic probability, addition theorem of probability, multiplication theorem of probability, independent event, sample space and events, conditional probability, Baye's theorem.		
Unit V	Random Variables and Discrete Probability Distributions	07 Hours
<b>Introduction:</b> Random variables, discrete random variables, expected values, expectation of a function of a		

random variable, variance, the Bernoulli and binomial random variables, Poisson random variable.		
<b>Discrete probability distribution:</b> The geometric random variable, the negative binomial random variable, the hypergeometric random variable.		
<b>Unit VI</b>	<b>Graph Theory and Trees</b>	<b>07 Hours</b>
<b>Introduction to Graph Theory:</b> Definition of graph, applications of graph, finite and infinite graphs, incidence and degree, isolated vertex, pendant vertex, and null graph, isomorphism, subgraphs, walk, path and circuits, Euler graphs, Hamiltonian paths and circuits.		
<b>Introduction to Trees:</b> Definition of tree, properties of trees, rooted and binary trees, spanning trees.		
<b>Total Hours</b>		<b>42</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
1. J.P. Trembley, "Discrete Mathematical Structures with Applications to Computer Science", McGrawHill Education (India) Pvt.Ltd. ISBN:13-978-0-07-463113-3.		
2. C. L. Liu, "Elements of Discrete Mathematics", TMH, ISBN:10-0-07-066913-9.		
3. S.C. Gupta, "Fundamentals of Statistics", Himalaya Publishing house, ISBN: 978-93-5051-769-7.		
<b>Reference Books:</b>		
1. Bernard Kolman, "Discrete Mathematical Structures", Prentice-Hall of India/Pearson, ISBN: 013-207-8457.		
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, 7th Edition, ISBN: 978-0-07-288008-3.		
3. N. Biggs, "Discrete Mathematics", Oxford University Press, ISBN: 0-19-850717-8.		
4. Sheldon Ross, "A first Course in Probability", Prentice Hall, ISBN: 13-978-0-136-03313-4.		
5. Narsingh Deo, "Graph with application to Engineering and Computer Science", Prentice Hall of India, ISBN: 0-87692-145-4.		
<b>MOOC Courses (Web Links):</b>		
1. Probability and Statistics, Prof. Somesh Kumar, IIT Kharagpur. <a href="https://archive.nptel.ac.in/noc/courses/noc17/SEM1/noc17-ma02/">https://archive.nptel.ac.in/noc/courses/noc17/SEM1/noc17-ma02/</a>		
2. Discrete Mathematics, Sudarshan Iyen, IIT Ropar. <a href="https://onlinecourses.nptel.ac.in/noc19_cs67/preview">https://onlinecourses.nptel.ac.in/noc19_cs67/preview</a>		
3. Introduction to Probability and Statistics, Prof. G. Srinivasan, IIT Madras. <a href="https://onlinecourses.nptel.ac.in/noc22_mg31/preview">https://onlinecourses.nptel.ac.in/noc22_mg31/preview</a>		

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO501.1	3	3	2	-	-	-	-	-
CO501.2	3	3	2	-	-	-	-	-
CO501.3	3	3	2	-	-	-	-	-
CO501.4	3	3	2	-	-	-	-	-
CO501.5	3	3	2	-	-	-	-	-
CO501.6	3	3	2	-	-	-	-	-
CO501	3	3	2	-	-	-	-	-

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01502</b>		<b>Course Name: Software Development Methodologies</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> <b>Cumulative Internal Examination (CIE): 40 Marks</b> <b>Semester-End Examination (SEE) (Paper): 60 Marks</b>
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To learn the software engineering life cycle by demonstrating planning, analysis, design, management and maintenance.</li> <li>• To be familiar with all the UML notations in software engineering.</li> <li>• To choose appropriate process model depending on the user requirements.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO502.1: Identify</b> appropriate software process model for software development.		Unit I
<b>CO502.2: Develop</b> software requirement specification for real world applications.		Unit II
<b>CO502.3: Apply</b> software design Modeling for project development.		Unit III
<b>CO502.4: Implement</b> agile software development process for real application.		Unit IV
<b>CO502.5: Estimate</b> software project plan with cost estimation.		Unit V
<b>CO502.6: Compute</b> software project maintenance for organization.		Unit VI
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Software Engineering</b>	<b>07 Hours</b>
<b>Introduction to Software Engineering:</b> Introduction, Software process models- Prescriptive models, Incremental process model, Evolutionary process model, Specialized process model, Process activities, Process improvement, Basics of agile methods.		
<b>Unit II</b>	<b>Software Requirement Engineering and Specification</b>	<b>07 Hours</b>
<b>Requirement Engineering:</b> Functional and non-functional requirements, Requirement engineering processes, Requirement elicitation, Requirement specification, Requirements Validation and requirement change. <b>Requirements Engineering Process:</b> Identifying the stakeholders, recognizing multiple viewpoints, Working toward collaboration. <b>Software Requirement Specification (SRS):</b> Introduction, Need for SRS, Characteristics, Components of SRS, Structure of requirement document.		
<b>Unit III</b>	<b>System Design and Modelling</b>	<b>07 Hours</b>
Context models, Interaction models -Use case modeling, sequence diagrams, structural models-Class diagrams generalization, Aggregation, Behavioral models -Data driven modeling, event driven modeling, model driven engineering.		
<b>Unit IV</b>	<b>An Agile View of Process</b>	<b>07 Hours</b>
<b>Introduction:</b> Agility, Agile process, Agile development techniques, Agile project management, <b>Agile Process Models:</b> Extreme programming (xp), Scrum, scaling Agile methods.		

Unit V	Software Management	07 Hours
<b>Introduction to Project Management:</b> Risk management, Managing people and team work. <b>Project Planning:</b> Software pricing, Plan-driven development, Project scheduling, Agile planning. <b>Estimation Techniques:</b> COCOMO cost modeling, Object oriented project, Web engineering projects, Agile development projects. management tool.		
Unit VI	Software Project Maintenance	07 Hours
Introduction, Maintenance categories, Major causes of maintenance, Reverse engineering and refactoring, Software evolution, Organizational and managerial issues.		
<b>Total Hours</b>		<b>42</b>
Learning Resources		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>Roger S Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill, Seventh or Eighth edition, ISBN 0073655783.</li> <li>Ian Sommerville, "Software Engineering", Pearson, Tenth edition, ISBN-13: 978-0133943030</li> <li>Grady Booch, James Rum Baugh, Ivar Jacobson, "The Unified Modelling Language user guide", Pearson, LPE ISBN 978-81-7758-372-4.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>Joseph Phillips, "IT Project Management On Track from Start to Finish", Tata McGraw-Hill, ISBN 13 978-0-07106727-0.</li> <li>John M. Nicolas and Herman Steyn, "Project Management for Engineering, Business and Technology", 4th Edition, Elsevier, ISBN 978-0-08-096704-2.</li> <li>Hans van vlet," Software Engineering", Principles and Practices, third edition, ISBN-13:978-8126527373.</li> <li>Richard fairley, "Software Engineering Concepts", Tata McGraw-Hill, ISBN-10: 9780074631218.</li> </ol>		
<b>1. MOOC Courses (Web Links):</b> Software Project Management, Prof. Rajib Mall & Prof. Durga Prasad Mohapatra, IIT Kharagpur. <a href="https://onlinecourses.nptel.ac.in/noc19_cs70/preview">https://onlinecourses.nptel.ac.in/noc19_cs70/preview</a>		

### CO-PO Mapping Matrix of the course,

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO502.1	3	3	3	1	3	1	2	2
CO502.2	3	3	3	1	3	1	2	2
CO502.3	3	3	3	1	3	1	2	2
CO502.4	3	3	3	1	3	1	2	2
CO502.5	3	3	3	1	3	3	2	2
CO502.6	3	3	3	1	3	3	3	2
CO502	3	3	3	1	3	3	2	2

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01503</b>		<b>Course Name: Data Structures and Algorithms</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> Cumulative Internal Examination (CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Prerequisite:</b> <ul style="list-style-type: none"> <li>Basic knowledge of programming language.</li> </ul>		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To study the representation, implementation of basic data structures.</li> <li>To study data structures and their implementations and applications.</li> <li>To study applications of Data Structure in solving real life problems.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO503.1: Explain</b> basic concepts of algorithmic complexities, strategies and data structures.		Unit I
<b>CO503.2: Make use of</b> linked lists for dynamic programming.		Unit II
<b>CO503.3: Implement</b> principles of stack and queue for solving computational problems.		Unit III
<b>CO503.4: Create</b> a hierarchical data structure for addressing real world problems.		Unit IV
<b>CO503.5: Apply</b> graph algorithms and hashing techniques for solving real world problems.		Unit V
<b>CO503.6: Choose</b> suitable methods for searching and/or sorting in application development.		Unit VI
Course Contents		
Unit I	Introduction to Algorithms and Data Structures	07 Hours
<b>Introduction to Algorithms:</b> Introduction, Characteristics, Algorithm design Tools, flowchart and Pseudocode. <b>Analysis of Algorithms:</b> Complexity of Algorithms, Space complexity, Time complexity, computing time complexity of an algorithm, Big-O notation. <b>Introduction to data structures:</b> Introduction, Abstract Data types (ADT), types of data Structures-Primitive & non-primitive, Linear and non- Linear, Static and dynamic Data Structure. <b>ADT Implementations:</b> Array implementations, Linked List Implementations. <b>Applications of Array:</b> Sparse matrix representation, addition and transpose, Polynomial representation & addition.		
Unit II	Linked Lists	07 Hours
<b>Introduction of Linked Lists:</b> Realization of linked list using dynamic memory management. Functions of linked list, Create, add node, delete node, search node, count nodes, traverse. <b>Types of Linked List:</b> Singly Linked List, Doubly Linked List, Doubly Circular Linked List, Generalized Linked List (GLL). <b>Application of Linked List:</b> Polynomial Manipulations- Polynomial addition.		
Unit III	Stacks and Queues	07 Hours
<b>Stacks:</b> Concept, basic stack operations, Implementation of Stacks using array and linked list. <b>Applications of Stack:</b> Reversing data, Decimal to binary conversion, Parsing (syntax/ parenthesis),		

Postponement (infix, prefix, postfix). <b>Queue:</b> Concept, basic queue operations, Implementation of Queue using linked list and array. <b>Types of queues:</b> Circular Queue, Deque, Priority Queue. <b>Queue Applications:</b> Categorizing data, Job scheduling in OS, Simulation.		
<b>Unit IV</b>	<b>Trees</b>	<b>07 Hours</b>
<b>Trees:</b> Concept of nonlinear data structure, Trees and binary trees-concept and terminology, Sequential & Linked representation of binary trees, tree traversal algorithms, Binary search trees (BST), BST operations, AVL Trees. <b>Applications of binary tree:</b> Expression tree, Decision tree.		
<b>Unit V</b>	<b>Graph &amp; Hashing</b>	<b>07 Hours</b>
<b>Graph:</b> Introduction, Terminologies, Graph Representations, Adjacency matrix and Adjacency list, Graph traversals- depth first and breadth first search. <b>Applications of graph:</b> Connected components, Spanning tree, Minimum cost spanning tree: Prims and Kruskal Algorithms, Dijkstra's Single source shortest path. <b>Hashing:</b> Introduction, Applications, Hash Table, Hash Functions.		
<b>Unit VI</b>	<b>Searching and Sorting</b>	<b>07 Hours</b>
<b>Searching:</b> Search Techniques, Sequential search, variant of sequential search- sentinel search, Binary search, Fibonacci search. <b>Sorting:</b> Types of Sorting-Internal and external sorting, General sort concepts-sort order, stability, Efficiency, number of passes, Sorting methods- Bubble sort, Insertion sort, Selection sort, Quick sort, Heap sort, Radix sort, Comparison of All Sorting Methods.		
<b>Total Hours</b>		<b>42</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
1. Horowitz, S., & Sahani, D. (n.d.). "Fundamentals of Data Structures in C. " University Press. ISBN: 9788173716058.		
2. Brassard and P. Bratley, "Fundamentals of Algorithmics", Prentice Hall India/Pearson Education, ISBN 9788120311312.		
3. Langsam, Y., Augenstein, M. J., & Tenenbaum, A. M. (n.d.). "Data Structures using C and C++." Pearson Education. ISBN 81-317-0328-2.		
<b>Reference Books:</b>		
1. R. F. Gilberg and B. A. Forouzan, "Data Structures: A Pseudocode Approach with C," Cengage Learning, ISBN 9788131503140.		
2. Berman, A. M. (n.d.). "Data Structures via C++: Objects by Evolution." Oxford University Press. ISBN:0-19-510843-4.		
3. Varsha Patil, "Data Structures using C++", Oxford University Press, ISBN 13:978-0-19-806623.		
<b>MOOC Courses (Web Links):</b>		
1. Data Structures and Algorithms, Prof. Naveen Garg Department of Computer Science and Engineering, IIT Delhi. <a href="https://nptel.ac.in/courses/106102064">https://nptel.ac.in/courses/106102064</a>		
2. Programming, Data Structures and Algorithms Dr. N S. Narayanaswamy Department of Computer Science Engineering, IIT Madras. <a href="https://nptel.ac.in/courses/106106133">https://nptel.ac.in/courses/106106133</a>		

**CO-PO Mapping Matrix of the course,**

<b>CO\PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>
<b>CO503.1</b>	3	2	-	-	-	-	-	-
<b>CO503.2</b>	3	3	-	-	-	-	-	-
<b>CO503.3</b>	3	2	-	-	-	-	-	-
<b>CO503.4</b>	3	2	2	-	-	-	-	-
<b>CO503.5</b>	3	3	2	-	-	-	-	-
<b>CO503.6</b>	3	3	2	-	-	-	-	-
<b>CO503</b>	<b>3</b>	<b>2.5</b>	<b>2</b>	-	-	-	-	-

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: RMT06501</b>		<b>Course Name: Research Methodology</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Lecture: 04 Hrs./ week	<b>Credit:</b> Theory: 04	<b>Examination Scheme:</b> Cumulative Internal Examination(CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>To understand the fundamental concepts and objectives of research.</li> <li>To develop the skills necessary for conducting effective literature reviews and synthesizing information ethically.</li> <li>To demonstrate proficiency in developing research proposals and understand the principles of research design.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO504.1: Explain</b> the fundamental concepts and role of literature review of Research Methodology.		Unit I
<b>CO504.2: Interpret</b> the fundamentals of designing sample surveys.		Unit II
<b>CO504.3: Apply</b> various data analysis techniques in research.		Unit III
<b>CO504.4: Demonstrate</b> Ethical Considerations in Research Methodology.		Unit IV
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Research Methodology and Design</b>	<b>10 Hours</b>
Introduction and Meaning of research, types of research, research methods vs. methodology, significance and process of research, criteria of good research. <b>Research Problem Definition:</b> Selecting the problem, defining the problem. <b>Literature Review: Process of reviewing literature-</b> selecting, and reviewing existing literature, and developing theoretical and conceptual frameworks, writing the literature review. <b>Hypothesis in Research:</b> Definition and characteristics, testing hypotheses, types of hypotheses. <b>Research Design:</b> Meaning and features of a research design, key concepts in research design, types of research design- exploratory, descriptive and experimental.		
<b>Unit II</b>	<b>Sampling Design and Data Collection</b>	<b>10 Hours</b>
<b>Design of Sample Surveys:</b> Introduction, sample design, sampling and non-sampling errors, sample survey versus census survey, types of sampling designs. <b>Measurement and Scaling:</b> Qualitative and quantitative data, classifications of measurement scales, goodness of measurement scales, sources of error in measurement, techniques of developing measurement tools, scaling, Scale classification bases, scaling techniques, multidimensional scaling, deciding the scale. <b>Data Collection:</b> Introduction, experimental and surveys, collection of primary data and secondary data, selection of appropriate method for data collection, case study method. Exemplar/Case Study: Draft a questionnaire to find online social sites of top 10 business practices.		
<b>Unit III</b>	<b>Data Analysis and Interpretation</b>	<b>10 Hours</b>
<b>Data Analysis:</b> Types of analysis, descriptive statistics- measure of central tendency, dispersion, skewness, measures of relationship. <b>Interpretation:</b> Meaning, need, techniques, and precautions in interpreting research results.		

<b>Linear Regression Analysis:</b> Definition of regression, purpose and use, linear regression; interpretation of regression co-efficient, regression analysis, curve fitting and developing correlation, parameter estimation, multivariate statistics, moments and response curve methods.		
<b>Unit IV</b>	<b>Report Writing and Ethical Considerations in Research</b>	<b>10 Hours</b>
<p><b>Report Writing:</b> Significance, steps, types of reports, oral presentation, writing mechanics.</p> <p><b>Ethical Considerations in Research Design: Intellectual Property Rights (IPR)</b> - Introduction to IPR, publications &amp; patents, <b>patenting Process</b>, international scenario, patents &amp; copyrights.</p> <p>Exemplar/Case Study: Draft the documentation required for e-filing of copyright and intellectual property rights (IPR).</p> <p>Exemplar/Case Study-Exploring thesis writing, focusing on structure, style guidelines, and cautious interpretation of findings.</p>		
<b>Total Hrs.</b>		<b>40 Hours</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
<ol style="list-style-type: none"> <li>1. C. R. Kothari and Gaurav Garg, "Research Methodology Methods and Techniques", 4<sup>th</sup> Edition, New Age International Publishers, 2019.</li> <li>2. Ranjit Kumar, "Research Methodology": A Step by Step Guide for Beginners, 3<sup>rd</sup> Edition, Sage Publications, 2011.</li> <li>3. T. Ramappa, "Intellectual Property Rights under WTO: Tasks before India", Wheeler Publications, 2010.</li> <li>4. Debora J. Halbert, "Resisting Intellectual Property", Routledge, Taylor &amp; Francis Group, 2005.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. William G. Zikmund, Barry J. Babin, John C. Carr, and Mitch Griffin, "Business Research Methods", Cengage Learning, 2013.</li> <li>2. Royce Singleton and Bruce C. Straits, "Approaches to Social Research", Oxford University Press, 2017.</li> </ol>		
<b>MOOC Courses (Web Links):</b>		
<a href="https://onlinecourses.nptel.ac.in/noc21_ge03/preview">https://onlinecourses.nptel.ac.in/noc21_ge03/preview</a>		

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO504.1	-	2		-	-	-	-	-
CO504.2	1	2	2	-	-	-	-	-
CO504.3	1	3	2	3	-	-	-	-
CO504.4	-	-	-	-	-	-	3	2
CO504	1	2.25	2	3	-	-	3	2

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA10501A - AI</b>		<b>Course Name: Elective I(A)-Artificial Intelligence</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit : Theory: 03</b>	<b>Examination Scheme:</b> <b>Cumulative Internal Examination (CIE): 40 Marks</b> <b>Semester-End Examination (SEE) (Paper): 60 Marks</b>
<b>Course Prerequisite:</b>		
<ul style="list-style-type: none"> <li>• Computer programming using any programming language.</li> <li>• Ability to understand pseudo code.</li> </ul>		
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>• To understand the fundamentals of Artificial Intelligence (AI) relative to software engineering.</li> <li>• To introduce Prolog as a declarative programming language for using AI to solve real business problems.</li> <li>• To design, build, and assess intelligent agents for various applications, helping to advance the field of artificial intelligence.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO505A.1: Explain</b> the Fundamentals of Artificial Intelligence.		Unit I
<b>CO505A.2: Apply</b> various AI searching techniques for solving complex problems.		Unit II
<b>CO505A.3: Implement</b> logic based Artificial Intelligence applications using Prolog.		Unit III
<b>CO505A.4: Make use of</b> an agent-based algorithm that solves real problems.		Unit IV
<b>CO505A.5: Describe</b> Nonfunctional requirements related to Artificial Intelligence.		Unit V
<b>CO505A.6: Elaborate</b> the principles of responsible Artificial Intelligence.		Unit VI
<b>Course Contents</b>		
<b>Unit I</b>	<b>Fundamentals of AI</b>	<b>07 Hours</b>
Historical and fundamental aspects of artificial intelligence, what is AI, types of AI, application of AI in today's world, roots of AI, when to use AI and when not to use AI, applying AI using knowledge representation and reasoning methods.		
<b>Unit II</b>	<b>Applying AI</b>	<b>07 Hours</b>
Represent declarative knowledge in the form of symbolic knowledge through various Knowledge Representation (KR) techniques - First Order Predicate Logic (FOPL), semantic network, conceptual graphs, scripts, frames, Applying various searching algorithms fall under informed and uninformed search methods to solve complex problem of AI domain, how to manage the uncertainty that inherently lies within many AI problem.		
<b>Unit III</b>	<b>Prolog</b>	<b>07 Hours</b>
Analysis and development process of the knowledge-based system & declarative development, introduction to prolog, introduction to proofs, syntax, data types, flow and functions, problem solving in prolog, tree representations, heuristic and expert system, pattern directed programming.		
<b>Unit IV</b>	<b>Intelligent Agents</b>	<b>07 Hours</b>
Concept of agents, types of agents (simple reflex, model-based, goal-based, utility-based), applying agents in AI		

across different environments such as- types of observables (observable vs partially), deterministic vs stochastic, static vs dynamic, discrete vs continuous.		
<b>Unit V</b>	<b>Nonfunctional requirements related to AI</b>	<b>07 Hours</b>
Introduction to non-functional requirements (NFR), expanding following NFR for AI – security, scalability, accessibility, maintainability, applying NFR using prolog.		
<b>Unit VI</b>	<b>Responsible AI</b>	<b>07 Hours</b>
Fundamentals of responsible AI, AI Ethical considerations, Bias and fairness, Privacy concerns, AI & Society, Impact on governance and compliance, Regulatory requirements, Accountability & Transparency.		
<b>Total Hours</b>		<b>42</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
1. Peter and Norvig, “Artificial Intelligence: A Modern Approach”, ISBN: 0-13- 103805.		
2. George F. Luger, “Artificial Intelligence: Structures and Strategies for Complex Problem Solving”, ISBN-10: 0-321-54589-3.		
<b>Reference Books:</b>		
1. Ronald Brachman and Hector Levesque, “Knowledge Representation and Reasoning”, ISBN: 1-55860-932-6.		
2. Stephen Lucci Danny Kopec, “Artificial Intelligence in the 21st Century”, ISBN: 978-1-942270-00-3.		
3. Avron Barr and Edward A. Feigenbaum, “The Handbook of Artificial Intelligence- Volume I”, ISBN: 0-86576-005-5.		
<b>MOOC Courses (Web Links):</b>		
1. Introduction to Artificial Intelligence, Prof. Anupam Basu, Prof. S. Sarkar, IIT Kharagpur. <a href="https://nptel.ac.in/courses/106105077">https://nptel.ac.in/courses/106105077</a>		
2. An Introduction to Artificial Intelligence, Prof. Mausam, IIT Delhi. <a href="https://onlinecourses.nptel.ac.in/noc22_cs56/preview">https://onlinecourses.nptel.ac.in/noc22_cs56/preview</a>		

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO505A.1	3	3	3	-	-	-	-	-
CO505A.2	3	3	3	-	-	-	-	-
CO505A.3	3	3	3	3	-	-	-	-
CO505A.4	3	3	3	-	-	-	-	-
CO505A.5	3	3	3	-	-	-	-	-
CO505A.6	3	3	3	-	-	-	-	-
CO505A	3	3	3	3	-	-	-	-

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA10501B - IoT</b>		<b>Course Name: Elective I(B)-Internet of Things</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> Cumulative Internal Examination (CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Prerequisite:</b> <ul style="list-style-type: none"> <li>Basics of Computer Network.</li> </ul>		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To know the IoT fundamentals and understand the technologies.</li> <li>To learn the basics of Arduino and Raspberry Pi installation, setup and configuration.</li> <li>To learn IoT protocols, cloud platforms and security issues in IoT.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO505B.1: Explain</b> fundamentals, architecture and framework of IoT.		Unit I
<b>CO505B.2: Analyze</b> IoT protocols for making IoT devices communication.		Unit II
<b>CO505B.3: Explain</b> python programming for development of IoT applications.		Unit III
<b>CO505B.4: Design</b> cloud based IoT system.		Unit IV
<b>CO505B.5: Develop</b> secured IoT application.		Unit V
<b>CO505B.6: Construct</b> real time IoT applications.		Unit VI
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Internet of Things</b>	<b>07 Hours</b>
<b>Introduction:</b> Definition and characteristics of IoT, IoT framework and architecture. <b>Design of IoT:</b> Things in IoT, IoT protocols. IoT functional blocks, IoT communication models, IoT Communication APIs. <b>IoT Enabling Technologies:</b> Wireless sensor networks, cloud computing, big data analytics, communication protocol, embedded systems, IoT level and deployment template.		
<b>Unit II</b>	<b>IoT Protocols</b>	<b>07 Hours</b>
Protocol standardization for IoT, M2M, IEEE 802.15.4, ModBus, KNX, ZigBee, MQTT and REST protocol, 6LoWPAN protocol, LoRa.		
<b>Unit III</b>	<b>IoT Platforms and Its Programming</b>	<b>07 Hours</b>
Introduction to Arduino and Raspberry Pi- installation, interfaces (Serial, SPI, I2C), Introduction to python program with Raspberry Pi with focus on interfacing external gadgets (Bluetooth Speaker, CCTV Camera, Robotic Arm etc.), controlling output, and reading input from pins. Introduction to Arduino programming,		

integration of sensors and actuators with Arduino.		
<b>Unit IV</b>	<b>Cloud platforms for IoT</b>	<b>07 Hours</b>
Introduction to cloud storage models and communication APIs, WAMP Autobahn for IoT, Xively cloud for IoT. <b>Python web application framework:</b> Django architecture, starting development with Django. Designing a RESTful web API, amazon web services for IoT, Amazon web services for IoT.		
<b>Unit V</b>	<b>Security in IoT</b>	<b>07 Hours</b>
<b>Introduction:</b> Vulnerabilities of IoT, security requirements, challenges for secure IoT. <b>Threat Modeling:</b> Threat analysis, use cases and misuse cases, activity modeling and threats. <b>Key elements:</b> Identity establishment, access control, data and message security, non-repudiation and availability, security model for IoT.		
<b>Unit VI</b>	<b>Domain Specific Applications of IoT</b>	<b>07 Hours</b>
<b>Home Automation:</b> Smart appliances, intrusion detection, smoke/gas detector. <b>Smart city:</b> smart parking, smart roads, structural health monitoring, surveillance applications. <b>Health &amp; Lifestyle:</b> Health and fitness monitoring, wearable electronics. <b>Agriculture:</b> smart irrigation, greenhouse control. <b>Environment:</b> weather monitoring, noise pollution monitoring. <b>Logistic:</b> Root generation and scheduling, shipment monitoring. <b>Retail Management:</b> inventory management, smart payments. <b>Industry applications:</b> machine diagnosis and prognosis, indoor air quality monitoring.		
<b>Total Hours</b>		<b>42</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
1. Vijay Madiseti, ArshdeepBahga, "Internet of Things: A Hands-On Approach", 2014, Universities Press (India) Pvt Ltd., ISBN: 978 81 7371 954 7.		
2. John Wiley, "The Internet of Things: Key Applications and Protocols", 2012, ISBN:978-81-265-5765-3.		
3. John Wiley, "Designing the Internet of Things", 2014, ISBN: 978-81-265-5686-1.		
<b>Reference Books:</b>		
1. Matt Richardson & Shawn Wallac, "Getting Started with Raspberry Pi", 2014, O'Reilly (SPD), ISBN:9789350239759.		
2. Pethuru Raj and Anupama C Raman, "The Internet of Things: Enabling Technologies, Platforms and Use Cases", 2017, CRC Press, ISBN: 13:978-1-4987-6128-4.		
3. Simon Monk, "Raspberry Pi Cookbook, Software and Hardware Problems and solutions", 2019, O'Reilly, ISBN 9781492043225.		
<b>MOOC Courses (Web Links):</b>		
1. Introduction to Internet of Things, Prof. Sudip Misra, IIT Kharagpur. <a href="https://nptel.ac.in/courses/106/105/106105166/">https://nptel.ac.in/courses/106/105/106105166/</a>		

**CO-PO Mapping Matrix of the course,**

<b>CO\PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>
<b>CO505B.1</b>	3	3	-	-	-	-	-	1
<b>CO505B.2</b>	3	3	-	-	-	-	-	1
<b>CO505B.3</b>	3	3	3	3	2	-	-	1
<b>CO505B.4</b>	3	3	3	3	2	-	-	1
<b>CO505B.5</b>	3	3	3	-	-	-	-	1
<b>CO505B.6</b>	3	3	3	3	2	-	-	1
<b>CO505B</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	-	-	<b>1</b>

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA10501C - DMBI</b>		<b>Course Name: Elective I(C)- Data Mining and Business Intelligence</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> Cumulative Internal Examination (CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To Gain knowledge of the basic concepts of BI, principles, and components of BI, including data warehousing, data mining, analytics, and reporting.</li> <li>To learn techniques for data visualization and reporting to facilitate effective decision-making.</li> <li>To explain different data pre-processing techniques.</li> <li>To understand the BI Applications in various industries.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO505C.1: Define</b> the basics concepts of data mining and data Warehouse.		Unit I
<b>CO505C.2: Apply</b> data Preprocessing techniques for analysis.		Unit II
<b>CO505C.3: Identify</b> Patterns in data using various data mining techniques.		Unit III
<b>CO505C.4: Explain</b> basic concepts of business intelligence and decision-making systems.		Unit IV
<b>CO505C.5: Make use of</b> the data visualizations techniques in real world Scenario.		Unit V
<b>CO505C.6: Elaborate</b> various modeling techniques and applications of business intelligence.		Unit VI
<b>Course Contents</b>		
<b>Unit I</b>	<b>Data Mining and Data Warehouse</b>	<b>07 Hours</b>
<b>Data mining:</b> Introduction, evolution of data mining systems, knowledge discovery process, verification vs. discovery, data mining process, models and methods for data mining, applications of data mining. <b>Data warehouse:</b> Introduction to data warehouse, data warehouse architecture, ETL, ETL tools, OLAP (online analytical processing) definitions, different OLAP architectures, difference between OLAP and OLTP, dimensional analysis, cubes, drill-down and roll-up, slice and dice or rotation, OLAP models, ROLAP versus MOLAP. <b>Defining schemas:</b> stars, snowflakes and fact constellations.		
<b>Unit II</b>	<b>Data Preprocessing</b>	<b>07 Hours</b>
<b>Data validation:</b> Incomplete data, data affected by noise. <b>Data transformation:</b> Standardization, feature extraction.		

<p><b>Data reduction:</b> Sampling, feature selection, principal component analysis, data discretization.</p> <p><b>Data exploration: Univariate analysis:</b> Graphical analysis of categorical attributes, graphical analysis of numerical attributes, measures of central tendency for numerical attributes, measures of dispersion for numerical attributes, identification of outliers for numerical attributes.</p> <p><b>Bivariate analysis:</b> Graphical analysis, measures of correlation for numerical attributes, contingency tables for categorical attributes.</p> <p><b>Multivariate analysis:</b> Graphical analysis, measures of correlation for numerical attributes.</p>		
<b>Unit III</b>	<b>Data Mining Techniques</b>	<b>07 Hours</b>
<p><b>Regression:</b> Introduction, regression problems, evaluation of regression models, linear regression.</p> <p><b>Classification:</b> Introduction, classification problems, evaluation of classification models, bayesian methods, logistic regression.</p> <p><b>Clustering:</b> Introduction, clustering methods, partition methods, hierarchical methods, evaluation of clustering models.</p> <p><b>Association rule:</b> Introduction, structure of association rule, apriori algorithm.</p>		
<b>Unit IV</b>	<b>Business Intelligence and Decision Support System</b>	<b>07 Hours</b>
<p><b>Business Intelligence-</b> Introduction, data-information-knowledge, business intelligence architectures, cycle of business intelligence analysis, factors in business intelligence projects, development of business intelligence system, ethics and business intelligence.</p> <p><b>Decision support system</b> – Definition of system, definition of decision support system, rationality and problem solving, types of decisions, decision making process, approaches to the decision-making process, development of decision support system.</p>		
<b>Unit V</b>	<b>Data Visualization and BI Tools</b>	<b>07 Hours</b>
<p><b>Data visualization:</b> What is data visualization, history of data visualization, importance of data visualization, types of visualization, types of charts and graphs. visualizing amount, distribution, proportions, associations among two or more quantitative variables, telling a story.</p> <p><b>Introduction to BI tools:</b> Excel, Microsoft Power BI, Microsoft SQL Server.</p>		
<b>Unit VI</b>	<b>BI Modeling and Application of BI</b>	<b>07 Hours</b>
<p><b>Models and modeling in BI:</b> Model presentation, model building, model assessment and quality of models.</p> <p><b>Modeling using logical structures:</b> Ontology &amp; Frame, modeling using graph structure, business process model and notation (BPNM), modeling using probabilistic structures, modeling using analytical structure, data generation, the role of time, data quality.</p> <p><b>Applications of business intelligence:</b> Relational marketing, market basket analysis, web mining, text mining, salesforce management, supply chain optimization, revenue management system.</p>		
<b>Total Hours</b>		<b>42</b>
<b>Learning Resources</b>		
<p><b>Text Books:</b></p> <p>1. Grossmann W, Rinderle-Ma, “Fundamental of Business Intelligence”, Springer, ISBN: 978- 662-46531-8.</p>		
<p><b>Reference Books:</b></p> <p>1. Carlo Vercelli’s, “Business Intelligence: Data Mining and Optimization for Decision Making”, WILEY, ISBN: 978-81-265-4188.</p> <p>2. Efraim Turban, Jay E. Aronson, Teng-Peng Liang, Ramesh Sharda, “Decision Support and Business Intelligence Systems”, Pearson, ISBN: 978-81-317-2425-5.</p>		

**MOOC Courses (Web Links):**

1. Business Analytics for Management Decision, Prof. Rudra P Pradhan, IIT Kharagpur.  
[https://onlinecourses.nptel.ac.in/noc20\\_mg11/preview](https://onlinecourses.nptel.ac.in/noc20_mg11/preview)
2. Business Intelligence & Analytics, Prof. Saji K Mathew, IIT Madras.  
[https://onlinecourses.nptel.ac.in/noc24\\_cs65/preview](https://onlinecourses.nptel.ac.in/noc24_cs65/preview)
3. The Business Intelligence Analyst Course 2024, 365 Careers, Udemy.  
<https://www.udemy.com/course/the-business-intelligence-analyst-course-2018>

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO505C.1	3	3	2	-	-	-	-	2
CO505C.2	3	3	2	-	-	-	-	2
CO505C.3	3	3	2	-	-	-	-	2
CO505C.4	3	3	2	-	-	-	-	2
CO505C.5	3	3	2	2	-	-	-	2
CO505C.6	3	3	2	-	-	-	-	2
CO505C	3	3	2	2	-	-	-	2

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01504</b>		<b>Course Name: Python Programming Laboratory</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Practical: 04 Hrs./ week	<b>Credit: 02</b>	<b>Examination Scheme:</b> Term work (TW): 25 Marks Practical (PR): 25 Marks
<b>Course Prerequisites:</b> <ul style="list-style-type: none"> <li>• Basic Mathematical Skills.</li> <li>• Basic Computing Skills.</li> </ul>		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To become familiar with the fundamentals of Python programming.</li> <li>• To develop programming logic using Python.</li> <li>• To explore the programming constructs of Python such as loops, arrays, lists, tuples etc.</li> <li>• To write Python functions to facilitate code reuse and use Python to perform read/ write operations on files.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		
<b>CO506.1: Implement</b> basic concepts of python programming.		
<b>CO506.2: Make use of</b> decision making, looping and special data types for real world applications.		
<b>CO506.3: Solve</b> computational problems using functions ,modules and strings.		
<b>CO506.4: Implement</b> object oriented programming concepts using python.		
<b>CO506.5: Develop</b> data analytical applications using python libraries.		
Sr. No.	List of Laboratory Assignments/Activity/Experiment	CO Mapping
1.	Installation of python Jupyter editor.	CO506.1
2.	To calculate the salary of an employee given his basic pay (taken as input from the user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employees pay professional tax as 2% of total salary. Calculate net salary payable after deductions.	CO506.1
3.	Develop a calculator application using Python.	CO506.1
4.	Create an application using python that computes the net amount of a bank account based on transaction log from console input. The transaction log format is shown as follows D(Deposit)=100, W(Withdraw)=700. Withdraw is not allowed if the minimum balance is below 500. (Hint: D 300, D 300, W 200, D 100 then output should be 500).	CO506.2
5.	Implement a playlist which will store the list of songs and implement the following functionalities. Adding new songs to the playlist. Playing a particular song. Removing songs from playlist.	CO506.2

	Shuffling the order of the songs. Playing the songs sequentially.	
6.	To find a value using linear search in python program	CO506.2
7.	Create an application for department library which has N books write functions for the following: Delete the duplicate entries. Display books in ascending order based on cost of books. Count the number of books with a cost of 500.	CO506.3
8.	Implement the tower of Hanoi in python.	CO506.3
9.	Create a dataset of ages of 10 students and carry out following functionalities: 1. Students average ages. 2. Mean of the students. 3. Median of the students. 4. Students with higher and lower age.	CO506.3
10.	Write a python program to shuffle a deck of cards.	CO506.3
11.	Create a string of customer reviews, remove punctuations and convert entire string in lower case, split reviews into words if in reviews encountered the word good or great then print positive review else if the words contain bad or horrible then print negative review or else print neutral review.	CO506.3
12.	Create a class Pet with attributes name, type and price implement constructors to Initialize these attributes.	CO506.4
13.	Create class EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary). Define function members to compute a)total number of employees in an organization b) count of male and female employee c) Employee with salary more than 10,000 d) Employee with designation "Assistant Manager".	CO506.4
14.	Create a parent class named Person with two attributes namely Age, Gender. Derive two classes: Teacher and Student Implement teaches method which will print "I am a teacher" and studies method which will print "I study".	CO506.4
15.	Create or import sample dataset and carry out Data cleaning, preprocessing and exploratory data analysis with pandas.	CO506.5
16.	Take suitable Numpy dataset and plot line, bar, scatter and histogram visualizations.	CO506.5

### Learning Resources

#### Text Books:

1. Anurag Gupta, G.P. Biswas "Python Programming- Problem Solving, Packages and Libraries" McGraw Hill Education. ISBN-13:978-93-5316-800-1.
2. Reema Thareja "Python Programming-Using Problem Solving Approach" Oxford University Press 2017. ISBN-13:978-0-19-948017-3.

#### Virtual Laboratory (Links):

1. Python Programming Lab | IIT Kharagpur: <https://python-iitk.vlabs.ac.in/>

#### MOOC Courses (Web Links):

1. Programming in Python, Dr. Rizwan Rehman | Dibrugarh University:  
[https://onlinecourses.swayam2.ac.in/cec22\\_cs20/preview](https://onlinecourses.swayam2.ac.in/cec22_cs20/preview)
2. Google's Python Class: <https://developers.google.com/edu/python>
3. Spoken Tutorial-Python:  
[https://spoken-tutorial.org/tutorial-search/?search\\_foss=Python+3.4.3&search\\_language=English](https://spoken-tutorial.org/tutorial-search/?search_foss=Python+3.4.3&search_language=English).
4. Programming in Python, Coursera, Meta staff: <https://www.coursera.org/learn/programming-in-python>

**CO-PO Mapping Matrix of the course,**

<b>CO\PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>
<b>CO506.1</b>	2	3	3	3	3	-	-	1
<b>CO506.2</b>	2	3	3	3	3	-	-	1
<b>CO506.3</b>	2	3	3	3	3	-	-	1
<b>CO506.4</b>	2	3	3	3	3	-	-	1
<b>CO506.5</b>	2	3	3	3	3	-	-	1
<b>CO506</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	-	-	<b>1</b>

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01505</b>		<b>Course Name: Data Structures and Algorithms Laboratory</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Practical: 04 Hrs./ week	<b>Credit:</b> 02	<b>Examination Scheme:</b> Term work (TW): 25 Marks Practical (PR) / Oral (OR): 25 Marks
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>• To study basics of Algorithms and data structures.</li> <li>• To study various linear &amp; nonlinear data structures.</li> <li>• To study applications of Data Structure in solving real life problems.</li> </ul>		
<b>Course Outcomes:</b>		
On completion of the course, the student will be able to,		
<b>CO507.1: Apply</b> elementary data structures such as Arrays, linked lists.		
<b>CO507.2: Implement</b> representation & application of Linked List.		
<b>CO507.3: Demonstrate</b> practical knowledge on the applications of stacks, queues.		
<b>CO507.4: Make use of</b> nonlinear data structure trees for mathematical problems.		
<b>CO507.5: Solve</b> real world problems using graphs.		
<b>CO507.6: Apply</b> appropriate searching and sorting algorithms for computational problems.		
Sr. No.	List of Laboratory Assignments/Experiments/Activity	CO Mapping
1.	Apply sparse matrices in practical scenarios in the context of social networks and maps.	CO507.1
2.	Implement application of array in polynomial expression.	CO507.1
3.	Write C++ program to maintain club member 's information using singly linked lists. Store student PRN, Name and A.Y. Write functions to: <ol style="list-style-type: none"> <li>a) Add and delete the members as well as both coordinators.</li> <li>b) Compute the total number of members of the club.</li> <li>c) Display members.</li> <li>d) Two linked lists exist for two divisions. Concatenate two lists.</li> <li>e) update the information if any member is canceled with a new entry.</li> </ol>	CO507.2
4.	Write C++ program for storing binary numbers using doubly linked lists. Write functions- <ol style="list-style-type: none"> <li>a) To compute 1's and 2's complement.</li> <li>b) Add two binary numbers.</li> </ol>	CO507.2
5.	Implement C++ program for expression conversion as infix to postfix and its evaluation using stack based on given conditions: <ol style="list-style-type: none"> <li>a) Operands and operators, both must be single characters.</li> <li>b) Input Postfix expression must be in a desired format.</li> <li>c) Only '+', '-', '*' and '/' operators are expected.</li> </ol>	CO507.3
6.	Write a program that uses a stack to check whether parentheses in a given expression are balanced. The expression can include parentheses (), curly braces {}, and square brackets [].	CO507.3
7.	Write C++ program with a recursive function for generating all possible configurations	CO507.3

	for the 4-queen's problem. (Use a queue data structure to store and manage the positions of the queens.).	
8.	Pizza parlor accepting maximum M orders. Orders are served on a first come first served basis. Order once placed cannot be canceled. Write C++ program to simulate the system using a circular queue using arrays.	<b>CO507.3</b>
9.	Implement an AVL tree data structure, a self-balancing binary search tree. Include operations for insertion, deletion, searching, and traversal. Verify the balancing property of AVL trees after each insertion and deletion operation.	<b>CO507.4</b>
10.	A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide a facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Search Tree for implementation.	<b>CO507.4</b>
11.	There are flight paths between cities. If there is a flight between city A and city B then there is an edge between the cities. The cost of the edge can be the time that flight takes to reach city B from A, or the amount of fuel used for the journey. Represent this as a graph. The node can be represented by the airport name or name of the city. Use adjacency list representation of the graph or use adjacency matrix representation of the graph. Check whether the graph is connected or not. Justify the storage representation used.	<b>CO507.5</b>
12.	You have a business with several offices; you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Solve the problem by Graph data structures & Prim's algorithm and /or Kruskal's algorithm.	<b>CO507.5</b>
13.	Consider the telephone book database of N clients. Make use of a hash table implementation to quickly look up a client's telephone number. Make use of two collision handling techniques and compare them using the number of comparisons required to find a set of telephone numbers.	<b>CO507.5</b>
14.	Implement all the functions of a dictionary (ADT) using hashing and handle collisions using chaining with / without replacement. Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique. Standard Operations: Insert (key, value), Find(key), Delete(key).	<b>CO507.5</b>
15.	Write a program for Employee Performance Evaluation Sorting System- A company has collected performance evaluation data for its employees over the past year. The dataset contains records of employee IDs and their corresponding performance scores. The company needs to implement a system to sort this data based on performance scores in ascending order using various sorting methods.	<b>CO507.6</b>
16.	Consider ABC Inc. has gathered a team of software engineers and data scientists to conduct research and experimentation with various searching methods. Write a program to analyze the performance of different algorithms and make informed decisions	<b>CO507.6</b>

	regarding the implementation of the search functionality.	
	<b>List of Project</b>	
	<b>Map Navigator (Dijkstra's Algorithm) / Shopping Cart App / To-Do list.</b>	<b>CO507.1 - CO507.6</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
1. Brassard and P. Bratley, "Fundamentals of Algorithmics", Prentice Hall India/Pearson Education, ISBN 9788120311312.		
<b>Virtual Laboratory (links):</b>		
1. <a href="https://ds2-iiith.vlabs.ac.in/">https://ds2-iiith.vlabs.ac.in/</a>		
<b>MOOC Courses (Web Links):</b>		
1. Data Structures and Algorithms, Prof. Naveen Garg Department of Computer Science and Engineering, IIT Delhi. Web Link: <a href="https://nptel.ac.in/courses/106102064">https://nptel.ac.in/courses/106102064</a>		
2. Programming Data Structures and Algorithms, Dr. N S. Narayanaswamy Department of Computer Science Engineering, IIT Madras. Web Link: <a href="https://nptel.ac.in/courses/106106133">https://nptel.ac.in/courses/106106133</a>		

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO507.1	3	3	3	-	2	-	-	1
CO507.2	3	3	3	-	2	-	-	1
CO507.3	3	3	3	-	2	-	-	1
CO507.4	3	3	3	-	2	-	-	1
CO507.5	3	3	3	-	2	-	-	1
CO507.6	3	3	3	-	2	-	-	1
CO507	3	3	3	-	2	-	-	1

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA10502</b>		<b>Course Name: Laboratory Practice - I</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> Practical: 02 Hrs./ week	<b>Credit:</b> 01	<b>Examination Scheme:</b> Term work (TW): 25 Marks
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To learn and apply various search strategies for AI.</li> <li>• To Formalize and implement constraints in search problems.</li> <li>• To learn interfacing of sensors and actuators using Arduino Uno/Raspberry Pi.</li> <li>• To learn and understand IoT platforms and its significance for real time applications.</li> <li>• Gain knowledge in extracting, transforming, and loading data from various sources into BI tools.</li> <li>• Increase proficiency in practical skills for Business Intelligence.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		
<b>Software Development Methodologies</b>		
CO508.1: Prepare the SRS plan for real world application.		
CO508.2: Develop project management plan using Agile Tool.		
<b>Elective I(A)- (Artificial Intelligence)</b>		
CO508A.3: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.		
CO508A.4: Design an interactive AI application.		
<b>Elective I(B)- (Internet of Things)</b>		
CO508B.3: Develop Smart applications using IoT.		
CO508B.4: Develop IoT application based on cloud environment.		
<b>Elective I(C)- (Data Mining and Business Intelligence)</b>		
CO508C.3: Apply supervised and unsupervised learning techniques.		
CO508C.4: Create visualizations using appropriate tools and techniques.		
<b>Sr. No.</b>	<b>List of Laboratory Assignments/Experiments/Activity</b>	<b>CO Mapping</b>
<b>Group A (Software Development Methodologies)</b>		
1.	Write Software Requirement Specification for ATM System / any real world application.	CO508.1
2.	Draw UML Diagram for ATM System / any real world application.	CO508.1
3.	Create Project Management Process for ATM System / any real world application using	CO508.2

	Agile tools and techniques.	
4.	Estimate the cost for implementation of ATM System / any real world application.	CO508.2
<b>Group B (Elective I)</b>		
<b>Elective I(A)- (Artificial Intelligence)</b>		
5.	Implement depth first search algorithm and Breadth First Search algorithm. Use an undirected graph and develop a recursive algorithm for searching all the vertices of a graph or tree data structure.	CO508A.3
6.	Implement A star (A*) Algorithm for any game search problem.	CO508A.3
7.	Implement Stock market trading Expert System.	CO508A.4
8.	Develop an elementary Chabot for any suitable customer interaction application.	CO508A.4
<b>Elective I(B)- (Internet of Things)</b>		
5.	Design and implement an IoT system using Arduino Uno/ Raspberry Pi using 'Ultrasonic sensor and Servo motor' such as 'Door opener in home automation'.	CO508B.3
6.	Write a program to control the color of the LED by turning 3 different potentiometers. One will be read for the value of Red, one for the value of Green, and one for the value of Blue.	CO508B.3
7.	Design and implement parameter monitoring IoT system keeping records on Cloud such as 'environment humidity and temperature monitoring'.	CO509B.4
8.	Create a small dashboard application to deploy on cloud.	CO509B.4
<b>Elective I(C)- (Data Mining and Business Intelligence)</b>		
5.	Perform the data classification algorithm using any classification algorithm.	CO508C.3
6.	Perform the data clustering algorithm using any clustering algorithm.	CO508C.3
7.	Create different Visualizations for given dataset: <a href="https://www.kaggle.com/datasets/fmendes/office-supply-sales">https://www.kaggle.com/datasets/fmendes/office-supply-sales</a> i. Bar chart. ii. Line Chart. iii. Pie Chart. iv. Stacked Bar Chart. v. Clustered Column Chart. vi. Area Chart. vii. Combo Chart.	CO508C.4
8.	Create Dashboard for Job market analysis.	CO508.4
<b>Learning Resources</b>		

**Text Books:**

1. Roger S Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill, Seventh or Eighth edition ISBN 0073655783.
2. Ronald Brachman and Hector Levesque, "Knowledge Representation and Reasoning", ISBN: 1-55860-932-6.
3. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", 2014, Universities Press (India) Pvt Ltd., ISBN: 978 81 7371 954 7.
4. Grossmann W, Rinderle-Ma, "Fundamental of Business Intelligence", Springer, ISBN: 978- 662-46531-8.

**Virtual Laboratory (links):**

1. <http://cse18-iiith.vlabs.ac.in/Introduction.html?domain=Computer%20Science>
2. <http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php>
3. [Virtual IoT Lab DEI \(iotvirtuallab.github.io\).](https://github.com/iiitvlab/iiitvlab)

**MOOC Courses (Web Links):**

1. The Business Intelligence Analyst Course 2024, 365 Careers, Udemy.  
<https://www.udemy.com/course/the-business-intelligence-analyst-course-2018>
2. Introduction to Internet of Things, Prof. Sudip Misra, IIT Kharagpur.  
<https://nptel.ac.in/courses/106/105/106105166/>
3. Introduction to Artificial Intelligence, Prof. Anupam Basu, Prof. S. Sarkar, IIT Kharagpur.  
<https://nptel.ac.in/courses/106105077>
4. Software Project Management, Prof. Rajib Mall & Prof. Durga Prasad Mohapatra, IIT Kharagpur.  
[https://onlinecourses.nptel.ac.in/noc19\\_cs70/preview](https://onlinecourses.nptel.ac.in/noc19_cs70/preview)

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
<b>Software Development Methodologies</b>								
CO508.1	3	3	3	3	-	2	2	2
CO508.2	3	3	3	3	-	2	2	2
<b>Elective I(A)- (Artificial Intelligence)</b>								
CO508A.3	3	3	3	3	-	-	-	-
CO508A.4	3	3	3	3	-	-	-	-
<b>Elective I(B)- (Internet of Things)</b>								
CO508B.3	3	3	3	3	-	-	-	-
CO508B.4	3	3	3	3	-	-	-	-
<b>Elective I(C)- (Data Mining and Business Intelligence)</b>								
CO508C.3	3	3	3	3	-	-	-	-
CO508C.4	3	3	3	3	-	-	-	-
CO508	3	3	3	3	-	2	2	2

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: HRT04501</b>		<b>Course Name: Human Rights-I</b>
<b>Semester: I</b>		
<b>Teaching Scheme:</b> <b>Practical: 02 Hrs./ week</b>	<b>Credit:</b> <b>Practical: 01</b>	<b>Examination Scheme:</b> <b>Term work (TW): 25 Marks</b>
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To understand the basics of human values and rights.</li> <li>• To understand the brief history of human rights in international and national perspective.</li> <li>• To acquaint with terminology of various legal instruments to protect Human Rights.</li> <li>• To know the effort taken by UN for protecting Human Rights.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		
<b>CO509.1: Recall</b> the basics of human values.		
<b>CO509.2: Compare</b> the concept of rights and duties.		
<b>CO509.3: Identify</b> the terminology of various legal instruments.		
<b>CO509.4: Analyze</b> the efforts taken by United Nations for protecting Human Rights.		
Sr. No.	List of content to be covered in assignments or activity	CO Mapping
1.	<b>Case Study Analysis</b> of human rights from national and international courts to understand the application and impact of human rights laws.	<b>CO509.1</b>
2.	<b>Debate</b> on contemporary human rights issues, such as freedom of speech vs. hate speech or privacy vs. security.	<b>CO509.1</b>
3.	<b>Role-Playing:</b> Simulate United Nations Human Rights Council meetings where students represent different countries or NGOs and debate human rights issues.	<b>CO509.2</b>
4.	<b>Report Review:</b> students have to research a report on recent human rights violations in different parts of the world and review the report to highlighting the involved rights and the response of the community.	<b>CO509.2</b>
5.	<b>Role Play</b> to explore the legal aspects of human rights violations and the role of different legal instruments.	<b>CO509.3</b>
6.	<b>Article Writing</b> on topics like the significance of human dignity, the importance of diversity, or the relationship between rights and duties.	<b>CO509.3</b>
7.	<b>Analyzing RTI or RTE Act</b> to understand the importance and provisions related to rights.	<b>CO509.4</b>
8.	<b>Use simulation games</b> to teach about the various types of legal instruments, such as treaties and protocols, and their real-world applications.	<b>CO509.4</b>
9.	Facilitate a <b>group discussion</b> on ethical and moral principles, discussing how they intersect with legal rights and duties, have students analyze different types of legal instruments, such as covenants and treaties, to understand their binding nature and implications.	<b>CO509.4</b>
10.	<b>Article Review</b> on role of UN in protecting human rights.	<b>CO509.3</b>
Learning Resources		
<b>Text Books:</b> 1. Rhona K. M. Smith, Textbook on International Human Rights, 7th Edition, Oxford University Press, 2016, ISBN: 9780198746218.		

**Reference Books:**

1. H.O. Agarwal, Human Rights, 21st Edition, Central Law Publications, 2020, ISBN: 978-9388267915.

**MOOC Courses (Web Links):**

1. <https://www.humanrights.com/course/>
2. <https://academy.amnesty.org/learn/course/external/view/elearning/115/an-introduction-to-human-rights>

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO509.1	1	-	-	-	-	1	-	1
CO509.2	1	-	-	-	1	1	-	1
CO509.3	1	-	-	-	1	1	-	1
CO509.4	1	-	-	-	-	1	-	1
CO509	1	-	-	-	1	1	-	1

P.E.S. Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01551</b>		<b>Course Name: Operating Systems and Computer Networks</b>
<b>Semester : II</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> Cumulative Internal Examination (CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To acquire knowledge of various functions of the operating system.</li> <li>• To learn disk structure &amp; file management in an operating system.</li> <li>• To study the fundamental concepts of networking standards, protocols and technologies.</li> <li>• To acquire knowledge of various layers protocols.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO510.1: Describe</b> fundamentals of Operating System & Process Management.		Unit I
<b>CO510.2: Select</b> various memory management techniques and disk scheduling algorithms.		Unit II
<b>CO510.3: Discuss</b> Linux processes and memory management.		Unit III
<b>CO510.4: Explain</b> networking basics.		Unit IV
<b>CO510.5: Identify</b> data link layer protocols and standards.		Unit V
<b>CO510.6: Summarize</b> application & transport layer protocols.		Unit VI
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Operating Systems &amp; Process Management</b>	<b>07 Hours</b>
<b>Operating Systems:</b> Introduction, types, services, structure. <b>Process Management:</b> Process concept, process model, process creation, termination, hierarchies, states. PCB, multithreading models. <b>Process Scheduling:</b> Criteria, algorithms, process synchronization, critical section, Peterson's solution, semaphores, IPC Problems - readers and writers, producer & consumer, monitors, atomic transactions. <b>Deadlock:</b> Characterization, deadlock prevention, detection and avoidance, recovery, banker's algorithm.		
<b>Unit II</b>	<b>Memory Management &amp; Storage Management</b>	<b>07 Hours</b>
<b>Memory Management:</b> Introduction, swapping, contiguous memory allocation, segmentation paging, structure of the page table. <b>Virtual Memory:</b> Introduction, demand paging, page replacement algorithms. <b>Storage Management:</b> Introduction to file system structure, access methods, directory and disk structure, file allocation methods, disk scheduling algorithms.		
<b>Unit III</b>	<b>Linux Operating System</b>	<b>07 Hours</b>

<b>Linux Operating System:</b> Introduction, Design principles, kernel modules, process management , scheduling , memory management, file system, I/O , Inter-process communication, network structure, security.		
<b>Unit IV</b>	<b>Fundamentals of Networking</b>	<b>07 Hours</b>
<p><b>Introduction to Networking:</b> Basics of network technology, types of computer networks, network protocols, network topologies, network media – transmission media, network devices.</p> <p><b>Reference Models:</b> OSI Model, TCP/IP Model, Comparison between OSI and TCP/IP models.</p> <p>Transmission Media : Guided, Wireless, Spectrum, Satellites.</p>		
<b>Unit V</b>	<b>Data Link Layer and Network Layer</b>	<b>07 Hours</b>
<p><b>Data link layer:</b> Design issues, services, Framing, error control, Flow control, Protocols-Simplex link layer protocols, Sliding Window protocol.</p> <p><b>Medium Access Control sublayer:</b> Channel allocation –static, dynamic, Multiple Access Protocols-ALOHA, Carrier Sense Multiple Access Protocols(CSMA).</p> <p><b>Network Layer:</b> Design issues, Routing algorithms, Protocols-IP Version 4 , IP Version 6, Open Shortest Path First, Border Gateway Protocols.</p>		
<b>Unit VI</b>	<b>Transport Layer and Application Layer</b>	<b>07 Hours</b>
<p><b>Transport Layer:</b> Services, Elements of transport Protocols-Transmission Control Protocol(TCP), User Datagram Protocol(UDP).</p> <p><b>Application Layer:</b> Overview of Domain Name System, Electronic mail architecture and services, overview of World Wide Web architecture, Dynamic web pages and web applications, Hypertext Transfer Protocols(HTTP) , Hypertext Transfer Protocol Security(HTTPS).</p>		
<b>Total Hrs.</b>		<b>42</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
<ol style="list-style-type: none"> <li>1. William Stallings, Operating System: Internals and Design Principles, Pearson, 7<sup>th</sup> Edition. ISBN: - 978-93-325-1880-3.</li> <li>2. Andrew S. Tanenbaum &amp; Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4<sup>th</sup> Edition ISBN: - 978-93-325-7577-6.</li> <li>3. Andrew S. Tanenbaum, Nick Feamster, Devid J Wethrall, “Computer Networks”, PHI, ISBN: 81-203-2175-8.</li> <li>4. Fourauzan B., "Data Communications and Networking", 5<sup>th</sup> Edition, Tata McGraw- Hill, Publications, ISBN: 0 – 07 – 058408 – 7.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Tom Adelstein and Bill Lubanovic, “Linux System Administration”, O“Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526.</li> <li>2. Harvey M. Deitel, “Operating Systems”, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978- 0131828278</li> <li>3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Wiley, 9<sup>th</sup> Edition. ISBN: -978-81-265-5427-0.</li> <li>4. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols” Prentice Hall, ISBN-10: 8131706885; ISBN-13: 978-8131706886.</li> <li>5. James F. Kurose, Keith W. Ross , Computer Networking – A top Dow Approach – 5<sup>th</sup> Edition, ISBN : 978-81-317-9054-0.</li> </ol>		
<b>MOOC Courses (Web Links):</b>		
<ol style="list-style-type: none"> <li>1. Operating System, Prof. Sorav Bansal, IIT Delhi. <a href="https://nptel.ac.in/courses/106102132">https://nptel.ac.in/courses/106102132</a></li> <li>2. Linux Operating System, Prof Kannan Moudgalya, IIT Bombay. <a href="https://onlinecourses.swayam2.ac.in/aic20_sp24/">https://onlinecourses.swayam2.ac.in/aic20_sp24/</a></li> </ol>		

3. Computer Networks and Internet Protocol, Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty, IIT Kharagpur. [https://onlinecourses.swayam2.ac.in/aic20\\_sp24/](https://onlinecourses.swayam2.ac.in/aic20_sp24/)
4. Computer Networks, Prof. Hema A Murthy, IIT Madras. <https://nptel.ac.in/courses/106106091>

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO510.1	3	3	2	-	-	-	-	-
CO510.2	3	3	2	-	-	-	-	-
CO510.3	3	3	2	-	-	-	-	-
CO510.4	3	2	2	-	-	-	-	-
CO510.5	3	2	2	-	-	-	-	-
CO510.6	3	2	2	-	-	-	-	-
CO510	3	2.5	2	-	-	-	-	-

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: CYS06551</b>		<b>Course Name: Introduction to Cyber Security</b>
<b>Semester: II</b>		
<b>Teaching Scheme:</b> Lecture: 04 Hrs./ week	<b>Credit: Theory: 04</b>	<b>Examination Scheme:</b> <b>Cumulative Internal Examination (CIE): 40 Marks</b> <b>Semester-End Examination (SEE) (Paper): 60 Marks</b>
<b>Course Prerequisite:</b> <ul style="list-style-type: none"> <li>Basic knowledge of the Internet and World Wide Web.</li> </ul>		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To protect and defend computer systems and networks.</li> <li>To plan, implement and monitor cyber security mechanisms to ensure protection of Information Technology Assets.</li> <li>To identify, analyze and remediate computer security breaches.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO511.1: Classify</b> various cybercrimes using IT Act 2000.		Unit I
<b>CO511.2: Make use of</b> cyber security tools, methods and cryptography techniques.		Unit II
<b>CO511.3: Apply</b> different processes for cyber forensics.		Unit III
<b>CO511.4: Explain</b> the diverse legal, social, ethical viewpoint of cybercrimes.		Unit IV
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Cyber Crimes</b>	<b>10 Hours</b>
<b>Introduction to Cyber Crimes:</b> Cyber-crime definition and origins of the world, cybercrime and information security, classification of cybercrimes, cyber defamation, web jacking, forgery, pornographic offences, software piracy, credit card frauds, identity theft, cybercrime and the IT Act 2000, a global perspective on cybercrimes.		
<b>Unit II</b>	<b>Basic Cryptography, Tools and Methods used in Cybercrimes</b>	<b>10 Hours</b>
<b>Introduction to Cryptography:</b> Data encryption standards, other classical ciphers, public key cryptography, private key cryptography, cryptographic checksums, applications of cryptography. <b>Introduction to tools and Methods:</b> Proxy servers, phishing, password cracking, keyloggers and spywares, virus and worms, Trojan horses and backdoors, steganography, DoS (Denial of Service) and DDoS (Distributed Denial of Service) attacks, SQL injection, buffer overflow, attacks on wireless networks, identity theft.		
<b>Unit III</b>	<b>Computer Forensics</b>	<b>10 Hours</b>
<b>Introduction to Computer Forensics:</b> Digital forensics science, the need for computer forensics, cyber forensics and digital evidence, digital forensics life cycle, chain of custody concept, network forensics, approaching computer forensics investigation, forensics and social networking sites, challenges in computer		

forensics.		
<b>Unit IV</b>	<b>Legal, Social, Ethical and Psychological Aspects of Cyber Crimes</b>	<b>10 Hours</b>
<p><b>Introduction to Legal perspective:</b> Cybercrime and legal landscape around the world, need of cyber laws, The Indian context of cyber laws, The Indian IT Act, challenges to Indian law, cybercrime scenario in India, digital signatures and the Indian IT Act, amendments to the Indian IT Act, cybercrimes and punishments.</p> <p><b>Introduction to Intellectual property related crimes:</b> copyright, patent, trademarks, trade secrets, trade name, domain name, ethical dimension of cybercrimes, the psychology, mindset and skills of hackers and other cyber criminals, sociology of cyber criminals, information warfare.</p>		
<b>Total Hours</b>		<b>40 Hours</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
<ol style="list-style-type: none"> <li>1. Nina Godbole, "Cyber Security: Understanding cyber-crimes, Computer Forensics and Legal perspective" WILEY India Pvt.Ltd, ISBN: 978-81-265-2179-1.</li> <li>2. Matt Bishop, "Introduction to Computer Security", Pearson Education ISBN: 978-81-775-8425-7.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Dr. Jyoti Rattan, "Cyber Laws and Information Technology" by Bharat law House Pvt. Ltd. ISBN: 978-93-5139-470-9.</li> <li>2. Ankit Fadia, "An unofficial guide to Ethical Hacking", by Macmillan publishers India Ltd. ISBN:13:978-1403-92964-8.</li> <li>3. M.V. Arun Kumar, "Network Security", University Science Press", ISBN:978-93-80856-72-8.</li> <li>4. Justice Yatindra Singh, "Cyber Laws", Universal law publishing company, ISBN: 978-81-7534-831-8.</li> </ol>		
<b>MOOC Courses (Web Links):</b>		
<ol style="list-style-type: none"> <li>1. Ethical Hacking by Prof. Indranil Sen Gupta- IIT Kharagpur. <a href="https://nptel.ac.in/courses/106105217">https://nptel.ac.in/courses/106105217</a></li> <li>2. Cyber Security and Privacy by Prof. Saji K Mathew –IIT Madras. <a href="https://onlinecourses.nptel.ac.in/noc23_cs127/preview">https://onlinecourses.nptel.ac.in/noc23_cs127/preview</a></li> </ol>		

### CO-PO Mapping Matrix of the course,

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
<b>CO511.1</b>	3	3	-	-	-	-	-	-
<b>CO511.2</b>	3	3	-	-	-	-	-	-
<b>CO511.3</b>	3	3	-	-	-	-	-	-
<b>CO511.4</b>	3	3	-	-	-	-	3	-
<b>CO511</b>	<b>3</b>	<b>3</b>	-	-	-	-	<b>3</b>	-

P.E.S. Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01552</b>		<b>Course Name: Java Programming</b>
<b>Semester: II</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> Cumulative Internal Examination (CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Prerequisite:</b>		
<ul style="list-style-type: none"> <li>Basic Computer Programming Concepts.</li> </ul>		
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>To learn the core concept of Java programming.</li> <li>To introduce the working environment of Java Program using the multithreading and file handling.</li> <li>To get acquainted with the purpose of applet and AWT in Java programming.</li> <li>To study the use of database connectivity in Java Programming.</li> <li>To gain knowledge of Java Servlet and JSP concepts in Java.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO512.1: Describe</b> the concept of Java programming.		Unit I
<b>CO512.2: Apply</b> the concepts of multithreading and GUI Programming for real world Applications.		Unit II
<b>CO512.3: Explain</b> the concept of network programming.		Unit III
<b>CO512.4: Design</b> real world applications using JDBC.		Unit IV
<b>CO512.5: Develop</b> server side applications using servlet & JSP.		Unit V
<b>CO512.6: Demonstrate</b> the concept of Spring & Hibernate.		Unit VI
<b>Course Contents</b>		
<b>Unit I</b>	<b>An Introduction to Core Java</b>	<b>07 Hours</b>
<b>An Introduction to Java:</b> A Short History of Java, Features of Java, Java Security Creating and Running Java Programs using Command Line Arguments and IDE, Programming Construct (Decision making statement, switch statement, looping statement), Class and Object (Defining a class, adding variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors), Object Oriented concepts with respect to Java. <b>Inheritance:</b> Extending a class, Overriding Method, using super, Final variable and Methods, this keyword), Interfaces, Packages, Exception Handling.		
<b>Unit II</b>	<b>Multithreading and GUI Programming</b>	<b>07 Hours</b>
<b>Multithreading:</b> Multithreading concepts, Thread Life cycle, Creating multithreaded application, Thread priorities, Thread synchronization. <b>Swing:</b> Components and Graphics, Containers, Frames and Panels, Layout Managers, Swing basic components, Event delegation Model: Event source and handler, Event categories, Listeners, interfaces, Anonymous classes, Swing Libraries: Model view Controller design pattern, Different layout, menus dialog boxes, text input.		

Unit III	Java I / O and Networking	07 Hours
<p><b>Java I/O:</b> Java IO package, Byte/Character Stream, Buffered reader / writer, File reader / writer, Print writer, File Sequential / Random.</p> <p><b>Socket and Server Socket</b> classes, URL class, ports, proxy servers, displaying data of a web page, InetAddress class, Datagram Socket and Datagram Packet, Two way communication, Creating client server chat application using TCP Sockets, Creating client server chat application using UDP Sockets, Java Telephone API, JAVA mail API.</p>		
Unit IV	JDBC	07 Hours
<p><b>JDBC:</b> Java database connectivity, Types of JDBC drivers, Writing first JDBC applications, Types of statement objects (Statement, Prepared Statement and Callable Statement), Types of resultset, ResultSetMetadata, Inserting and updating records, JDBC and Swing, Connection pooling.</p>		
Unit V	Servlet and JSP	07 Hours
<p><b>Servlets:</b> Introduction, Web application Architecture, HTTP Protocol &amp; HTTP Methods, Web Server &amp; Web Container, Servlet Interface, HTTPServlet, Generic Servlet, Servlet Life Cycle, Servlet Config, Servlet Context, Servlet Communication: Servlet-Browser CommunicationsendError, setHeader, sendRedirect, Web-Component Communication- Forward, Include, Tracking Mechanisms: Session Object, Cookies, URL-Rewriting, Hidden-Form Fields.</p> <p><b>JSP:</b> Introduction, LifeCycle, JSP Scripting Elements: declaratives, scriptlets, expressions, Implicit Objects, JSP Directives: page, include, taglib, JSPStandard Actions: useBean tag, setProperty tag, getProperty tag.</p>		
Unit VI	Hibernate and Spring	07 Hours
<p><b>Hibernate:</b> Hibernate architecture and features, hibernate elements, Object Relational persistence, working with persistence object, The Hibernate Query Language (HQL) and externalizing queries, Writing Hibernate applications.</p> <p><b>Spring:</b> Overview of spring, the core spring module, wiring beans, aspect-oriented spring, database and managing transactions with swing, building web applications with spring MVC, working with remote services, Managing spring with JMX.</p>		
<b>Total Hours</b>		<b>42</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
<ol style="list-style-type: none"> <li>1. E. Balagurusamy, "Programming with Java A primer", Sixth Edition, McGraw Hill Education (India) Private Limited, ISBN 93-5134-320-0.</li> <li>2. Herbert Schildt, "JAVA Complete Reference", 9th Edition, McGraw Hill Education (India) Private Limited, ISBN: 93-392-1209-6.</li> <li>3. Steven Horlzner, "Java 2 programming black book", Dreamtech Press, ISBN 978-93-5119-940-3.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Kathy Sierra &amp; Bert Bates, "Head First Java", O'relly Publication, ISBN – 81-7366-602-4.</li> <li>2. Paul Deitel, Harvey M. Deitel, "Java SE8 for Programmers", 3<sup>rd</sup> Edition, Pearson, ISBN – 978-93-325-3906-8.</li> <li>3. Bryan Bashan, Kathy Sierra &amp; Bert Bates, "Head First Servlets &amp; JSP", O'relly Publication, ISBN –81-73bb-403-X.</li> </ol>		
<b>MOOC Courses (Web Links):</b>		
<ol style="list-style-type: none"> <li>1. Multithreaded Programming, Debasis Samanta, IIT Kharagpur. <a href="https://onlinecourses.nptel.ac.in/noc24_cs43/unit?unit=58&amp;lesson=60">https://onlinecourses.nptel.ac.in/noc24_cs43/unit?unit=58&amp;lesson=60</a></li> <li>2. Java Object Database Connectivity (ODBC), Debasis Samanta, IIT Kharagpur. <a href="https://onlinecourses.nptel.ac.in/noc24_cs43/unit?unit=98&amp;lesson=99">https://onlinecourses.nptel.ac.in/noc24_cs43/unit?unit=98&amp;lesson=99</a></li> </ol>		

**CO-PO Mapping Matrix of the course,**

<b>CO\PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>
<b>CO512.1</b>	3	-	3	3	-	-	-	1
<b>CO512.2</b>	3	-	3	3	-	-	-	1
<b>CO512.3</b>	3	-	3	3	-	-	-	1
<b>CO512.4</b>	3	-	3	3	-	-	-	1
<b>CO512.5</b>	3	2	3	3	-	-	-	1
<b>CO512.6</b>	3	2	3	3	-	-	-	1
<b>CO512</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	-	-	-	<b>1</b>

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01553</b>		<b>Course Name: Database Systems</b>
<b>Semester: II</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> <b>Cumulative Internal Examination (CIE): 40 Marks</b> <b>Semester-End Examination (SEE) (Paper): 60 Marks</b>
<b>Course Prerequisite:</b> ● MCA01503-Data Structure and Algorithm.		
<b>Course Objectives:</b> ● To study the fundamental concepts of database management systems. ● To apply SQL and PL/SQL queries on databases. ● To learn distributed, XML and NoSQL databases.		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO513.1: Explain</b> basic concepts of database management systems.		Unit I
<b>CO513.2: Design</b> database using the E-R Model for the given requirements.		Unit II
<b>CO513.3: Apply</b> SQL and PL/SQL queries on databases.		Unit III
<b>CO513.4: Describe</b> various Distributed Database system architectures.		Unit IV
<b>CO513.5: Implement</b> various XML scripts according to the database.		Unit V
<b>CO513.6: Make use of</b> Modern database techniques like NOSQL.		Unit VI
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to DBMS</b>	<b>07 Hours</b>
<b>Introduction</b> to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database and Application Architecture, Database users and Administrator.		
<b>Unit II</b>	<b>Database Design Using the E-R Model</b>	<b>07 Hours</b>
<b>Database Design and ER Model:</b> Entity, Attributes, Relationships, mapping cardinalities, Constraints, Keys, ER Diagram, Reducing ER diagrams to relational schemas, Extended E-R Features. <b>Normalization:</b> Need of normalization, Insert, Update and Delete anomalies.,1NF,2NF,3NF normal forms.		
<b>Unit III</b>	<b>SQL and PL/SQL</b>	<b>07 Hours</b>
<b>SQL:</b> Characteristics and advantages, SQL Data Types and Literals, SQL Operators, Tables: Creating, Modifying, Truncate, Drop Views: Creating, Dropping, Updating using Views, Indexes, SQL DML Queries: SQL Insert, Update, Delete, Select Query and clauses, Set Operations, Joins, Aggregate Functions, Nested Queries. <b>PL/SQL:</b> Concept of Stored Procedures and Functions, Cursors, Triggers.		

Unit IV	Distributed Database Architecture and Design	07 Hours
<p><b>Distributed Systems:</b> Introduction of distributed database systems, Features of distributed database, Homogeneous and Heterogeneous distributed databases, Advantages and Disadvantages of distributed systems, Design Issues. <b>Fragmentation:</b> Horizontal Fragmentation, Vertical Fragmentation, Hybrid Fragmentation.</p> <p><b>Distributed DBMS Architecture:</b> Client/Server Systems, Peer-to-peer Distributed Systems, MDBS Architecture.</p> <p><b>Alternative Design Strategies:</b> Top-down design process, Bottom-up design process.</p>		
Unit V	XML Databases	07 Hours
Relational Database Tables and XML, Generating XML pages using Basic SQL, Oracle Database and XML.		
Unit VI	NoSQL Database	07 Hours
<p><b>Types of data:</b> Structured, semi-structured, unstructured data.</p> <p><b>NoSQL Databases:</b> Introduction, Key value store, Document store, Column oriented database, Graph database, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL.</p> <p><b>Big Data:</b> Introduction of Big Data, V's of Big Data.</p> <p><b>HADOOP:</b> Introduction of Hadoop, HDFS, Map Reduce, Hadoop Architecture.</p>		
<b>Total Hours</b>		<b>42</b>
Learning Resources		
<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN0-07-120413-X, 6th edition.</li> <li>Tamer Ozsu, Patrick Valduriez, "Principles of Distributed Database", Third Edition ISBN-978-81-7758-177-5.</li> <li>Gavin Powell, "Beginning XML Databases", Wiley Publishing Inc. ISBN-978-0764570779.</li> <li>Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN10: 0321826620, ISBN-13: 978-0321826626.</li> </ol>		
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719.</li> <li>Saeed K. Rahimi and Frank S. Haug, "Distributed Database Management Systems: A Practical Approach" ISBN-13: 978-1118104757.</li> <li>Elliotte Rusty Harold and W. Scott Means, "XML in a Nutshell" ISBN-13: 978-0596007645.</li> <li>Adam Fowler, "NoSQL for Dummies", John Wiley &amp; Sons, ISBN-1118905628.</li> </ol>		
<p><b>MOOC Courses (Web Links):</b></p> <ol style="list-style-type: none"> <li>Introduction to Database Systems and Design, Prof. P. Sreenivasa Kumar. IIT Madras. <a href="https://nptel.ac.in/courses/106106095">https://nptel.ac.in/courses/106106095</a></li> <li>Database Design, Dr. S. Srinath, Prof. D. Janaki Ram, IISc Bangalore. <a href="http://www.infocobuild.com/education/audio-video-courses/computer-science/database-design-iit-madras.html">http://www.infocobuild.com/education/audio-video-courses/computer-science/database-design-iit-madras.html</a></li> <li>Introduction to Database Systems, Prof. P. Sreenivasa Kumar Swayam, IIT Madra. <a href="https://onlinecourses.nptel.ac.in/noc20_cs03/preview">https://onlinecourses.nptel.ac.in/noc20_cs03/preview</a></li> <li>Database Management System, Dr. B. Lavanya, University of Madras. <a href="https://onlinecourses.swayam2.ac.in/cec21_cs11/preview">https://onlinecourses.swayam2.ac.in/cec21_cs11/preview</a></li> </ol>		

**CO-PO Mapping Matrix of the course,**

<b>CO\PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>
<b>CO513.1</b>	3	3	3	-	-	-	-	-
<b>CO513.2</b>	3	3	3	-	-	-	-	-
<b>CO513.3</b>	3	3	-	-	-	-	-	-
<b>CO513.4</b>	3	3	-	-	-	-	-	-
<b>CO513.5</b>	3	3	-	3	-	-	-	-
<b>CO513.6</b>	3	3	-	3	-	-	-	-
<b>CO513</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	-

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA10551A -ML</b>		<b>Course Name: Elective II(A)-Machine Learning</b>
<b>Semester: II</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> Cumulative Internal Examination (CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Prerequisite:</b>		
<ul style="list-style-type: none"> <li>Mathematical Foundation.</li> <li>Python programming.</li> </ul>		
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>To study fundamentals of machine learning.</li> <li>To acquaint with various machine learning algorithms.</li> <li>To study trends in machine learning.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO514A.1: Explain</b> the basic concepts of Machine Learning.		Unit I
<b>CO514A.2: Describe</b> the types of Machine Learning.		Unit II
<b>CO514A.3: Discuss</b> the Mathematical & Statistical foundation for Machine Learning.		Unit III
<b>CO514A.4: Implement</b> data preprocessing techniques on sample data.		Unit IV
<b>CO514A.5: Build</b> a model using different machine learning modeling techniques.		Unit V
<b>CO514A.6: Apply</b> Python programming for machine learning problems.		Unit VI
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Machine Learning</b>	<b>07 Hours</b>
What is Machine Learning, History and evolution of ML, Applications of ML Applicability boundaries for ML.		
<b>Unit II</b>	<b>Types of Machine Learning</b>	<b>07 Hours</b>
Supervised Learning - Concept and examples, Difference between classification and regression Unsupervised Learning - Concept and examples, Clustering and dimensionality reduction Reinforcement Learning , Basic principles and applications.		
<b>Unit III</b>	<b>Mathematical &amp; Statistical foundation for Machine Learning</b>	<b>07 Hours</b>
Linear Algebra: Vectors, matrices, and operations , Probability and Statistics: Basic concepts of probability, Descriptive and inferential statistics, Optimization, Gradient descent and variants.		
<b>Unit IV</b>	<b>Data lifecycle for Machine Learning</b>	<b>07 Hours</b>
Data Cleaning: Handling missing values, Removing duplicates, Feature Engineering: Feature scaling and normalization, Encoding categorical variables, Dimensionality Reduction: Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA).		
<b>Unit V</b>	<b>Types of Models &amp; Testing</b>	<b>07 Hours</b>
Regression: Linear regression, Polynomial regression, Regularization techniques (Ridge and Lasso), Classification: Logistic regression, Decision trees, Support Vector Machines (SVM), k-Nearest Neighbors (k-NN), Naive Bayes. Ensemble methods (Random Forest, Gradient Boosting). Model Evaluation and Selection,		

Unsupervised Learning Algorithms.		
Unit VI	Programing in python for implementing Machine Learning	07 Hours
Introduction of python relative to ML, Python libraries building for ML models: Python Libraries, NumPy, Pandas, Matplotlib, Scikit-learn, TensorFlow and Keras. Setting up the environment, Implementing and deploying models.		
<b>Total Hours</b>		<b>42</b>
Learning Resources		
<b>Text Books:</b>		
1. Ethem Alpaydin: Introduction to Machine Learning, PHI 3 <sup>rd</sup> Edition, ISBN:978-81-203-5078-6.		
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press,ISBN:978-1-316-50611-0.		
<b>Reference Books:</b>		
1. Parag Kulkarni: Reinforcement Learning and Systemic Machine Learning for Decision Making, IEEE Press, ISBN:978-81-265-5625-0.		
2. Tom Mitchell, Machine Learning Indian Edition, McGraw Hill Education. ISBN:13:978-1-25-909695-2.		
<b>MOOC Courses (Web Links):</b>		
1. Introduction to Machine Learning, Balaraman Ravindran, IIT Madras. <a href="https://nptel.ac.in/courses/106106139">https://nptel.ac.in/courses/106106139</a>		
2. Machine Learning and Deep Learning-Fundamentals And Applications, Prof. M. K. Bhuyan,IIT Guwahati. <a href="https://nptel.ac.in/courses/108103192">https://nptel.ac.in/courses/108103192</a>		

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO514A.1	3	3	3	-	-	-	-	-
CO514A.2	3	3	3	-	-	-	-	-
CO514A.3	3	3	3	-	-	-	-	-
CO514A.4	3	3	3	-	-	-	-	-
CO514A.5	3	3	3	-	-	-	-	-
CO514A.6	3	3	3	3	-	-	-	-
CO514A	3	3	3	3	-	-	-	-

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA10551B-ARVR</b>		<b>Course Name: Elective II(B)- Augmented Reality and Virtual Reality</b>
<b>Semester: II</b>		
<b>Teaching Scheme:</b> Lecture: 03 Hrs./ week	<b>Credit:</b> Theory: 03	<b>Examination Scheme:</b> Cumulative Internal Examination (CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Prerequisite:</b> Artificial Intelligence.		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To understand fundamentals of augmented and virtual reality.</li> <li>• To describe various elements and components used in AR/VR hardware and software.</li> <li>• To understand VR systems and development tools.</li> <li>• To create Augmented Reality applications that allows users to interact with the immersive 3D world.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
<b>CO514B.1: Define</b> the basics of virtual reality and its elements.		Unit I
<b>CO514B.2: Explain</b> the representation of the Virtual world.		Unit II
<b>CO514B.3: Identify</b> the importance of perception, motion and tracking in VR systems.		Unit III
<b>CO514B.4: Explain</b> the basics of augmented reality and challenges.		Unit IV
<b>CO514B.5: Examine</b> the use of various augmented reality components and devices.		Unit V
<b>CO514B.6: Elaborate</b> the emerging role of augmented reality in various sectors.		Unit VI
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Virtual Reality</b>	<b>07 Hours</b>
<b>Introduction:</b> Definition, history, key elements of VR, combining the elements, cyberspace, applications of virtual reality, telepresence, future of virtual reality.		
<b>Unit II</b>	<b>Representing the Virtual World in VR</b>	<b>07 Hours</b>
<b>Interface to the virtual world-input:</b> user monitoring, world monitoring. <b>Interface to the virtual world-output:</b> visual displays, aural displays, haptic displays, vestibular and other senses. <b>Geometry of virtual worlds:</b> Geometric models, changing position and orientation, axis-angle representation of rotation, viewing transformations, changing the transformations.		
<b>Unit III</b>	<b>Visual Perception, Motion and Tracking in VR</b>	<b>07 Hours</b>
<b>Visual perception:</b> perception of depth, perception of motion, perception of color, combining sources of information <b>Visual rendering ray:</b> Tracing and shading models, rasterization, correcting optical distortions, improving latency and frame rates, immersive photos and videos. <b>Motion in real and virtual worlds:</b> Velocities and accelerations, mismatched motion and vection. <b>Tracking:</b> Tracking 2d orientation, tracking 3d orientation.		
<b>Unit IV</b>	<b>Introduction to Augmented Reality</b>	<b>07 Hours</b>

<b>Introduction:</b> Definition, components of augmented reality, history, differences between augmented reality and virtual reality.		
<b>Challenges with AR:</b> Technical challenges of augmented reality, social challenges of augmented reality, working of augmented reality.		
<b>Unit V</b>	<b>Augmented Reality Components and Devices</b>	<b>07 Hours</b>
<b>Multimodal Displays:</b> Audio Displays, Haptic, Tactile, and Tangible Displays, Olfactory and Gustatory Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays.		
<b>Tracking and Sensors:</b> Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.		
<b>Unit VI</b>	<b>Augmented Reality Techniques</b>	<b>07 Hours</b>
<b>Markers in AR:</b> Marker-based, Marker-less, Template markers, 2D barcode markers, imperceptible markers, marker use, Localization-based augmentation, real-world examples Tracking methods- Visual tracking, feature-based tracking, hybrid tracking, initialization and recovery.		
<b>AR Interfaces:</b> Tangible AR interface, Collaborative AR interfaces, hybrid AR interfaces, multimodal AR interfaces. <b>AR development tools:</b> ARToolKit, ARCore, ARKit.		
<b>AR Applications:</b> Education, medicine ,military ,engineering and architecture, entertainment.		
<b>Total Hours</b>		<b>42</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
1. William R Sherman and Alan B Craig, “Understanding Virtual Reality: Interface, Application and Design”, (The Morgan Kaufmann Series in Computer Graphics), Morgan Kaufmann Publishers, San Francisco, CA, 2002, ISBN:1-55860-353-0.		
2. Steven M. LaValle, “Virtual Reality”, Cambridge University Press, 2016.		
3. Zeynep Tacgin, “Virtual and Augmented Reality- An Educational Handbook”, Cambridge Scholars Publishing ,2020, ISBN:1-5275-4813-9.		
<b>Reference Books:</b>		
1. Kharis O'Connell, “Designing for Mixed Reality”, O'Reilly Media, Inc., 2016, ISBN: 9781491962381.		
2. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.		
3. Millington, Ian, “Artificial Intelligence for Games”, 3 rd edition, CRC Press, 2019.		
<b>MOOC Courses (Web Links):</b>		
1. Fundamentals of Augmented Reality & Virtual Reality,Dr. José Prabhu J,Udemy. <a href="https://www.udemy.com/course/fundamentals-of-augmented-reality-virtual-reality-101-ar-vr/?couponCode=LEADERSALE24A">https://www.udemy.com/course/fundamentals-of-augmented-reality-virtual-reality-101-ar-vr/?couponCode=LEADERSALE24A</a>		

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO514B.1	3	3	2	2	-	-	-	-
CO514B.2	3	3	2	2	-	-	-	-
CO514B.3	3	3	2	2	-	-	-	-
CO514B.4	3	3	2	2	-	-	-	-
CO514B.5	3	3	2	2	-	-	-	-
CO514B.6	3	3	2	2	-	-	-	-
CO514B	3	3	2	2	-	-	-	-

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Course)		
Course Code: MCA10551C-BDA		Course Name: Elective II(C)- Big Data Analytics
Semester: II		
Teaching Scheme: Lecture: 03 Hrs./ week	Credit: Theory: 03	Examination Scheme: Cumulative Internal Examination(CIE): 40 Marks Semester-End Examination (SEE) (Paper): 60 Marks
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To introduce students to basic concepts, terms, applications of big data.</li> <li>To apprehend Analytical Methods in big data analytics.</li> <li>To acquaint with tools like Hadoop, NoSQL, MapReduce which are required to manage and analyze big data.</li> <li>To visualize big data using different tools.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		Mapping of Course Outcome to Unit
CO514C.1: Elaborate concepts of Big Data Analytics.		Unit I
CO514C.2: Explain Big Data Analytics Life Cycle.		Unit II
CO514C.3: Utilize the Big data management tools in real world application.		Unit III
CO514C.4: Apply NoSQL operations for big data analysis.		Unit IV
CO514C.5: Make use of various big data visualization techniques.		Unit V
CO514C.6: Develop various applications of Big Data in real world problems.		Unit VI
Course Contents		
Unit I	Introduction to Big Data Analytics	07 Hours
<b>Introduction to Big Data:</b> evolution, characteristics - volume, velocity, variety, veracity, structuring big data, challenges with big data, traditional business intelligence versus big data, big data analytics, advantages of big data analytics, future of big data, careers in big data.		
Unit II	Big Data Analytics Life Cycle	07 Hours
<b>Data Analytic Life Cycle:</b> Introduction to big data analytics life cycle, sources of big data, phase 1: discovery, phase 2: data preparation, phase 3: model planning, phase 4: model building, phase 5: communication result, phase6: operations.		
Unit III	Big Data Management	07 Hours
<b>Operational Databases:</b> Importance of RDBMS in big data, PostgreSQL, MongoDB, CouchDB, HBase. <b>MapReduce Fundamentals:</b> The MapReduce framework, features of MapReduce, working of MapReduce, exploring map and reduce function, Uses of MapReduce. <b>Hadoop:</b> Introduction to Hadoop, Hadoop ecosystem, Hadoop distributed file system, HDFS architecture, HDFS commands, features of HDFS.		
Unit IV	Introduction to NoSQL and MongoDB	07 Hours
<b>NoSQL:</b> Introduction to NoSQL, characteristics of NoSQL, history of NoSQL, types of NoSQL. <b>MongoDB:</b> Introduction to MongoDB, using JSON to store the data, creating or generating a unique key, terms used in RDBMS and MongoDB, data types in MongoDB, create database, drop database, MongoDB, CRUD operations, insert method, save method, update method, remove method, find method, dealing with null values, count, limit, sort and skip methods, arrays, aggregate function, MapReduce function, java script programming, cursors, MongoImport, MongoExport, automatic generation of unique numbers.		

Unit V	Data Visualization	07 Hours
<p><b>Data Visualization:</b> Ways of representing visual data, techniques for visual data representation, type of data visualization, applications of data visualization, visualizing big data, deriving business solutions, turning data into information, tools used in data visualization.</p> <p><b>Introduction to Tableau:</b> Tableau software, installation of tableau public, operations on data in tableau, data analytics in tableau public, using visual controls in tableau public.</p>		
Unit VI	Big Data in Business Context	07 Hours
Big data in social networking, marketing, product design and development, use of big data in preventing fraudulent activities, use of big data in retail industry, social media analytics, text analytics, mobile analytics.		
<b>Total Hours</b>		<b>42</b>
Learning Resources		
<p><b>Text Books:</b></p> <p>1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley, ISBN: 978-81-265-5478-2.</p>		
<p><b>Reference Books:</b></p> <p>1. DT Editorial Services, “Big Data Black Book”, dreamtech press, ISBN: 978-93-5119-931-1.</p> <p>2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, Wiley, ISBN: 978-81-265-4328-1.</p>		
<p><b>MOOC Courses (Web Links):</b></p> <p>1. Master Big Data - Apache Spark/Hadoop/Sqoop/Hive/Flume/Mongo, Navdeep Kaur, Udemy.  <a href="https://www.udemy.com/course/big-data-ingestion-using-sqoop-and-flume-cca-and-hdpcd/?couponCode=LEADERSALE24A">https://www.udemy.com/course/big-data-ingestion-using-sqoop-and-flume-cca-and-hdpcd/?couponCode=LEADERSALE24A</a></p> <p>2. Big Data Computing, Dr. Rajiv Misra, IIT Patna, NPTEL.  <a href="https://onlinecourses.nptel.ac.in/noc20_cs92/preview">https://onlinecourses.nptel.ac.in/noc20_cs92/preview</a></p>		

#### CO-PO Mapping Matrix of the course,

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO514C.1	-	-	-	-	-	-	-	-
CO514C.2	2	2	-	-	-	-	-	-
CO514C.3	3	3	3	3	-	-	-	-
CO514C.4	3	3	3	3	-	-	-	-
CO514C.5	3	3	3	3	-	-	-	-
CO514C.6	2	2	2	-	-	-	-	-
CO514C	2.6	2.6	2.8	3	-	-	-	-

P.E.S. Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01554</b>		<b>Course Name: Java Programming Laboratory</b>
<b>Semester: II</b>		
<b>Teaching Scheme:</b> Practical: 04 Hrs./ week	<b>Credit:</b> 02	<b>Examination Scheme:</b> Term work (TW): 25 Marks Practical (PR) / Oral (OR): 25 Marks
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>● To learn the core concept of Java programming.</li> <li>● To introduce the working environment of Java Program using the multithreading and file handling.</li> <li>● To get acquainted the purpose of applet and AWT in Java programming.</li> <li>● To study the use of database connectivity in Java Programming.</li> <li>● To gain knowledge of Java Servlet and JSP concept in Java.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		
<b>CO515.1: Apply</b> core concept of Java programming to write program.		
<b>CO515.2: Construct</b> application by using multithreading and GUI Programming.		
<b>CO515.3: Develop</b> real world applications using IO & Networking.		
<b>CO515.4: Develop</b> Java applications to interact with the database using JDBC.		
<b>CO515.5: Design</b> server side applications using servlet & JSP.		
<b>CO515.6: Demonstrate</b> the concept of Spring & Hibernate.		
<b>Sr. No.</b>	<b>List of Laboratory Assignments/Experiments/Activity</b>	<b>CO Mapping</b>
1.	Create a hierarchy of Employee, Manager, Sales Manager, they should have the following functionality: a) Employee: Display name, date of birth and id of Employee. b) Manager: Display all above information with salary drawn. Sales Manager: Display all above information and commission if applicable.	<b>CO515.1</b>
2.	Write a Java program to calculate salary using packages. Creates a package employee and create a class Emp. Data members are name, employee id, category, basic pay, HRA, DA, net pay, provident fund, gross pay, income tax, and allowance. Calculate the values in methods. Call the methods to perform and print values.	<b>CO515.1</b>
3.	Write a program to accept roll no. Marks from users. Throw user defined exception Marks out of Bound if marks are <0 or marks>100.	<b>CO515.1</b>
4.	Write a program that simulates a traffic signal light with short delay between states.	<b>CO515.2</b>
5.	Write a program to design an admission enquiry form using Swing.	<b>CO515.2</b>
6.	Create a Java Desktop application to find the area of circle, rectangle, circumference of circle and area of square. Design the IDE and programming logic with two JPanel containers contains the following: -JPanel1. Add three JRadioButtons and set the buttons as: Circle, Rectangle and Square.-JPanel2. Add four JCheckBoxes and set the buttons as Area, Perimeter, Circumference. When you select an option from JPanel1, it automatically hides the facilities which is not appropriate for selected option. Similarly, apply the same for JTextfield controls. a) Write the code for circle JRadioButton to make available the display controls which are appropriate for Circle operation.	<b>CO515.2</b>

	<ul style="list-style-type: none"> <li>b) Write the code for Rectangle JRadioButton to make available the display controls which are appropriate for Rectangle operation.</li> <li>c) Write the code for Square JRadioButton to make available the display controls which are appropriate for Square operation.</li> <li>d) Write the code for Calculate button to calculate the desired operations which you choose from JRadioButtons.</li> <li>e) Write the code for Exit button to exit application.</li> </ul>	
7.	Write a Java Socket program for client server chatting application.	<b>CO515.3</b>
8.	Write a program to establish connection between client and server use datagram packet & socket.	<b>CO515.3</b>
9.	Write a Java program to concatenate multiple text files sequentially into single file. Accept file names from command line arguments.	<b>CO515.3</b>
10.	Design GUI based JDBC application to navigate (first, last, next, previous) through student records. (Assume suitable table structure).	<b>CO515.4</b>
11.	Write JDBC backend class, which establishes a connection with the database having a table "STUDENT" with structure – roll no, name, class, DOB. Using the above backend class WAP to accept roll_no from command line and display the details with proper error messages. Display all the records from table with proper formatting.	<b>CO515.4</b>
12.	Write a Java program to display the employee id, age, Date of joining, first name and last name using JDBC connectivity. (Assume suitable table structure)	<b>CO515.4</b>
13.	Write a servlet to create a data entry screen, which accepts name, standard (as a list box) with add button. (Create html page using servlet.).	<b>CO515.5</b>
14.	Write a JSP code for accepting book id from HTML page. Verify it with book table (Assume suitable fields). If book is already exists, then display its details. If not, insert new details in to table.	<b>CO515.5</b>
15.	Create a CRUD application using Spring MVC.	<b>CO515.6</b>
16.	Write HQL for executing fundamental queries (CRUD).	<b>CO515.6</b>
<b>Learning Resources</b>		
<b>Virtual Laboratory (links):</b> <a href="https://java-iitd.vlabs.ac.in/List%20of%20experiments.html">https://java-iitd.vlabs.ac.in/List%20of%20experiments.html</a>		
<b>MOOC Courses (Web Links):</b> <a href="https://onlinecourses.nptel.ac.in/noc22_cs47/preview">https://onlinecourses.nptel.ac.in/noc22_cs47/preview</a>		

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
<b>CO515.1</b>	3	3	3	3	-	-	-	2
<b>CO515.2</b>	3	3	3	3	-	-	-	2
<b>CO515.3</b>	3	3	3	3	-	-	-	2
<b>CO515.4</b>	3	3	3	3	-	-	-	2
<b>CO515.5</b>	3	3	3	3	-	-	-	2
<b>CO515.6</b>	3	3	3	3	-	-	-	2
<b>CO515</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	-	-	-	<b>2</b>

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: MCA01555</b>		<b>Course Name: Database Systems Laboratory</b>
<b>Semester: II</b>		
<b>Teaching Scheme:</b> <b>Practical: 04 Hrs./ week</b>	<b>Credit:</b> <b>02</b>	<b>Examination Scheme:</b> <b>Term work (TW): 25 Marks</b> <b>Practical (PR) / Oral (OR): 25 Marks</b>
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To design and implement the queries using different databases.</li> <li>To understand the setup of various databases.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		
<b>CO516.1: Design</b> database using ER diagram notations.		
<b>CO516.2: Implement</b> DDL and DML statements using SQL.		
<b>CO516.3: Apply</b> procedures, functions, cursors and triggers to manipulate database using PL/SQL.		
<b>CO516.4: Construct</b> databases using distributed database and XML.		
<b>CO516.5: Implement</b> the concepts of non-relational databases like MongoDB.		
<b>Sr. No.</b>	<b>List of Laboratory Assignments/Experiments/Activity</b>	<b>CO Mapping</b>
1.	Design and draw an ER/EER diagram using standard notations for Hotel Management System and map this system into Database Tables or schemas.	<b>CO516.1</b>
2.	Design an E-R diagram for keeping track of the exploits of your favorite sports team. You should store the matches played, the scores in each match, the players in each match and individual player statistics for each match. Summary statistics should be modeled as derived attributes.	<b>CO516.1</b>
3.	Create the following tables. Insert the appropriate data in these tables and solve the queries Client_master (client_no, name, address1, address2, city,pincode,state,bal_due) Product_master(product_no, description, profit_percent, unit_measure, qty_on_hand , reorder_lvl, sell_price, cost_price) Salesman_master(salesman_name, address1, address2, city, pincode, state, sal_amt, tgt_to_get,ytd_sales,remarks) Sales_order(order_no,order_date,client_no,dely_addr,salesman_no, dely_type,billed_yn, dely_date, order_status) Sales_order_details(order_no, product_no,qty_ordered,qty_disp,product_rate) <b>Constraints are</b> Client_master( Client_no is PK & first letter must start with 'C' , Name Not NULL) Product_master(product_no is PK & first letter must start with 'P') Salesman_master(salesman_no is PK & first letter must start with 'S' Name not NULL) Sales_Order(order_no is PK & first letter must start with 'O',dely_type(Delivery: part(P)/full(f) Default (F), dely_date cannot be less than order_date, order_status values ('In Process', 'Fulfilled' 'BackOrder','Cancelled').	<b>CO516.2</b>
4.	Based on the below mentioned schema/tables apply the SQL queries EMP (Empno, Ename, Job, Mgr, Hiredate, Sal, Comm, Dept no)	<b>CO516.2</b>

	<p>DEPT (Deptno,Dname,Loc)</p> <p>a) Add a record to the department table with values (50,'PERSONNEL','BOSTON').</p> <p>b) If a new person HERALD joins the organization in place of TURNER on the 5th of September 1992 with employee number 7999, make the required changes.</p> <p>c) Delete all the records of the employees whose job is 'Computer Programmar'.</p> <p>d) Convert the hire date of the employees to the number of years.</p> <p>e) Display details of all employees who were hired earliest and latest.</p> <p>f) Find out the department in which the maximum number of employees works.</p> <p>g) Select names of all employees whose names start with 'S'.</p> <p>h) Find the day of the week, time of the day, month and century on which SMITH joined.</p> <p>i) Find out details of employees where commission is greater than 7% of salary.</p> <p>j) Display the names of people and their departments working in either the Sales or Research department.</p>	
5.	<p>Based on the below mentioned schema/tables apply the SQL queries</p> <p>EMP (Empno, Ename, Job, Mgr, Hiredate, Sal, Comm, Dept no)</p> <p>DEPT (Deptno,Dname,Loc)</p> <p>a) Display the department name which has more than 3 employees in it.</p> <p>b) Write a query which concatenates the employee number, his name and manager number. Display the output with spaces in between the columns.</p> <p>c) Display the locations of the employees.</p> <p>d) Display name, salary and location of employees who stay in CHICAGO.</p> <p>e) List number, name, job, manager number and manager job of each employee.</p> <p>f) Display information about employees who have the maximum number of employees reporting to him.</p> <p>g) Create a view on emp table which will display empno, ename, sal, deptno, dname.</p>	<b>CO516.2</b>
6.	Write a PL/SQL which will accept age of the person if age is more than 18 display message as "Eligible for voting" else display message as "Not eligible for voting"	<b>CO516.3</b>
7.	<p>Perform the following operations with the help of cursors</p> <p>i. Increase salary of each customer by 5000.</p> <p>ii. Retrieve the customer name and address.</p>	<b>CO516.3</b>
8.	Create a stored function to perform item_id check operation. Which accepts item_id returns a flag as per the id exist or not.	<b>CO516.3</b>
9.	Application using database triggers – Create a transparent audit system for a table Client_master. The system must keep track of the records that are being deleted or updated. When the record is deleted or modified the original record details date of operation are stored in the audit table then the delete update is allowed to go.	<b>CO516.3</b>
10.	Write up on set up of a distributed database and installing database instance.	<b>CO516.4</b>
11.	Write the installation steps of Oxygen XML Editor.	<b>CO516.4</b>
12.	Create an XML file for three students by creating External DTD for student record which includes elements as Name and Address Which consists of sub elements Name(Fname, Lname),Address(Street, City, State, Zipcode, email, phone.	<b>CO516.4</b>
13.	Create a simple XML file of your personal information.	<b>CO516.4</b>
14.	Create a XML Schema for a Library System. Which contains book Information like (Title, Author, Publisher, Price).	<b>CO516.4</b>
15.	Write the installation steps of Mongo DB.	<b>CO516.5</b>
16.	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators).	<b>CO516.5</b>

### Learning Resources

**Virtual Laboratory (links):**

1. <https://vsit.edu.in/vlab/DBMS/Broad%20Goal.html>

**MOOC Courses (Web Links):**

1. Introduction to Database Systems and Design, Prof. P. Sreenivasa Kumar. IIT Madras.  
<https://nptel.ac.in/courses/106106095>
2. Database Design, Dr. S. Srinath, Prof. D. Janaki Ram, IISc Bangalore.  
<http://www.infocobuild.com/education/audio-video-courses/computer-science/database-design-iit-madras.html>
3. Database Management Systems, Prof. Partha Pratim Das, IIT Kharagpur.  
[https://onlinecourses.nptel.ac.in/noc20\\_cs09/preview](https://onlinecourses.nptel.ac.in/noc20_cs09/preview)
4. Database Management System, Dr. B. Lavanya., University of Madras.  
[https://onlinecourses.swayam2.ac.in/cec21\\_cs11/preview](https://onlinecourses.swayam2.ac.in/cec21_cs11/preview)

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO516.1	3	3	3	3	-	-	-	1
CO516.2	3	3	3	3	-	-	-	1
CO516.3	3	3	3	3	-	-	-	1
CO516.4	3	3	3	3	-	-	-	1
CO516.5	3	3	3	3	-	-	-	1
CO516	3	3	3	3	-	-	-	1

PES's Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Course)		
<b>Course Code: MCA10552</b>		<b>Course Name: Laboratory Practice - II</b>
<b>Semester: II</b>		
<b>Teaching Scheme:</b> Practical: 02 Hrs./ week	<b>Credit: 01</b>	<b>Examination Scheme:</b> Term work (TW): 25 Marks
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To study process and memory management operating system algorithms.</li> <li>To study network addressing and IP protocols.</li> <li>To learn data collection and preprocessing techniques for Machine Learning.</li> <li>To understand the concepts of Augmented and Virtual reality.</li> <li>Increase proficiency in practical skills for Business Intelligence.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		
<b>Operating Systems and Computer Networks</b>		
CO517.1: <b>Apply</b> operating system algorithms for processor performance.		
CO517.2: <b>Demonstrate</b> LAN and WAN protocol behavior using Modern Tools.		
<b>Elective II(A)- (Machine Learning)</b>		
CO517A.3: <b>Demonstrate</b> proficiency with statistical analysis of data.		
CO517A.4: <b>Apply</b> machine learning concepts and methods to solve problems.		
<b>Elective II(B)- (Augmented Reality and Virtual Reality)</b>		
CO517B.3: <b>Use</b> tools and techniques of augmented and virtual reality for real world problems.		
CO517B.4: <b>Design</b> ARVR applications.		
<b>Elective II(C)- (Big Data Analytics)</b>		
CO517C.3: <b>Apply</b> various data manipulation operations using NoSQL.		
CO517C.4: <b>Create</b> different data visualizations by analyzing big data and using visualization tools.		
<b>Sr. No.</b>	<b>List of Laboratory Assignments/Experiments/Activity</b>	<b>CO Mapping</b>
<b>Group A ( Operating Systems and Computer Networks)</b>		
1.	Write a C / C++ program for implementation of scheduling algorithms a) FCFS b) SJF c) Priority d) Round Robin.	CO517.1
2.	Write a C-program to test inter process communication by implementing the producer – consumer problem using semaphores.	CO517.1
3.	Write a program to analyze following packet formats captured through Wireshark/Cisco for wired networks. 1. Ethernet 2. IP 3. TCP 4. UDP.	CO517.2
4.	Write a program for DNS lookup. Given an IP address input, it should return URL and vice versa.	CO517.2
5.	Study of any network simulation tools - To create a network with three nodes and establish a TCP connection between node 0 and node 1 such that node 0 will send TCP	CO517.2

	packet to node 2 via node 1.	
<b>Group B (Elective-II)</b>		
<b>Elective II(A)- (Machine Learning)</b>		
6	Generate a proper 2-D data set of N points. Split the data set into Training Data set and Test Dataset.	<b>CO517A.3</b>
7.	Implementation of Support Vector Machines (SVM) for classifying images of hand- written digits into their respective numerical classes (0 to 9).	<b>CO517A.3</b>
8.	Predict the price of the Uber ride from a given pickup point to the agreed drop-off location. Perform following tasks: 1. Pre-process the dataset. 2. Identify outliers. 3. Check the correlation. 4. Implement linear regression and ridge, Lasso regression models.	<b>CO517A.4</b>
9.	Implement K-Means clustering on any dataset. Determine the number of clusters using the elbow method.	<b>CO517A.4</b>
<b>Elective II(B)- (Augmented Reality and Virtual Reality)</b>		
6.	Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.	<b>CO517B.3</b>
7.	Demonstration of the working of HTC Vive, Google Daydream or Samsung gear VR.	<b>CO517B.3</b>
8.	Develop and deploy a simple marker-based AR app in which you have to write a C# program to play video on tracking a particular marker.	<b>CO517B.4</b>
9.	Develop and deploy an AR app, implement the following using Vuforia Engine developer portal: i. Plane detection. ii. Marker based tracking (Create a database of objects to be tracked Vuforia). ii. Object Tracking.	<b>CO517B.4</b>
<b>Elective II(C)- (Big Data Analytics)</b>		
6.	Apply MongoDB Queries using CRUD operations.	<b>CO517C.3</b>
7.	a. Implement Map-reduce operation using MongoDB. b. Implement MongoDB Queries using aggregation and indexing using MongoDB.	<b>CO517C.3</b>
8.	Using Sample superstore dataset create visualization to analyze following problem statements: (Download Dataset: <a href="https://community.tableau.com/s/question/0D54T00000CWeX8SAL/sample-superstore-sales-excelxls">https://community.tableau.com/s/question/0D54T00000CWeX8SAL/sample-superstore-sales-excelxls</a> ) i. find which product is ranked 6th in sales for west region? ii. Using the Orders and Returns tables of the Sample- Superstore data, find what percent of the total Sales Were Returned Sales? iii. find what percent of Profit was generated by the top 10 products with the highest Sales? iv. compute the percentage growth in Sales between June 2017 and June 2020?	<b>CO517C.4</b>

9.	Create Different visualization to analyze customer segmentation data.	CO517C.4
<b>Learning Resources</b>		
<b>Virtual Laboratory (links):</b>		
1. <a href="https://naim30.github.io/OS-virtual-lab/#">https://naim30.github.io/OS-virtual-lab/#</a>		
2. <a href="http://vlabs.iitkgp.ac.in/ant/1/">http://vlabs.iitkgp.ac.in/ant/1/</a>		
<b>MOOC Courses</b>		
1. Operating System , IIT Delhi, .Prof. Sorav Bansal..Web Link: <a href="https://nptel.ac.in/courses/106102132">https://nptel.ac.in/courses/106102132</a> .		
2. Computer Networks and Internet Protocol, IIT Kharagpur, Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty Web Link: <a href="https://onlinecourses.swayam2.ac.in/aic20_sp24/">https://onlinecourses.swayam2.ac.in/aic20_sp24/</a>		
3. Introduction to Machine Learning, IIT Madras, Balaraman Ravindran. <u>AI and MLOps Course: PG Level Certification at IISc (talentsprint.com).</u>		
4. MongoDB - The Complete Developer & Guide 2024, Udemy, Maximilian Schwarz Müller. <u>MongoDB - The Complete Developer's Guide 2024   Udemy.</u>		
5. Virtual Reality Engineering, IIT Madras, Prof. M Manivannan. <a href="https://archive.nptel.ac.in/noc/courses/noc18/SEM1/noc18-ge08/">https://archive.nptel.ac.in/noc/courses/noc18/SEM1/noc18-ge08/</a>		

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
<b>Operating Systems and Computer Networks</b>								
CO517.1	3	3	3	3	-	-	-	-
CO517.2	3	3	3	3	-	-	-	-
<b>Elective II(A)- (Machine Learning)</b>								
CO517A.3	3	3	3	3	-	-	-	2
CO517A.4	3	3	3	3	-	-	-	2
<b>Elective II(B)- (Augmented Reality and Virtual Reality)</b>								
CO517B.3	3	3	3	3	-	-	-	-
CO517B.4	3	3	3	3	-	-	-	-
<b>Elective II(C)- (Big Data Analytics)</b>								
CO517C.3	3	3	3	3	-	-	-	-
CO517C.4	3	3	3	3	-	-	-	-
CO517	3	3	3	3	-	-	-	2

P.E.S. Modern College of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University) Level 6.0: First Year MCA (2024 Pattern)		
<b>Course Code: HRT04551</b>		<b>Course Name: Human Rights-II</b>
<b>Semester: II</b>		
<b>Teaching Scheme:</b> <b>Practical: 02 Hrs./ week</b>	<b>Credit:</b> <b>Practical: 01</b>	<b>Examination Scheme:</b> <b>Term work (TW): 25 Marks</b>
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To Aware about Human Values and rights.</li> <li>• To Understanding of legal instruments of Human Rights.</li> <li>• To Know about UN efforts on protecting Human Rights.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, the student will be able to,		
<b>CO518.1: Outline</b> the Indian context on Human Rights.		
<b>CO518.2: Analyze</b> the Enforcement Mechanism for Human Rights.		
<b>CO518.3: Extend</b> the legal redress on human rights violation.		
<b>CO518.4: Criticize</b> the role of advocacy groups in protecting human rights.		
<b>Sr. No.</b>	<b>List of content to be covered in assignments or activity</b>	<b>CO Mapping</b>
1	<b>Screening a documentary/ movie, follow up with discussions on</b> understanding Human Rights and Duties in the Indian Constitution, and discuss gain insights into the interplay between fundamental rights, duties and human rights in India.	<b>CO518.1</b>
2	<b>Study</b> the provisions of the Protection of Human Rights Act, 1993 and <b>Discuss</b> the importance of human right act, 1993.	<b>CO518.1</b>
3	<b>Case Analysis of</b> specific cases where the NHRC or SHRCs intervened to protect human rights.	<b>CO518.3</b>
4	<b>Group Discussion on</b> role and responsibilities of Commissions on Women, Children, Minority and Scheduled Castes, and Scheduled Tribes in protecting their rights.	<b>CO518.2</b>
5	<b>Article Writing</b> on topics like Inequalities in society and Human Rights and Good Governance.	<b>CO518.2</b>
6	<b>Situation Analysis</b> on recent abuse of Executive Power in different parts of the world, highlighting the involved rights and the response of the international community.	<b>CO518.3</b>
7	<b>Group Discussion</b> to explore the role of Protection Bodies in protecting Human Rights.	<b>CO518.3</b>
8	<b>Role-Playing:</b> Simulate international Complaint Mechanism for Human Rights.	<b>CO518.4</b>
9	<b>Article review</b> on Role of Corporate sector and NGOs in protecting Human Rights.	<b>CO518.4</b>
10	<b>Guest Session on</b> Overview of ESG principles, SDG goals and their relevance to human rights.	<b>CO518.4</b>
<b>Learning Resources</b>		
<b>Text Books:</b>		
1. Rhona K. M. Smith, Textbook on International Human Rights, 7th Edition, Oxford University Press, 2016, ISBN: 9780198746218.		
2. H.O. Agarwal, Human Rights, 21st Edition, Central Law Publications, 2020, ISBN: 978-9388267915.		
<b>Reference Books:</b>		



1. Bhagyashree Deshpande, Human Rights: Law & Practice, Central Law Publications, 2017, ISBN: 9789382676744.

**MOOC Courses (Web Links):**

1. [https://onlinecourses.swayam2.ac.in/cec24\\_hs06/preview](https://onlinecourses.swayam2.ac.in/cec24_hs06/preview).

**CO-PO Mapping Matrix of the course,**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO518.1	-	-	-	-	-	-	1	1
CO518.2	-	-	-	-	-	-	1	1
CO518.3	-	-	-	-	-	-	1	1
CO518.4	-	-	-	-	-	-	1	1
CO518	-	-	-	-	-	-	1	1