

**FACULTY OF SCIENCE AND TECHNOLOGY**  
**Savitribai Phule Pune University**  
**Maharashtra, India**



**Curriculum for**  
**First Year Master of Computer**  
**Applications (MCA)**

**FOR**  
**POST GRADUATE PROGRAMME IN**  
**Master of Computer Applications (2020 Course)**

**With Effect from Year 2020-21**

# Savitribai Phule Pune University

## Master of Computer Applications

### Program Outcomes

**Students are expected to know and be able to-**

**PO1.** Apply knowledge of mathematics, computer science, computing specializations appropriate for real world applications.

**PO2.** Identify, formulate, analyze and solve *complex* computing problems using relevant domain disciplines.

**PO3.** Design and evaluate solutions for *complex* computing problems that meet specified needs with appropriate considerations for real world problems.

**PO4.** Find solutions of complex computing problems using design of experiments, analysis and interpretation of data.

**PO5.** Apply appropriate techniques and modern computing tools for development of complex computing activities.

**PO6.** Apply professional ethics, cyber regulations and norms of professional computing practices.

**PO7.** Recognize the need to have ability to engage in independent and life-long learning in the broadest context of technological change.

**PO8.** Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO9.** Communicate effectively with the computing community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO10.** Assess societal, environmental, health, safety, legal and cultural issues within local and global contexts, and the consequent responsibilities relevant to the professional computing practices.

**PO11.** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary environments.

**PO12.** Identify a timely opportunity and use innovation, to pursue opportunity, as a successful Entrepreneur /professional.

## Structure for First Year MCA (Semester 1)

Year : First

Semester : I

Course Code	Course	Teaching Scheme Hours/Week		Examination Scheme						Credit	
		TH	PR	Int	Ext	TW	OR	PR	Total Marks	TH	PR
310901	<a href="#">Discrete Mathematics and Statistics</a>	3	-	30	70	-	-	-	100	3	
310902	<a href="#">Data Structures and Algorithms</a>	3	-	30	70	-	-	-	100	3	
310903	<a href="#">Object Oriented Programming</a>	3	-	30	70	-	-	-	100	3	
310904	<a href="#">Software Engineering &amp; Project Management</a>	3	-	30	70	-	-	-	100	3	
310905	<a href="#">Information Systems and Engineering Economics</a>	3	-	30	70	-	-	-	100	3	
310906	<a href="#">Data Structures and Algorithms Laboratory</a>	-	4	-	-	25	-	50	75		2
310907	<a href="#">OOP Laboratory</a>	-	4	-	-	25	-	50	75		2
310908	<a href="#">Python Programming Laboratory</a>	1	2	-	-	50	-	-	50	1	1
310909	<a href="#">Business Communication Lab</a>	-	2	-	-	50		-	50		1
	Total	16	12	150	350	150	-	100	750	22	
310910	# Audit Course-1									Grade	
310911	* <a href="#">Non Credit Course -1</a> : MOOC Course-I- Swayam/Spoken Tutorial/NPTEL course									Grade	

# 310910-Audit Course 1(AC1) Options:

310910A-[AC1-I Foreign Language](#)310910B-[AC1-II Road Safety](#)

## Structure for First Year MCA (Semester 2)

Year : First

Semester : II

Course Code	Course	Teaching Scheme Hours/Week		Examination Scheme						Credit	
		TH	PR	Int	Ext	TW	OR	PR	Total Marks	TH	PR
310912	<a href="#">Database Management System</a>	3	-	30	70	-	-	-	100	3	
310913	<a href="#">Computer Network</a>	3	-	30	70	-	-	-	100	3	
310914	<a href="#">Java Programming</a>	3	-	30	70	-	-	-	100	3	
310915	<a href="#">Operating Systems</a>	3	-	30	70	-	-	-	100	3	
310916	**Elective-I	3		30	70	-	-	-	100	3	
310917	<a href="#">Database Management System Laboratory</a>	-	4	-	-	25	-	50	75		2
310918	<a href="#">Operating System Laboratory</a>	-	2	-	-	50	-	-	50		1
310919	<a href="#">Java Programming Laboratory</a>	-	4	-	-	25	-	50	75		2
310920	<a href="#">Project Based Learning-I (Mini Project- I)</a>	-	2	-	-	50	-	-	50		1
	Total	15	12	150	350	150	--	100	750	21	
310921	# Audit Course-2									Grade	
310922	* <a href="#">Non Credit Course -2</a> : MOOC Course- II - Swayam/Spoken Tutorial/NPTEL course									Grade	

# 310921-Audit Course 2(AC2) Options:

310921A- [AC2-I: Foreign Language](#)310921B [AC2-II: Environmental Studies](#)310921C- [AC2-III: Augmented reality and Virtual Reality](#)

## \*\*Elective-I Course (310916)

Course Code	Course
(310916)	Elective I
310916A	<a href="#">Mobile Computing</a>
310916B	<a href="#">Artificial Intelligence</a>
310916C	<a href="#">Cyber Security</a>
310916D	<a href="#">Block Chain</a>
310916E	<a href="#">Open Elective</a>

**\*Non Credit MOOC Courses:** Non Credit course is compulsory. No grade points are associated with non-credit courses and are not accounted in the calculation of the performance indices SGPA & CGPA. Result of assessment will be PP or NP. Set of non-credit courses offered is provided. **Conduction and assessment of performance in said course is to be done at institute level.** The selection of 3 distinct non-credit MOOC courses, one per semester (Sem I, II & III) should be decided by respective institute. The list of non credit MOOC courses suggested is given below

### **Suggested MOOC Courses- Swayam /Spoken Tutorial/NPTEL**

<b>Sr. No.</b>	<b>Non Credit Course -1</b>	<b>Non Credit Course -2</b>
1	C programming -8 weeks	Introduction To Soft Computing-8 weeks
2	Enhancing soft skill and personality – 8 wks	RDBMS Postgres SQL -6 weeks
3	Design and analysis of algorithms -8 weeks	Privacy and Security in Online Social Media -8 weeks
4	Linux (Spoken tutorial)	Employment Communication A Lab based course – 8 weeks
5	Soft Skill Development-8 weeks	PHP and MySQL (Spoken tutorial)
6	Speaking Effectively -8 weeks	Scilab (Spoken tutorial)

**\*\* Institute may choose any one of suggested MOOC Course or decide any other MOOC course at Institute level.**

# SEMESTER I

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310901: Discrete Mathematics and Statistics</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisite courses, if any:</b> Basic Knowledge of Mathematics and Statistics <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To study discrete objects and relationships among them</li> <li>To use appropriate set, function and relation models to understand practical examples, and interpret the associated operations and terminologies in context.</li> <li>To learn logic and proof techniques to expand mathematical maturity</li> <li>To determine number of logical possibilities of events</li> <li>To formulate problems precisely, solve the problems, apply formal proof techniques, and explain the reasoning clearly.</li> <li>To demonstrate how these concepts can be applied to solve nontrivial real life problems.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Solve real world problems logically by using set and induction approaches. <b>CO2:</b> Describe and implement relations and functions. <b>CO3:</b> Apply logical reasoning to solve a variety of problems <b>CO4:</b> Apply statistical concepts to solve basic problems. <b>CO5:</b> Solve the problems of Discrete Distributions and Continuous Distributions. <b>CO6:</b> Explain various Descriptive Statistical concepts		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Set Theory and Logic</b>	<b>06 Hours</b>
Discrete Mathematics, Significance of Discrete Mathematics in Computer Engineering, Sets–Naïve Set, Theory (Cantor Set Theory), Need for Sets, Representation of Sets, Set Operations, cardinality of set, principle of inclusion and exclusion, Types of Sets –Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, power set. Propositional Logic-logic, Propositional Equivalences, Application of Propositional Logic-Translating English Sentences, Proof by Mathematical Induction, Strong Mathematical Induction.		
<b>Unit II</b>	<b>Relations and Functions</b>	<b>06 Hours</b>
Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings, partitions, Hasse Diagram, Lattices, Chains and Anti-chains, Transitive Closure and Warshalls Algorithm, Functions-Subjective, Injective and Bijective functions, Inverse Functions and composition of functions, The Pigeonhole Principle.		
<b>Unit III</b>	<b>Permutations and Combinations</b>	<b>06 Hours</b>
The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Generalized Permutations and Combinations. Binomial Coefficients Identities.		
<b>Unit IV</b>	<b>Introduction To Probability</b>	<b>06 Hours</b>
Introduction to probability, sample space and events, permutations and combinations, Axioms of probability, conditional probability, Bayes Theorem.		
<b>Unit V</b>	<b>Descriptive Statistics</b>	<b>06Hours</b>

Concept of Population, sample, Types of Sampling, Random Sampling Frequency distributions: Mean, Median, Mode, Variance and Standard Deviation. Co-relation, regression and their methods.		
<b>Unit VI</b>	<b>Discrete Distributions</b>	<b>06 Hours</b>
Random Variables, Discrete probability densities, cumulative Distribution, mathematical Expectations, Geometric Distribution, Binomial Distribution, Introduction to Hypothesis Testing.		
<b>Learning Resources:</b>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Tata McGraw-Hill, ISBN 978-0-07-288008-3, 7<sup>th</sup> Edition.</li> <li>2. C. L. Liu, “Elements of Discrete Mathematics”, TMH, ISBN 10:0-07-066913-9..</li> <li>3. Kishor S. Trivedi, “Probability and Statistics with Reliability, Queuing and Computer Science Applications”, Wiley , Second Edition, ISBN:9781119285441</li> <li>4. Sheldon Ross, “A first Course in Probability”, Prentice Hall, ISBN-13: 978-0-13-603313-4</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Bernard Kolman, Robert C. Busby and Sharon Ross, “Discrete Mathematical Structures”, Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.</li> <li>2. N. Biggs, “Discrete Mathematics”, 3rd Edition, Oxford University Press, ISBN 0 –19 850717 –8.</li> <li>3. Narsingh Deo, “Graph with application to Engineering and Computer Science”, Prentice Hall of India, 1990, 0 –87692 –145 –4.</li> <li>4. Dr. K. D. Joshi, “Foundations of Discrete Mathematics”, New Age International Limited, Publishers, January 1996, ISBN: 8122408265, 9788122408263</li> <li>5. Papoulis, Pillai, “Probability, Random Variables and Stochastic Processes”, 4th Edition ISBN:0-07-048658-1.</li> <li>6. Veerarajanl, “Probability, Statistics And Random”, Tata McGraw-Hill, ISBN:0-07-049482-7</li> <li>7. S.C. Gupta, V.K Kapoor, S. Chand, “Fundamentals of Mathematical Statistics”, Sultan Chand &amp; Sons, ISBN-10: 8180545288.</li> <li>8. D .P. Apte , “Probability and Combinatorics”, Excel Books, ISBN-13: 978-8174465207</li> </ol>		
<b>e-Books:</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.cis.upenn.edu/~jean/discmath-root-b.pdf">https://www.cis.upenn.edu/~jean/discmath-root-b.pdf</a></li> <li>2. <a href="https://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf">https://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf</a></li> <li>3. <a href="http://discrete.openmathbooks.org/pdfs/dmoi-tablet.pdf">http://discrete.openmathbooks.org/pdfs/dmoi-tablet.pdf</a></li> </ol>		
<b>MOOC Courses:</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.coursera.org/specializations/discrete-mathematics">https://www.coursera.org/specializations/discrete-mathematics</a></li> <li>2. <a href="https://www.coursera.org/learn/discrete-mathematics">https://www.coursera.org/learn/discrete-mathematics</a></li> <li>3. <a href="https://www.my-mooc.com/en/categorie/statistics-and-probability">https://www.my-mooc.com/en/categorie/statistics-and-probability</a></li> <li>4. <a href="https://www.edx.org/learn/statistics">https://www.edx.org/learn/statistics</a></li> </ol>		



<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310902: Data Structures and Algorithms</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisite courses, if any:</b> Nil		
<b>Companion Course, if any:</b> <ul style="list-style-type: none"> <li>310906: Data Structures and Algorithms Laboratory</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 develop the ability to synthesize and analyze algorithms</li> <li>To study applications of Data Structure in solving real life problems</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Explain the Complexity of Algorithms & fundamentals of Data Structures. <b>CO2:</b> Describe representation & application of Linked List <b>CO3:</b> Write programs that uses stacks, queues. <b>CO4:</b> Apply nonlinear data structure trees to solve mathematical problems. <b>CO5:</b> Explain representations & the applications of graphs. <b>CO6:</b> Implement different searching and sorting algorithms.		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Algorithm and Data Structures</b>	<b>08 Hours</b>
<b>Algorithms:</b> Problem Solving, Introduction to Algorithms, Characteristics of algorithms, Algorithm design tools: Pseudo code and flowchart, Analysis of Algorithms, Complexity of algorithms- Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, standard measures of efficiency. Algorithmic Strategies- Introduction to algorithm design strategies- Divide and Conquer, and Greedy strategy. <b>Introduction to data structures:</b> Concept of data, Data types, Data Object, Data structure, Notation of Data Structure, Abstract Data types (ADT), types of data structure, Linear data structures using sequential organization: Concept of sequential organization, Concept of Linear data structures, arrays as ADT, Multidimensional arrays, Storage representations (row major and column major and their address calculation). Application of array in sparse matrix representation, addition and transpose		
<b>Unit II</b>	<b>Linked Lists</b>	<b>06 Hours</b>
Concept of linked organization, singly linked list, doubly linked list, circular linked list and operations on above data structure. Application of linked list for Representation and manipulations of polynomials		
<b>Unit III</b>	<b>Stacks and Queues</b>	<b>06 Hours</b>

<b>Stacks:</b> concept, Primitive operations, Stack Abstract Data Type, Implementation of stacks using sequential and linked organization, Application of stack for expression conversion, evaluation <b>Queue:</b> Concept, Queue as Abstract Data Type, Realization of Queues Using Arrays , Circular Queue, Deque, Priority Queue, Array implementation of priority queue, Linked Queue and operations.		
<b>Unit IV</b>	<b>Trees</b>	<b>06 Hours</b>
Concept of nonlinear data structure, Trees and binary trees-concept and terminology, Sequential & Linked representation of binary trees, Algorithm for tree traversals, Binary search trees(BST) , BST operations, AVL Trees , Applications of binary tree : expression tree, decision tree		
<b>Unit V</b>	<b>Graph</b>	<b>06 Hours</b>
Representation of graph -Adjacency matrix and Adjacency list, Graph traversals- depth first and breadth first search , application of graph: connected components , Spanning tree, Minimum cost spanning tree-Prims and Kruskal Algorithms, Dijkstra's Single source shortest path		
<b>Unit VI</b>	<b>Searching and Sorting</b>	<b>06 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>Learning Resources:</b>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Aho A., Hopcroft J., Ulman J., “Data Structures and Algorithms”, Pearson Education, ISBN-0201-43578-0</li> <li>2. Brassard &amp; Bratley, “Fundamentals of Algorithmics”, Prentice Hall India/Pearson Education, ISBN 13-9788120311312.</li> <li>3. Richard F. Gilberg, Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Cengage Learning, ISBN: 9788131503140.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Horowitz and Sahani, “Fundamentals of Data Structures in C++”, University Press, ISBN 10: 0716782928 ISBN 13: 9780716782926.</li> <li>2. Yedidyah Langsam, Moshe J Augenstein, Aron M Tenenbaum, “Data Structures using C and C++”, Pearson Education, ISBN 81-317-0328-2.</li> <li>3. A Michael Berman, “Data Structures via C++: Objects by Evolution”, Oxford University Press, ISBN:0-19-510843-4.</li> <li>4. Trembley, J.P. and Sorenson P.G., “An Introduction to Data Structures with Applications”, McGrawHill</li> </ol>		
<b>e-Books: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://doc.lagout.org/Alfred%20V.%20Aho%20-%20Data%20Structures%20and%20Algorithms.pdf">https://doc.lagout.org/Alfred%20V.%20Aho%20-%20Data%20Structures%20and%20Algorithms.pdf</a></li> <li>2. <a href="https://www.cs.bham.ac.uk/~jxb/DSA/dsa.pdf">https://www.cs.bham.ac.uk/~jxb/DSA/dsa.pdf</a></li> </ol>		
<b>MOOC Courses: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://swayam.gov.in/nd1_noc19_cs40/preview">https://swayam.gov.in/nd1_noc19_cs40/preview</a></li> <li>2. <a href="https://nptel.ac.in/courses/106/102/106102064/">https://nptel.ac.in/courses/106/102/106102064/</a></li> </ol>		

<b>Savitribai Phule Pune University, Pune</b> <b>First Year of MCA (2020Course)</b> <b>310903: Object Oriented Programming</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisites:</b> Basics of programming languages <b>Companion Course, if any:</b> OOP Laboratory <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To study basics of Object Oriented Programming (OOP).</li> <li>To understand object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism.</li> <li>To use the object-oriented paradigm in program design.</li> <li>Provide programming insight using OOP constructs.</li> <li>To lay a foundation for advanced programming.</li> <li>To develop an ability to write programs in C++ for problem solving</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Explore the basics of OOP <b>CO2:</b> Analyze the strengths of object oriented programming <b>CO3:</b> Design and apply OOP principles for effective programming <b>CO4:</b> Develop programming application using object oriented programming language C++ <b>CO5:</b> Achieve applicability of OOP <b>CO6:</b> Percept the utility of OOP for advanced programming		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Basics of Programming</b>	<b>06 Hours</b>
<b>Basics of C++</b> - Need of Object-Oriented Programming (OOP), Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming and advantages of it, Principles, Benefits of OOP, C++ as object oriented programming language, Syntax & Structure of C++ Programming Comments, header files.		
<b>Unit II</b>	<b>Classes, Objects and Functions</b>	<b>07 Hours</b>
<b>Classes and Objects</b> -Data Types and Variables, Operators, Control-flow Statements, Looping Statements, Arrays, Strings, Structures, Enumerations, Class, Object, class and data abstraction, class scope and accessing class members, separating interface from implementation, controlling access to members <b>Functions-</b> Function, function prototype, accessing function and utility function, Constructors and destructors, Copy Constructor, Objects and Memory requirements, Static Class members, data abstraction and information hiding, inline function.		
<b>Unit III</b>	<b>Inheritance and Polymorphism</b>	<b>07 Hours</b>
<b>Operator Overloading-</b> concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion. <b>Inheritance-</b> Base Class and derived Class, protected members, relationship between base Class and		

<p>derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Inheritance, Public and Private Inheritance, Levels of Inheritance, Multiple Inheritance.</p> <p><b>Polymorphism-</b> concept, relationship among objects in inheritance hierarchy, abstract classes, polymorphism.</p>		
<b>Unit IV</b>	<b>Virtual Functions</b>	<b>06 Hours</b>
<p><b>Virtual Function-</b> Need for virtual function, Friend Functions, Static Functions, Assignment and Copy Initialization, this Pointer, virtual function, dynamic binding, Virtual destructor, this Pointer</p>		
<b>Unit V</b>	<b>Templates and Exception Handling</b>	<b>07 Hours</b>
<p><b>Templates-</b> function templates, Function overloading, overloading Function templates, class templates, class template, template and inheritance, template and friends Generic Functions, Applying Generic Function, Generic Classes, The type name and export keywords, The Power of Templates.</p> <p><b>Exception Handling-</b> Fundamentals, C++ Standard Exceptions</p>		
<b>Unit VI</b>	<b>Files handling</b>	<b>07 Hours</b>
<p>Ifstream, of stream, istream, ostream and fstream classes and their hierarchy. Input and output operation - open() ,get(), getline(), read(), seekg() and tellg() AND put(), seekp(), tellp(),and write() functions, Command-Line Arguments, Printer output, Early vs. Late Binding, Error Handling in File I/O</p>		
<b>Learning Resources:</b>		
<p><b>Text Books :</b></p> <ol style="list-style-type: none"> <li>1. Bjarne Stroustrup, “The C++ Programming language”, Third edition, Pearson Education. ISBN 9780201889543.</li> <li>2. E.Balagurusamy,Programming with C++,Tata McGraw Hill, 3<sup>rd</sup> Edition</li> <li>3. Deitel, “C++ How to Program”, 4<sup>th</sup> Edition, Pearson Education, ISBN:81-297-0276-2</li> </ol>		
<p><b>Reference Books :</b></p> <ol style="list-style-type: none"> <li>1. Robert Lafore, “Object-Oriented Programming in C++”, fourth edition, Sams Publishing, ISBN:0672323087 (ISBN 13: 9780672323089)</li> <li>2. E. Balgurusamy, “Object oriented programming in C++ “, Tata McGraw Hill, ISBN: 9780071072830,</li> <li>3. Herbert Schildt, “C++ The complete reference”, Eighth Edition, McGraw Hill Professional, ISBN:978-00-72226805</li> <li>4. Matt Weisfeld, “The Object-Oriented Thought Process”, Third Edition, Pearson ISBN-13:075-2063330166</li> <li>5. Cox Brad, Andrew J. Novobilski, “Object Oriented Programming: An Evolutionary Approach”, Second Edition, Addison–Wesley, ISBN: 13:978-020-1548341.</li> </ol>		
<p><b>e-Books: &lt;web links&gt;</b></p> <ol style="list-style-type: none"> <li>1. <a href="http://www.freebookcentre.net/Language/Free-C++-Books-Download.html">http://www.freebookcentre.net/Language/Free-C++-Books-Download.html</a></li> <li>2. <a href="https://fac.ksu.edu.sa/sites/default/files/ObjectOrientedProgramminginC4thEdition.pdf">https://fac.ksu.edu.sa/sites/default/files/ObjectOrientedProgramminginC4thEdition.pdf</a></li> <li>3. <a href="https://www.pdfdrive.com/c-object-oriented-programming-e39562275.html">https://www.pdfdrive.com/c-object-oriented-programming-e39562275.html</a></li> </ol>		
<p><b>MOOC Courses: &lt;web links&gt;</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/106/101/106101208/">https://nptel.ac.in/courses/106/101/106101208/</a></li> <li>2. <a href="https://nptel.ac.in/courses/106/105/106105151/">https://nptel.ac.in/courses/106/105/106105151/</a></li> <li>3. <a href="https://swayam.gov.in/nd1_noc20_cs53/preview">https://swayam.gov.in/nd1_noc20_cs53/preview</a></li> <li>4. <a href="https://swayam.gov.in/nd1_noc20_cs07/preview">https://swayam.gov.in/nd1_noc20_cs07/preview</a></li> </ol>		

<b>Savitribai Phule Pune University, Pune</b> <b>First Year of MCA (2020 Course)</b> <b>310904: Software Engineering &amp; Project Management</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisite courses, if any:</b> NA <b>Companion Course, if any:</b> NA  <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>• To understand software development and software lifecycle process models</li> <li>• To know methods of capturing, specifying, visualizing and analysing software requirements.</li> <li>• To introduce principles of agile software development, the SCRUM process and agile practices</li> <li>• To learn about project planning, execution and tracking.</li> <li>• To understand project management through life cycle of the project.</li> <li>• To know leadership and understand its role and importance in successfully managing IT projects</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Choose and apply appropriate lifecycle model of software development <b>CO2:</b> Analyze software requirements by applying various modelling techniques <b>CO3:</b> Describe principles of agile development, discuss the SCRUM process and distinguish Agile process model from other process models <b>CO4:</b> Describe project schedule and cost estimation <b>CO5:</b> Understand IT project management through life cycle of the project and future trends in IT Project Management. <b>CO6:</b> Define ethics and understand its importance in project leadership.		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Software Engineering</b>	<b>06 Hours</b>
Nature of Software, Software Process, Software Engineering Practices, Software Myths, Generic Process Model, Analysis and comparison of Process Models: Waterfall Model, Incremental Models, Evolutionary Models, Concurrent, Specialized Process Models, Personal and Team Process Models, Introduction to Clean Room Software Engineering. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, CMM Models.		
<b>Unit II</b>	<b>Requirement Analysis</b>	<b>06 Hours</b>
Requirements Capturing: requirements engineering (elicitation, specification, validation, negotiation, prioritizing requirements (Kano diagram) - real life application using case study. Requirements Analysis: basics, scenario based modelling, UML models: use case diagram and class diagram, data modelling, data and control flow model, behavioural modelling using state diagrams - real life application case study, Software Requirement Specification(SRS).		
<b>Unit III</b>	<b>Agile Development Process</b>	<b>06 Hours</b>
Agile Development: Agile manifesto, agility and cost of change, agility principles, myth of planned development, toolset for the agile process. Extreme Programming: XP values, process, industrial XP, SCRUM - process flow, scrum roles, scrum cycle description, product backlog, sprint planning meeting, sprint backlog, sprint execution, daily scrum meeting, maintaining sprint backlog and burn-down chart, sprint review and retrospective.		

Agile Practices: test driven development, refactoring, pair programming, continuous integration, exploratory testing versus scripted testing		
<b>Unit IV</b>	<b>Project Planning</b>	<b>06 Hours</b>
Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, Effort estimation and scheduling: Importance of Project Schedules, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule using Gantt Charts, Adding Milestones to Gantt Charts, Using Tracking Gantt Charts to Compare Planned and Actual Dates, Critical Path Method, Program Evaluation and Review Technique (PERT) with examples. Planning Cost Management, Estimating Costs, Types of Cost Estimates, Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates.		
<b>Unit V</b>	<b>Project Management</b>	<b>08Hours</b>
<p>Project monitoring and control: tools for project management, Software tools like Microsoft project management or any other open source tools.</p> <p>The Importance of Project Quality Management: Planning Quality Management, Performing Quality Assurance, Controlling Quality, Tools and Techniques for Quality Control (Statistical control, Six Sigma)</p> <p>Risk Analysis &amp; Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Risks Monitoring and Management, The RMMM plan for case study project.</p> <p>Software Configuration Management: The SCM repository, SCM process, Version Control and Change Control, SCM tools- GitHub or others, Configuration management for Web Apps.</p> <p>Maintenance &amp; Reengineering: Software Maintenance, Reengineering, Business Process Reengineering</p>		
<b>Unit VI</b>	<b>Leadership and Ethics</b>	<b>04 Hours</b>
Project Leadership: Approaches to Leadership, Leadership Styles, Emotional Intelligence, Ethics in Projects: Ethical Leadership, Common Ethical Dilemmas, Making Sound Ethical Decisions, Codes of Ethics and Professional Practices		
<b>Learning Resources:</b>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Roger S Pressman, Software Engineering: A Practitioner's Approach, McGraw-Hill, Seventh or Eighth Edition.</li> <li>2. Joseph Phillips, IT Project Management –On Track From Start to Finish, Tata McGraw-Hill, ISBN13: 978-0-07106727-0, ISBN-10: 0-07-106727-2</li> <li>3. John m. Nicolas and Herman Steyn, Project Management for Engineering, Business and Technology, 4<sup>th</sup> Edition, Elsevier, ISBN 978-0-08-096704-2</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Pankaj Jalote, Software Engineering: A Precise Approach, Wiley India, ISBN: 9788126523115.</li> <li>2. Marchewka, Information Technology Project Management, Wiley India, ISBN: 9788126543946</li> </ol>		
<b>e-Books: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.e-booksdirectory.com/listing.php?category=25">https://www.e-booksdirectory.com/listing.php?category=25</a></li> <li>2. <a href="https://www.vumultan.com/.../CS605Software%20Engineering%20Practitioner's%20Appro">https://www.vumultan.com/.../CS605Software%20Engineering%20Practitioner's%20Appro</a></li> <li>3. <a href="http://originaldocs.net/pdf/software-engineering-book-by-pressman-7th-edition-free-download.pdf">http://originaldocs.net/pdf/software-engineering-book-by-pressman-7th-edition-free-download.pdf</a></li> </ol>		
<b>MOOC Courses: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.classcentral.com/course/swayam-software-engineering-14293">https://www.classcentral.com/course/swayam-software-engineering-14293</a></li> </ol>		
<b>NPTEL Courses: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.nptelvideos.in/2012/11/software-engineering.html">https://www.nptelvideos.in/2012/11/software-engineering.html</a></li> </ol>		



<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310905: Information Systems and Engineering Economics</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit     03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisite courses, if any:</b> NA <b>Companion Course, if any:</b> NA  <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To prepare the students to get knowledge of Management Functions, Organisational Structures and understanding of Information Systems.</li> <li>To prepare the students to get aware about Information Systems and Project Management using latest trends.</li> <li>To prepare the students to Management Information Systems Applications.</li> <li>To expose the students to the managerial Decision Support Systems issues relating to Information Systems and apply appropriate tools.</li> <li>To impart basic Banking and financial Accounting knowledge that is required for a Career as software Developer.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Understand the need, usage and importance Management Functions, Organisational structure and Information Systems. <b>CO2:</b> Understand the Information Systems, Project Management, Managing Data resources, Knowledge Management, Business Process Integration and Enterprise Systems. <b>CO3:</b> Understand the Management Information Systems Applications using in an Organization. <b>CO4:</b> Elaborate Managerial Decision Making Models and applying to Business Intelligence. <b>CO5:</b> Implement the basic Accounting concepts in the banking and financial applications <b>CO6:</b> Apply the basic concepts of cost accounting in real world problem		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Basic of Management Theory &amp; Practices</b>	<b>06 Hours</b>
Introduction of Management, its nature and purpose, Functions and activities of Management, planning, organizing, staffing, directing and controlling Introduction of Organisation, Need for Organization , Process of Organizing , Organizational structure Functional organization , Product Organization , <b>Memorandum of Association (MOA)</b> and <b>Articles of Association (AOA)</b> , Definition, types, merits and demerits of each of structures (Line, Functional, Line and staff, Committee, Matrix and Project structure) Role of Information Systems in Organizations, Concepts, Challenges of Information Systems, Information Systems and Management Strategy Case Studies - Information Systems in the Indian Railways, Information Systems in an e-commerce Organization.		
<b>Unit II</b>	<b>Leveraging Information Systems</b>	<b>06 Hours</b>
Information Systems and Project Management, Managing Data Resources, Business Process Integration and Enterprise Systems, ICT for Development and E-Governance, Knowledge Management Systems, Case Studies on In-house or Cloud based ERP implementation, Online Banking, Unique Identification Authority of India (UIDAI).		

<b>Unit III</b>	<b>Management Information System (MIS)</b>	<b>06 Hours</b>
Management Information System (MIS) Definitions, Role of MIS, Structure of MIS based on management activity and functions. Ethical and Social Issues, Information Systems Security and Control, Applications of MIS , Customer relationship Management (CRM), Supply chain management (SCM), Case Studies on Social Media Application and Services, Information Technology Infrastructure in a Bank, Information Technology Infrastructure in a manufacturing / process industry.		
<b>Unit IV</b>	<b>Managerial Decision Making</b>	<b>06 Hours</b>
Introduction of Managerial Decision Making, Decision making environment: Open Systems, Closed system, Decision making under certainty, Decision making under uncertainty, Decision making under risk, Decision Types /models: Structured decisions, unstructured decisions, Programmable decisions, Non programmable Decisions Classical Model Administrative model, Decision making tools: Autocratic, Participative, and Consultative Decision Making , Herbert Simpson's Model, Principle of Rationality / Bounded Rationality, Business Intelligence, Case study on Web-Based Decision Support Systems for Retirement Planning.		
<b>Unit V</b>	<b>Introduction Financial Accounting</b>	<b>06Hours</b>
<b>Financial Accounting</b> -Definition, Scope and objectives, System of Book Keeping, Terms used in accounting, of Accounting process, Concepts and Conventions in accounting, 3 rules for book keeping. <b>Journalisation</b> - Rules for Journalisation, posting in a Ledger, subsidiary books, preparation of Trial balance. <b>Final Accounts</b> - Preparation of Trading and profit and loss Account and Balance sheet of a Proprietary and partnership firms.		
<b>Unit VI</b>	<b>Managerial and Cost Accounting</b>	<b>06 Hours</b>
<b>Concept of cost</b> <b>Elements of Cost</b> - Material, Labour and Expenses, Classification of cost & Types of Costs , Preparation of Cost Sheet. <b>Overhead</b> -Meaning and Definition of Overhead, Classification of Overheads, <b>Marginal Costing</b> – Meaning and Various Concepts – Fixed Cost, Variable Cost, Contribution, P/V Ratio, Break Even Point, Margin of Safety. <b>Ratio Analysis</b> -Meaning and rationale, advantages and limitations. Types of Ratios Liquidity Ratios, Solvency Ratios, Profitability Ratios, Efficiency Ratios, Integrated Ratios		
<b>Learning Resources:</b>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Rahul De, "MIS: Management Information Systems in Business, Government and Society", Wiley India, ISBN: 13: 978-81-265-2019-0.</li> <li>2. Gordan Devis, Margrethe H. Oison, "Management Information Systems", McGraw-Hill, ISBN 13:9780070662414</li> <li>3. Financial Management :By S.M. Inamdar , Everest Publication</li> <li>4. Cost &amp; Management Account : By S.M. Inamdar , Everest Publication</li> <li>5. Book Keeping &amp; Accounting Textbook of Standard XI : Balbharati</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Kenneth C., Laudon, Jane P. Laudon , "Management Information Systems Managing the Digital Firm", Pearson, 14<sup>th</sup> Edition, ISBN 978-93-325-4890-9, eISBN 978-93-325-8266-8</li> <li>2. Efraim Turban, Jay E Aronson and Ting-Peng Liang "Decision Support and Intelligent Systems, Prentice Hall, 7<sup>th</sup> Edition, ISBN 0131230131</li> </ol>		



3. Efraim Turban, Carol Pollard and Gregory Wood , “Information Technology on Management on Demand Strategies for Performance Growth and Sustainability”, Willey, ISBN: 978-118-89079-0
4. William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, Engineering Economy, Pearson Education, ISBN13: 978-01-334-3927-4
5. A.P. Rao , “Management Accounting”
6. Dr.Sanjay Patankar , “Management Accounting”
7. Khan and Jain, “ Management Accounting:”
8. Milind Oka , “ E – Commerce “

**e-Books: <web links>**

1. [http://ebooks.lpude.in/management/mba/term\\_4/DMGT505\\_MANAGEMENT\\_INFORMATION\\_SYSTEM.pdf](http://ebooks.lpude.in/management/mba/term_4/DMGT505_MANAGEMENT_INFORMATION_SYSTEM.pdf)
2. <http://www.freebookcentre.net/business-books-download/Financial-Management.html>

**NPTEL Courses: <web links>**

1. <https://nptel.ac.in/courses/110/105/110105146/>
2. <https://nptel.ac.in/courses/110/105/110105145/>
3. <https://nptel.ac.in/courses/110/105/110105147/>
4. <https://nptel.ac.in/courses/110/101/110101131/>

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310906: Data Structures and Algorithms Laboratory</b>		
<b>Teaching Scheme:</b> <b>TH: 04 Hours/Week</b>	<b>Credit</b> <b>02</b>	<b>Examination Scheme:</b> <b>TW: 25 Marks</b> <b>PR : 50 Marks</b>
<b>Prerequisite courses, if any:</b> NA		
<b>Companion Course, if any:</b> <ul style="list-style-type: none"> <li>Data Structures and Algorithms</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 various linear &amp; non liner data structures</li> <li>To implement applications of Data Structure in solving real life problems</li> <li>To study various searching &amp; sorting algorithms</li> <li>To implement various searching &amp; sorting techniques.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Implement elementary data structures such as Arrays, linked lists <b>CO2:</b> Implement representation & application of Linked List <b>CO3:</b> Demonstrate practical knowledge on the applications of stacks, queues <b>CO4:</b> Implement nonlinear data structure trees to solve mathematical problems. <b>CO5:</b> Implement representations & the applications of graphs. <b>CO6:</b> Implement different searching and sorting algorithms.		
<b>Guidelines for Instructor's Manual</b>		
The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references		
<b>Guidelines for Student Journal</b>		
The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and <b>handwritten write-up</b> of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, Design, test cases, conclusion/analysis. <b>Program codes with sample output of all performed assignments are to be submitted as softcopy.</b> As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.		
<b>Guidelines for Assessment</b>		
Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab		

assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

### Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical

### Suggested List of Laboratory Assignments

1.	A. Implement application of array in sparse matrix to perform simple and fast transpose B. Implement application of array in polynomial expression.
2.	A. Write a menu driven program to perform following operations on singly linked list: Create, Insert, Delete, and Display B. Write a menu driven program to perform following operations on singly linked list: Create, reverse, search, count and Display
3.	A. Create two doubly linked lists. Sort them after creation using pointer manipulation. Merge these two lists into one list so that the merged list is in sorted order. (No new Node should be created). B. Write a menu driven program to perform operations on doubly linked list
4.	A. Implement circular linked list and perform operations on it. B. Represent polynomial as a circularly linked list and write a menu driven program to perform addition and evaluation
5.	A. Implement stack as an ADT. Use this ADT to perform expression conversion and evaluation. (Infix – Postfix) B. Implement stack as an ADT. Use this ADT to perform expression conversion (Infix – Prefix).
6.	A. Implement circular queue using arrays. B. Implement Linked queue
7.	A. Represent graph using adjacency list/adjacency matrix and perform Depth First Search. B. Represent graph using adjacency list/adjacency matrix and perform Breadth First Search.
8.	A. Implement minimum cost spanning tree algorithm. B. Implement shortest path algorithm
9.	A. Write a program to implement Merge sort method. B. Write a program to implement Heap sort method..
10.	A. Implement Sequential and Binary Search
11.	A. Create binary tree and perform recursive traversals. B. Create binary tree. Find height of the tree and print leaf nodes. Find mirror image, print original and mirror image using level-wise printing.
	Note: Data Structures Laboratory can be implemented using any programming language

<b>Savitribai Phule Pune University,</b> <b>Pune First year of MCA (2020 Course)</b> <b>310907: Object Oriented Programming Laboratory</b>		
<b>Teaching Scheme:</b> <b>PR: 04 Hours/Week</b>	<b>Credit</b> <b>02</b>	<b>Examination Scheme:</b> <b>TW:25 Marks</b> <b>PR: 50 Marks</b>
<b>Guidelines for Instructor's Manual</b> <p>The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction &amp; Assessment guidelines, topics under consideration- concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.</p>		
<b>Guidelines for Student Journal</b> <p>The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and <b><u>handwritten write-up</u></b> of each assignment (Title, Objectives, Problem Statement, Outcomes, software &amp; Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, <u>Theory- Concept in brief, algorithm, flowchart, Design, test cases, conclusion/analysis.</u> <b><u>Program codes with sample output of all performed assignments are to be submitted as softcopy.</u></b></p> <p>As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.</p>		
<b>Guidelines for Assessment</b> <p>Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.</p>		
<b>Guidelines for Practical Examination</b> <p>Both internal and external examiners should jointly set problem statements. <u>During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement.</u> The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation.</p> <p>So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.</p>		
<b>Guidelines for Laboratory Conduction</b> <p>The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged. In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts</p>		

learned.

### Suggested List of Laboratory Assignments

1.	<p>Implement a class Complex which represents the Complex Number data type. Implement the following operations:</p> <ol style="list-style-type: none"> <li>1. Constructor (including a default constructor which creates the complex number <math>0+0i</math>).</li> <li>2. Overloaded <b>operator+</b> to add two complex numbers.</li> <li>3. Overloaded <b>operator*</b> to multiply two complex numbers.</li> <li>4. Overloaded <b>&lt;&lt;</b> and <b>&gt;&gt;</b> to print and read Complex Numbers.</li> </ol>
2.	<p>Implement a class Quadratic that represents degree two polynomials i.e., polynomials of type <math>ax^2+bx+c</math>. The class will require three data members corresponding to a, b and c. Implement the following operations:</p> <ol style="list-style-type: none"> <li>1. A constructor (including a default constructor which creates the 0polynomial).</li> <li>2. Overloaded <b>operator+</b> to add two polynomials of degree2.</li> <li>3. Overloaded <b>&lt;&lt;</b> and <b>&gt;&gt;</b> to print and read polynomials. To do this, you will need to decide what you want your input and output format to looklike.</li> <li>4. A function eval that computes the value of a polynomial for a given value of x.</li> <li>5. A function that computes the two solutions of the equation <math>ax^2+bx+c=0</math>.</li> </ol>
3.	<p>Implement a class CppArray which is identical to a one-dimensional C++ array (i.e., the index set is a set of consecutive integers starting at 0) except for the following :</p> <ol style="list-style-type: none"> <li>1. It performs range checking.</li> <li>2. It allows one to be assigned to another array through the use of the assignment operator (e.g. <code>cp1=cp2</code>)</li> <li>3. It supports a function that returns the size of the array.</li> <li>4. It allows the reading or printing of array through the use of <code>cout</code> and <code>cin</code>.</li> </ol>
4.	<p>Write a C++ program create a calculator for an arithmetic operator (+, -, *, /). The program should take two operands from user and performs the operation on those two operands depending upon the operator entered by user. Use a switch statement to select the operation. Finally, display the result.</p> <p>Some sample interaction with the program might look like this:</p> <p>Enter first number, operator, second number: 10 / 3 Answer =3.333333</p> <p>Do another (y/n)?y</p> <p>Enter first number, operator, second number: 12</p> <p>+ 100 Answer = 112 Do another (y/n)? n</p>
5.	<p>Develop an object oriented program in C++ to create a database of student information system containing the following information: Name, Roll number, Class, division, Date of Birth, Blood group, Contact address, telephone number, driving license no. etc</p> <p>Construct the database with suitable member functions for initializing and destroying the data viz constructor, default constructor, Copy constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete.</p>
6.	<p>Create a class template to represent a generic vector. Include following member functions:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> To create the vector.</li> <li><input type="checkbox"/> To modify the value of a given element</li> <li><input type="checkbox"/> To multiply by a scalar value</li> <li><input type="checkbox"/> To display the vector in the form (10,20,30,...)</li> </ul>

7.	<p>Create a class Rational Number (fractions) with the following capabilities:</p> <ul style="list-style-type: none"> <li>a) Create a constructor that prevents a 0 denominator in a fraction, reduces or simplifies fractions that are not in reduced form and avoids negative denominators.</li> <li>b) Overload the addition, subtraction, multiplication and division operators for this class.</li> <li>c) Overload the relational and equality operators for this class.</li> </ul>
8.	<p>Imagine a publishing company which does marketing for book and audiocassette versions. Create a class publication that stores the title (a string) and price (type float) of a publication. From this class derive two classes: book, which adds a page count (type int), and tape, which adds a playing time in minutes (type float).</p> <p>Write a program that instantiates the book and tape classes, allows user to enter data and displays the data members. If an exception is caught, replace all the data member values with zero values.</p>
9.	<p>Write a function in C++ to count and display the number of lines not starting with alphabet 'A' present in a text file "STORY.TXT".</p> <p>Example:</p> <p>If the file "STORY.TXT" contains the following lines, The roses are red. A girl is playing there. There is a playground. An aeroplane is in the sky. Numbers are not allowed in the password. T he function should display the output as 3.</p>
10.	<p>Write C++ Program with base class convert declares two variables, val1 and val2, which hold the initial and converted values, respectively. It also defines the functions getinit( ) and getconv( ), which return the initial value and the converted value. These elements of convert are fixed and applicable to all derived classes that will inherit convert. However, the function that will actually perform the conversion, compute( ), is a pure virtual function that must be defined by the classes derived from convert. The specific nature of compute( ) will be determined by what type of conversion is taking place.</p>

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310908: Python Programming Laboratory</b>		
<b>Teaching Scheme:</b> <b>TH: 01 Hour/Week</b> <b>PR: 2 Hours/Week</b>	<b>Credit</b> <b>TH : 1</b> <b>PR : 1</b>	<b>Examination Scheme:</b> <b>Term Work: 50 Marks</b>
<b>Prerequisites:</b> Basics of any programming language		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>Describe the core syntax and semantics of Python programming language.</li> <li>Discover the need for working with the strings and functions.</li> <li>Illustrate the process of structuring the data using lists, dictionaries, and tuples.</li> <li>Infer the Object-oriented Programming concepts in Python.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements. <b>CO2:</b> Express proficiency in the handling of strings and functions. <b>CO3:</b> Articulate the Object-Oriented Programming concepts using Python. <b>CO4:</b> Create Python programs by utilizing the data structures like lists, dictionaries, tuples and sets. <b>CO5:</b> Design program using string manipulation functions. <b>CO6:</b> Implement OOP's concept in Python.		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Basics of Python</b>	<b>05 Hours</b>
Introduction to Python, Features of Python, Python interpreter, interactive and non-interactive mode of Python Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python. Decision control statement, branching Statements: if, if-else, nested if, if-else statements, Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops, The break, continue, pass, else statement used with loops. Other data types- Tuples, Lists, Sets and Dictionary		
<b>Unit II</b>	<b>Functions, Modules And String</b>	<b>05 Hours</b>
<b>Functions:</b> Calling Functions, Creating Functions, Formal Arguments, Positional Arguments, Default Arguments, Default Function Object Argument Example, Variable-length Arguments, Non-keyword Variable Arguments (Tuple), Keyword Variable Arguments (Dictionary), user defined functions and library functions, The return Statement and void Function, Scope and Lifetime of Variables, *args and **kwargs, Command Line Arguments. <b>Modules:</b> Standard Library modules, Commonly Used Modules, Categorizing the Standard Types, Unsupported Types. <b>Packages:</b> Understanding Packages Powerful Lambda or anonymous function in python, <b>Strings:</b> Creating and Storing Strings, String-only Operators, String Built-in Methods, Special Features of Strings, Accessing Characters in String by Index Number, String Slicing and Joining, Formatting Strings		
<b>Unit III</b>	<b>OOPs Concept</b>	<b>05 Hours</b>
Object Oriented programming, Python Objects, Standard Types, Other Built-in Types, Internal Types,		



scope, Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, and Polymorphism, Composition, containership, reusability, delegation, data abstraction

### **Books:**

#### **Text Books:**

1. Chun, J Wesley, Core Python Programming, Second Edition, Pearson, 2007 Reprint 2010
2. Kenneth A. Lambert, The Fundamentals of Python: First Programs, Cengage Learning, ISBN:978-1111822705
3. Gowrishankar S, Veena A, **“Introduction to Python Programming”**, 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

#### **Reference Books:**

1. Barry, Paul, Head First Python, 2nd Edition, O Rielly, 2010
2. Lutz, Mark, Learning Python, 4th Edition, O Rielly, 2009
3. David Beazley, Brian K. Jones “Python Cookbook”, 3<sup>rd</sup> Edition. O’Reilly Publications
4. Jake VanderPlas “Python Data Science Handbook” O’Reilly Publications
5. Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, ISBN-10: 9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943

### **Python Programming Laboratory**

#### **Guidelines for Instructor's Manual**

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

#### **Guidelines for Student Journal**

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, Design, test cases, conclusion/analysis.

**Program codes with sample output of all performed assignments are to be submitted as softcopy.** As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

#### **Guidelines for Assessment**

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

#### **Guidelines for Practical Examination**

Both internal and external examiners should jointly set problem statements. During practical

1. Write a Python program to calculate the sum of three given numbers, if the values are equal then return three times of their sum
2. To accept N numbers from user. Compute and display maximum in list, minimum in list, sum and average of numbers
3. To accept student’s five courses marks and compute his/her result. Student is passing if he/she



scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the grade is distinction. If aggregate is  $60 \geq$  and  $< 75$  then the grade is first division. If aggregate is  $50 \geq$  and  $< 60$ , then the grade is second division. If aggregate is  $40 \geq$  and  $< 50$ , then the grade is third division.

4. To check whether input number is Armstrong number or not. An Armstrong number is an integer with three digits such that the sum of the cubes of its digits is equal to the number itself.
5. To accept the number and Compute a) square root of number, b) Square of number, c) Cube of number d) check for prime, d) factorial of number e) prime factors
6. To accept two numbers from user and compute smallest divisor and Greatest Common Divisor of these two numbers.
7. To accept list of N integers and partition list into two sub lists even and odd numbers.
8. Write a Python program which accepts a sequence of comma-separated numbers from user and generate a list and a tuple with those numbers.
9. Write a Python program to get a directory listing, sorted by creation date.
10. Write a python program that accepts a string from user and perform following string operations-i. Calculate length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome ii. Check substring
11. 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 "Asst Manager".
12. Create class STORE to keep track of Products ( Product Code, Name and price). Display menu of all products to user. Generate bill as per

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310909: Business Communication Lab</b>		
<b>Teaching Scheme:</b> <b>PR: 2 Hours/Week</b>	<b>Credit</b> <b>PR : 1</b>	<b>Examination Scheme:</b> <b>Term Work: 50 Marks</b>
<b>Pre-requisite Course:</b> Basic writing Skills including grammar and mechanics		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To understand the concept, process and importance of communication.</li> <li>To develop an integrative approach where reading, writing, presentation skills are used together to enhance ability to communicate and write effectively.</li> <li>To create awareness about Methods and Media of communication.</li> <li>To improve job seeking skills.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Apply business communication strategies and principles to prepare effective communication for domestic and international business situations <b>CO2:</b> Identify ethical, legal, cultural, and global issues affecting business communication. <b>CO3:</b> Utilize analytical and problem solving skills appropriate to business communication. <b>CO4:</b> Participate in team activities using collaborative work skills. <b>CO5:</b> Select appropriate organizational formats and channels used in developing and presenting business messages. <b>CO6:</b> Communicate via electronic mail, Internet, and other technologies. <b>CO7:</b> Deliver an effective oral business presentation		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Communication</b>	<b>06 Hours</b>
Introduction to Communication, Meaning and Definition, Process of communication and importance, Principles of effective communication, Types of Communication, Scope of Business communication - Internal & External, Barriers to Communication, Linguistic Barriers, Psychological Barriers, Interpersonal Barriers, Cultural Barriers, Physical Barriers, Organizational Barriers , Overcoming the barriers <b>Verbal Communication</b> - Written Communication-Advantages & Limitations (writing a Cover Letter, Memo, Agenda, Notice & Minutes), Oral Communication - Principles of effective oral communication - Techniques of effective speech, Media of oral communication (Face-to-face conversation - Teleconferences - Press Conference - Demonstration - Radio Recording - Dictaphone - Meetings - Demonstration and Dramatization - Public address system - Grapevine - Group Discussion - Oral report – Advantages and Limitations <b>Non-Verbal Communication</b> - Body Language ( Positive & Negative Gestures)handshakes, gazes, smiles, hand movements, styles of working, voice modulations, body sport for interviews; business etiquettes; business dining, business manners of people of different cultures, managing customer care		
<b>Unit II</b>	<b>Listening Skills</b>	<b>06 Hours</b>

Importance, Types of Listening, Barriers to Effective listening, Difference between listening and hearing – active listening, academic listening, listening for details - listening and note-taking, listening for sound contents of videos, listening to talks and descriptions, listening for meaning - listening to announcements (railway/ bus stations/ airport / stadium announcement etc.) ,Listening to Radio and Television ,listening to news programs, Tips for effective listening, 10 Commandments of listening

<b>Unit III</b>	<b>Speaking and Presentation Skills</b>	<b>06 Hours</b>
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Interactive nature of communication, importance of context ,formal and informal –set Expressions in different situations ,greeting – introducing - making requests - asking for /giving permission - giving instructions and directions – agreeing / disagreeing - seeking and giving advice - inviting and apologizing telephonic skills - conversational manners

Presentation as a skill - prerequisites of effective presentation, format of presentation; Assertiveness – indicators of assertive behaviour, strategies of assertive behaviour; elements of presentation strategies – audience – objectives medium- key ideas - structuring the material - organizing content - audio-visual aids - hand-outs - use of power point - clarity of presentation - non-verbal communication - seminar paper presentation and discussion, Communication skills for group discussion and interviews

<b>Unit IV</b>	<b>Business Correspondence</b>	<b>06 Hours</b>
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Need of Business Correspondence , Components and layout of Business letter,

Drafting of letters: Enquiry, Quotation, order , Complaints and follow up , Recovery , Email etiquette, notices, circulars, memos, Preparing agenda and writing minutes of meetings , Making notes on Business conversations , Effective use of SMS and Case writing and Documentation, Persuasive letter, Proposal, Report Writing , Preparing Press Release and Press Notes, Job application letter , Essentials of an impressive Resume

<b>Unit V</b>	<b>Creativity and Capacity Building</b>	<b>06 Hours</b>
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**Creativity at Workplace:** Introduction, Current Workplaces, Creativity, Motivation, Nurturing Hobbies at Work, The Six Thinking Hat Method Ethical Values: Ethics and Society, Theories of Ethics, Correlation between Values and Behavior, Nurturing Ethics, Importance of Work Ethics, Problems in the Absence of Work Ethics

**Capacity Building:** Learn, Unlearn and Relearn: Capacity Building, Elements of Capacity Building, Zones of Learning, Ideas for Learning, Strategies for Capacity Building

<b>Unit VI</b>	<b>Soft Skills</b>	<b>06 Hours</b>
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**Leadership and Team Building:** Leader and Leadership, Leadership Traits, Culture and Leadership, Leadership Styles and Trends, Team Building, Types of Teams,

**Decision Making and Negotiation:** Introduction to Decision Making, Steps for Decision Making, Decision Making Techniques, Negotiation Fundamentals, Negotiation Styles, Major Negotiation Concepts

**Stress and Time Management:** Stress, Sources of Stress, Ways to Cope with Stress

**Reference Books:**

1. S.A. Sherlekar , “Modern Business Organization “
2. C.B. Gupta, “Business Organization & Management”
3. McGrath, E.H., “Basic Managerial Skills for All”, PHI, New Delhi
4. Gajendra S. Chauhan, Sangeeta Sharma, “Soft Skills: an Integrated Approach to Maximise Personality”, Wiley India
5. Write Rightly A Course for Sharpening Your Writing Skills. (CUP)
6. Hamp-Lyons and etal, “Study Writing”, 2nd Edition, Cambridge University Press, 2008.
7. Barun K. Mitra , “Personality Development and Soft Skills”, Oxford Press
8. D. Sudha Rani, “Business Communication and Soft Skills Laboratory Manual”
9. D. Sudha Rani, Business Communication and Soft Skills Laboratory Manual

### Guidelines for Instructor's Manual

The instructor’s manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

### Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign

### Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

### Suggested List of Laboratory Assignments

#### LANGUAGE LAB

- |   |   |
|---|---|
| 1 | Listening Comprehension Exercise            |
| 2 | Reading Comprehension & Vocabulary Exercise |
| 3 | Error Detection                             |
| 4 | Role Play I                                 |
| 5 | Telephone Conversation                      |
| 6 | Face to Face Conversation                   |

#### CAREER LAB

- |   |  |
|---|--|
| 1 | Introducing Yourself   |
| 2 | Thumbnail Portrait   |
| 3 | Writing Skills - Covering Letter, Resume , Application letter, Report Writing, Proposal Writing ,Email Communication |
| 4 | Presentation Skills – Dos and Don'ts   |
| 5 | Group Discussion   |
| 6 | Mock Interview   |
| 7 | Public Speaking activity   |
| 8 | Soft skills- Assertiveness   |
| 9 | Leadership Skills and Team Building Activity   |

**Savitribai Phule Pune University, Pune**  
**First year of MCA (2020 Course)**  
**310910A: Audit Course-1-I-Foreign Language- Japanese**

**About course:**

With changing times, the competitiveness has gotten into the nerves and Being the Best at all times is only the proof of it. Nonetheless, being the best differs significantly from Communicating the best,,. The best can merely be communicated whilst using the best suited Language! Japanese is the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major centre of Japanese Education in India while increasing the precedence for Japanese connoisseurs. Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the resume since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages. It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an on-going process and ultimately soldier on it. The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

**Course Objectives:**

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

**Course Outcomes:**

On completion of the course learner will-

**CO1:** Have ability of basic communication.

**CO2:** Have the knowledge of Japanese script.

**CO3:** Get introduced to reading , writing and listening skills

**CO4:** Will develop interest to pursue professional Japanese Language course.

**Course Contents**

- 1: Introduction to Japanese Language. Hiragana basic Script, colors, Days of the week.
- 2: Hiragana : modified Kana, double consonant, Letters combined with ya, yu, yo Long vowels, Greetings and expressions
- 3: Self Introduction, Introducing other person, Numbers, Months, Dates, Telephone numbers, Stating one's age.

**Reference Books:**

1. Minna No Nihongo, "Japanese for Everyone", Elementary Main Text book 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.
2. <http://www.tcs.com> ([http://www.tcs.com/news\\_events/press\\_releases/Pages/TCS-Inaugurates-Japancentric-Delivery-Center-Pune.aspx](http://www.tcs.com/news_events/press_releases/Pages/TCS-Inaugurates-Japancentric-Delivery-Center-Pune.aspx))

**Savitribai Phule Pune University**  
**First Year of MCA (2020 Course)**  
**310910B : Audit Course 1**  
**AC1-II: Road Safety**

Road transport remains the least safe mode of transport, with road accidents representing the main cause of death of people. The boom in the vehicle population without adequate road infrastructure, poor attention to driver training and unsatisfactory regulation has been responsible for increase in the number of accidents. India's vehicle population is negligible as compared to the World statistics; but the comparable proportion for accidents is substantially large.

The need for stricter enforcement of law to ensure greater safety on roads and an environment-friendly road transport operation is of paramount importance. Safety and security are growing concerns for businesses, governments and the traveling public around the world, as also in India. It is, therefore, essential to take new initiatives in raising awareness, skill and knowledge of students as one of the ibid stake holders who are expected to follow the rules and policies of the government in order to facilitate safety of individual and safe mobility of others.

**Course Contents:**

1. Existing Road Transport Scenario
2. Accident Causes & Remedies
3. Road Accident Investigation & Investigation Methods
4. Regulatory / Legislative Provisions for Improving Road Safety
5. Behavioral Training for Drivers for Improving Road Safety
6. Road Safety Education

**References:**

- 1 Road Accidents in India Issues & Dimensions, Ministry of Road Transport & Highways Government of India ([www.unescap.org/sites/default/files/2.12.India\\_.pdf](http://www.unescap.org/sites/default/files/2.12.India_.pdf))
- 2 Road Safety in India- Insights and analysis, [http://indiatrtransportportal.com/wp-content/uploads/2012/11/Road\\_safety\\_2012.pdf](http://indiatrtransportportal.com/wp-content/uploads/2012/11/Road_safety_2012.pdf)
- 3 Road User's Handbook, ROADS & MARITIME PUBLICATIONS
- 4 Improving Road Safety in Developing Countries, The national Academic Press

**Savitribai Phule Pune University, Pune****First year of MCA (2020 Course)****310911: Non Credit Course-1: MOOC Course-I- Swayam/Spoken Tutorial /NPTEL**

**SWAYAM** is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

(**NPTEL**) National Programme on Technology Enhanced Learning is a project of MHRD initiated by seven Indian Institutes of Technology (**Bombay, Delhi, Kanpur, Kharagpur, Madras, Guwahati and Roorkee**) along with the Indian Institute of Science, Bangalore in 2003, to provide quality education to anyone interested in learning from the IITs. The main goal was to create web and video courses in all major branches of engineering and physical sciences at the undergraduate and postgraduate levels and management courses at the postgraduate level.

**Spoken Tutorial** is an initiative of national mission on education through ICT, MHRD, Govt. of India to promote IT literacy through Open Source Software. It is a multi-award winning educational content portal. Here one can learn various Free and Open Source Software all by oneself. Anybody with a computer and a desire for learning can learn from any place, at any time and in any language of their choice.

**About Course and Grade**

**Non Credit course** is compulsory. No grade points are associated with non-credit courses and are not accounted in the calculation of the performance indices SGPA & CGPA. Result of assessment will be PP or NP. Set of non-credit courses offered is provided. **Conduction and assessment of performance in said course is to be done at institute level.**

**PP and NP Grade** - The student registered and completed non credit MOOC course shall be awarded the grade PP after satisfactory completion of credit course and shall be included in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory internal assessment performance and secured a passing grade in that course. Student who is unable to complete MOOC course will be awarded as NP grade.

**Guidelines for Conduction**

Students have to enrol themselves for any one course which will be on going and complete the assignments. Grades will be given on the basis of submitted assignments and marks obtained. If student wants to earn a verified certificate, he/she will have to fill the online exam registration form and take the proctored exam conducted by NPTEL/Spoken Tutorial in person at any of the designated exam centres

**Suggested List of Courses (Any One)**

1. C programming -8 weeks
2. Enhancing soft skill and personality – 8 weeks
3. Design and analysis of algorithms -8 weeks
4. Soft Skill Development-8 weeks
5. Speaking Effectively -8 weeks
6. Linux (Spoken tutorial)

**Institute may choose any one of suggested MOOC Course or decide any other MOOC course at Institute level.**

**Learning Resources:**

1. MOOC Courses: <web links>
2. <https://nptel.ac.in/course.html>
3. <https://swayam.gov.in/explorer>
4. <https://spoken-tutorial.org/tutorial-search>



# SEMESTER II



<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310912: Database Management System</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisite courses, if any:</b> Discrete Mathematics, Data Structures		
<b>Companion Course, if any:</b> Database Management System Lab		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.</li> <li>To provide a strong formal foundation in database concepts, technology and practice.</li> <li>To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.</li> <li>Be familiar with the basic issues of transaction processing and concurrency control.</li> <li>To learn and understand various Database Architectures and Applications.</li> <li>To learn a powerful, flexible and scalable general purpose database to handle big data.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Design E-R Model for given requirements and convert the same into database tables. <b>CO2:</b> Use database techniques such as SQL & PL/SQL. <b>CO3:</b> Use modern database techniques such as NOSQL. <b>CO4:</b> Explain transaction Management in relational database System. <b>CO5:</b> Describe different database architecture and analyses the use of appropriate architecture in real time environment. <b>CO6:</b> Students will be able to use advanced database Programming concepts Big Data – HADOOP		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction</b>	<b>07 Hours</b>
Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables.		
<b>Unit II</b>	<b>SQL AND PL/SQL</b>	<b>07 Hours</b>
SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: concept of Stored Procedures & Functions, Cursors, Triggers, Assertions, roles and privileges, Embedded SQL, Dynamic SQL.		
<b>Unit III</b>	<b>Relational Database Design</b>	<b>07 Hours</b>
Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional		

Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF.		
<b>Unit IV</b>	<b>Database Transactions and Query Processing</b>	<b>07 Hours</b>
Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Need, Locking Methods, Deadlocks, Timestamping Methods, Recovery methods : Shadow-Paging and Log-Based Recovery, Checkpoints, Query Processing, Query Optimization, Performance Tuning.		
<b>Unit V</b>	<b>Parallel and Distributed Databases</b>	<b>07Hours</b>
Introduction to Database Architectures: Multi-user DBMS Architectures, Parallel Databases: Speedup and Scale up, Architectures of Parallel Databases. Distributed Databases: Architecture of Distributed Databases, Distributed Database Design, Distributed Transaction: Basics, Failure modes, Commit Protocols, Concurrency Control in Distributed Database.		
<b>Unit VI</b>	<b>NoSQL Database</b>	<b>07 Hours</b>
Introduction to NoSQL Database, Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Distributed Database Model, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, NoSQL Data Models, Case Study-unstructured data from social media. Introduction to Big Data, HADOOP: HDFS, MapReduce.		
<b>Learning Resources:</b>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition</li> <li>2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4</li> <li>3. Pramod J. Sadalage and Martin Fowler, —NoSQL Distilled, Addison Wesley, ISBN10: 0321826620, ISBN-13: 978-0321826626</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. C J Date, —An Introduction to Database Systems, Addison-Wesley, ISBN: 0201144719</li> <li>2. S.K.Singh, —Database Systems : Concepts, Design and Application, Pearson, Education, ISBN 978-81-317-6092-5</li> <li>3. Kristina Chodorow, Michael Dirolf, —MongoDB: The Definitive Guide, O'Reilly Publications, ISBN: 978-1-449-34468-9.</li> <li>4. Adam Fowler, —NoSQL For Dummies, John Wiley &amp; Sons, ISBN-1118905628</li> <li>5. Kevin Roebuck, —Storing and Managing Big Data - NoSQL, HADOOP and More, Emereopyt Limited, ISBN: 1743045743, 9781743045749</li> <li>6. Joy A. Kreibich, —Using Sqlite, O'REILLY, ISBN: 13:978-93-5110-934-1</li> <li>7. Garrett Grolemond, —Hands-on Programming with R, O'REILLY, ISBN : 13:978-93- 5110-728-6</li> </ol>		
<b>e-Books: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="http://www.freebookcentre.net/database-books-download/Introduction-to-Database-Systems.html">http://www.freebookcentre.net/database-books-download/Introduction-to-Database-Systems.html</a></li> </ol>		
<b>MOOC Courses: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.coursera.org/courses?query=database">https://www.coursera.org/courses?query=database</a></li> <li>2. <a href="https://cs.stanford.edu/people/widom/DB-mooc.html">https://cs.stanford.edu/people/widom/DB-mooc.html</a></li> <li>3. <a href="http://www.edx.org">www.edx.org</a></li> </ol>		

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310913: Computer Network</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisite courses, if any: Basic Knowledge of Computer</b> <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To understand the fundamental concepts of networking standards, protocols and technologies</li> <li>To learn different techniques for framing, error control, flow control and routing.</li> <li>To learn role of protocols at various layers in the protocol stacks.</li> <li>To learn network programming.</li> <li>To develop an understanding of modern network architectures from a design and performance perspective.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Analyze the requirements for a given organizational structure to select the most appropriate networking architecture, topologies, transmission mediums, and technologies. <b>CO2:</b> Demonstrate design issues, flow control and error control. <b>CO3:</b> Analyze data flow between TCP/IP model using Application, Transport and Network Layer protocols. <b>CO4:</b> Illustrate applications of Computer Network capabilities, selection and usage for various sectors of user community. <b>CO5:</b> Illustrate Client-Server architectures and prototypes by the means of correct standards and technology. <b>CO6:</b> Demonstrate different routing and switching algorithms.		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Physical Layer</b>	<b>06 Hours</b>
Introduction of LAN; MAN; WAN; PAN, Ad-hoc Network, OSI Model, TCP/IP Model, Topologies: Star and Hierarchical; Design issues for Layers, Transmission Mediums: CAT5, 5e, 6, OFC and Radio Spectrum, Network Devices: Bridge, Switch, Router, Brouter and Access Point, Manchester and Differential Manchester Encodings; IEEE802.11: Frequency Hopping (FHSS) and Direct Sequence (DSSS)		
<b>Unit II</b>	<b>Logical Link Control</b>	<b>06 Hours</b>
Design Issues: Services to Network Layer, Framing, Error Control and Flow Control. Error Control: Parity Bits, Hamming Codes (11/12-bits) and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol, WAN Connectivity : PPP and HDLC		
<b>Unit III</b>	<b>Medium Access Control</b>	<b>06 Hours</b>
Channel allocation: Static and Dynamic, Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, IEEE 802.3 Standards and Frame Formats, CSMA/CD, Fast Ethernet, Gigabit Ethernet, IEEE 802.11a/b/g/n and IEEE 802.15 and IEEE 802.16 Standards, CSMA/CA.		
<b>Unit IV</b>	<b>Network Layer</b>	<b>06 Hours</b>
Network Layer Services, Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP, Routing Protocols: Distance Vector, Link State, Path Vector, Routing in Internet: RIP ,OSPF, BGP, Congestion control and QoS, MPLS, Mobile IP, Routing in MANET : AODV, DSR		

Unit V	Transport Layer	06Hours
Transport Layer Services, UDP: Datagram services, Applications, Berkley Sockets, Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, TCP: Services, Features, Segment, TCP Timer management, TCP Congestion Control, Real Time Transport protocol(RTP), Stream Control Transmission Protocol (SCTP), Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless.		
Unit VI	Application Layer	06 Hours
Client Server Paradigm: Communication using TCP and UDP, Peer to Peer Paradigm, Application Layer Protocols :Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP,TFTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP) .		
<b>Learning Resources:</b>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Andrew S. Tenenbaum, “Computer Networks”, PHI, ISBN 81-203-2175-8.</li> <li>2. Fourauzan B., "Data Communications and Networking", 5 th Edition, Tata McGraw- Hill, Publications, ISBN: 0 – 07 – 058408 – 7</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Kurose, Ross “Computer Networking a Top Down Approach Featuring the Internet”, Pearson, ISBN-10: 0132856204</li> <li>2. Matthew S. G, “802.11 Wireless Networks”, O’Reilly publications, ISBN: 81-7656-992-5</li> <li>3. 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>4. Holger Karl and Andreas Willing, “Protocols and Architectures for Wireless Sensor Networks”, Wiley India , ISBN: 9788126533695</li> <li>5. Eldad Perahia, Robert Stacey, “Next Generation Wireless LANs”, Cambridge, ISBN-10: 1107016762; ISBN-13: 978-1107016767</li> <li>6. Efraim Turban, Linda Volonino, Gregory R. Wood “Computer Networking a Top Down Approach Featuring the Internet”, 10th Edition, Wiley; ISBN13: 978-1-118-96126-1sor</li> </ol>		
<b>e-Books:</b> <ol style="list-style-type: none"> <li>1.<a href="http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf">http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf</a></li> <li>2.<a href="http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf">http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf</a></li> </ol>		
<b>MOOC Courses:</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.coursera.org/courses?query=computer%20network">https://www.coursera.org/courses?query=computer%20network</a></li> <li>2. <a href="https://www.udacity.com/course/computer-networking--ud436">https://www.udacity.com/course/computer-networking--ud436</a></li> </ol>		

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310914: Java Programming</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisites:</b> Basic Computer Programming Concepts  <b>Course Objectives:</b> <ol style="list-style-type: none"> <li>1. To learn the core concept of Java programming</li> <li>2. to introduce the working environment of Java Program using the multithreading and file handling</li> <li>3. To get acquainted the purpose of applet and AWT in Java programming</li> <li>4. To study the use of database connectivity in Java Programming</li> <li>5. To gain knowledge of Java Servlet and JSP concept in Java</li> </ol>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Describe the core concept of Java programming <b>CO2:</b> Discover the need for working with the multithreading and file handling <b>CO3:</b> Illustrate the purpose of applet and AWT in Java programming <b>CO4:</b> Indicate the use of database connectivity using Java Programming <b>CO5:</b> Articulate the networking concepts in Java <b>CO6:</b> Implement Java Servlet and JSP concept in Java		
<b>Course Contents</b>		
<b>Unit I</b>	<b>An Introduction to Core Java</b>	<b>08 Hours</b>
<b>An Introduction to Java:</b> <ul style="list-style-type: none"> <li>• A Short History of Java, Features of Java, Creating and Running Java Programs using Command Line Arguments and IDE</li> <li>• Programming Construct (Decision making statement, switch statement, looping statement)</li> <li>• Class and Object (Defining a class, Adding variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors)</li> <li>• Object Oriented concepts with respect to Java (Inheritance:</li> <li>• Extending a class, Overriding Method, using super, Final variable and Methods, this keyword)</li> <li>• Interfaces, Packages (Java API package, Using system packages, Creating Packages &amp; Using a Package, Interface Introduction, creating and using interfaces)</li> <li>• Exception Handling (Types of error, exceptions, try and catch statement, nested try statement, throws and finally statement, build it exceptions, chained exceptions, creating own exception)</li> </ul>		
<b>Unit II</b>	<b>Multithreading and File Handling</b>	<b>07 Hours</b>
<b>Multithreading:</b> <ul style="list-style-type: none"> <li>• Multithreading concepts</li> <li>• Thread Life cycle</li> <li>• Creating multithreaded application</li> <li>• Thread priorities</li> </ul>		

<ul style="list-style-type: none"> <li>• Thread synchronization</li> <li>• Java Input Output:</li> <li>• Java IO package</li> <li>• Byte/Character Stream</li> <li>• Buffered reader / writer</li> <li>• File reader / writer</li> <li>• Print writer</li> <li>• File Sequential / Random</li> </ul>		
<b>Unit III</b>	<b>Applets and AWT Programming</b>	<b>07 Hours</b>
<b>Applet As Java Applications:</b> <ul style="list-style-type: none"> <li>• Life cycle of Applet</li> <li>• Creation and Execution of Java Applets,</li> <li>• Displaying it using Web Browser with appletviewer.exe</li> <li>• Advantages and Disadvantages of Applet Vs Applications</li> <li>• Parameter Passing to applet</li> </ul> <b>Abstract Windows Toolkit:</b> <ul style="list-style-type: none"> <li>• Components and Graphics</li> <li>• Containers, Frames and Panels</li> <li>• Layout Managers</li> <li>• AWT basic components</li> <li>• Event delegation Model: Event source and handler, Event categories, Listeners, interfaces</li> <li>• Anonymous classes</li> <li>• Swing Libraries: Model view Controller design pattern, Different layout, menus dialog boxes,</li> <li>• text input</li> </ul>		
<b>Unit IV</b>	<b>JDBC</b>	<b>07 Hours</b>
<ul style="list-style-type: none"> <li>• Java database connectivity, Types of JDBC drivers</li> <li>• Writing first JDBC applications</li> <li>• Types of statement objects (Statement, PreparedStatement and CallableStatement)</li> <li>• Types of resultset, ResultSetMetadata</li> <li>• Inserting and updating records</li> <li>• JDBC and AWT</li> <li>• Connection pooling</li> </ul>		
<b>Unit V</b>	<b>Networking with Java</b>	<b>07 Hours</b>
<ul style="list-style-type: none"> <li>• Networking basics: Sockets, port, Proxy servers, Internet addressing 7 URL</li> <li>• java.net – networking classes and interfaces</li> <li>• Implementing TCP/IP based Server and Client</li> <li>• Datagrams – Datagram packet, Datagram server and client</li> <li>• URL connections</li> </ul>		
<b>Unit VI</b>	<b>Java Servlet and JSP</b>	<b>06 Hours</b>
<b>Servlet:</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Life cycle of servlet</li> </ul>		
<ul style="list-style-type: none"> <li>• Handling HTTP Get Request</li> <li>• Handling HTTP Post Request</li> <li>• Introduction to JSP:</li> </ul>		

- Getting Familiar with JSP Server
- First JSP
- Adding Dynamic contents via expressions
- Scriptlets, Mixing Scriptlets and HTML
- Directives, Declaration, Tags and Session

**Books:****Text Books:**

1. Programming with Java , A primer ,Forth edition , By E. Balagurusamy
2. Herbert Schilt, “JAVA Complete Reference”, 7th Edition, Tata McGraw Hill, ISBN: 9780070636774
3. Java 2 programming black books, Steven Horlzner

**Reference Books:**

1. Eckel B., "Thinking in Java", 3rd Edition, Pearson Education
2. “Complete Reference Java” by Herbert Schildt(5th edition)
3. Core Java 2 Volume - I Cay S Horstmann, Fary Cornell
4. Core Java 2 Volume - II Cay S Horstmann, Fary Cornell
5. Developing Java Servlets James Goodwill
6. Beginning Java Networking Chad Darby, John Griffin & others

**Websites links**

1. <http://tutorialpoint.com>
2. <https://www.w3schools.in/java-tutorial>

**MOOC Courses:**

1. <https://moocfi.github.io/courses/2013/programming-part-1/>
2. <https://java-programming.mooc.fi/>
3. <https://education.oracle.com/java-se-programming-i-mooc>



<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310915: Operating System</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisite courses, if any:</b> 1. 310902- Data structures and Algorithms <b>Companion Course, if any:</b> 1. 310918- Operating System laboratory <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To introduce basic concepts and functions of modern operating systems</li> <li>To understand the concept of process and thread management.</li> <li>To understand the concept of concurrency control</li> <li>To understand the concept of disk scheduling and File management.</li> <li>To understand various Memory Management techniques</li> <li>To understand the features of LINUX operating system</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Fundamental understanding of the role of Operating Systems. <b>CO2:</b> To understand the concept of a process and thread. <b>CO3:</b> To apply the concept of process scheduling. <b>CO4:</b> To apply the concept of process synchronization, mutual exclusion and the deadlock <b>CO5:</b> To realize the concept of disk scheduling and File system <b>CO6:</b> To understand the various memory management techniques.		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Overview of operating system</b>	<b>06 Hours</b>
Operating System Objectives and Functions, The Evolution of Operating Systems, Developments Leading to Modern Operating Systems, Virtual Machines. BASH Shell scripting: Basic shell commands, shell as a scripting language.		
<b>Unit II</b>	<b>Process description and control</b>	<b>06 Hours</b>
Process: Concept of a Process, Process States, Process Description, Process Control (Process creation, Waiting for the process/processes, Loading programs into processes and Process Termination), Execution of the Operating System. Threads: Processes and Threads, Concept of Multithreading, Types of Threads Scheduling: CPU scheduling , Types of Scheduling, Scheduling criteria, Scheduling Algorithms		
<b>Unit III</b>	<b>Concurrency control</b>	<b>06 Hours</b>
Process/thread Synchronization and Mutual Exclusion: Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support-Semaphore and monitor Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem Deadlock : Principles of Deadlock, Deadlock Modelling, Strategies to deal with deadlock: Deadlock Prevention, Deadlock Avoidance, Deadlock detection and recovery		
<b>Unit IV</b>	<b>Memory management</b>	<b>06 Hours</b>
Memory Management: Memory Management Requirements, Memory Partitioning: Fixed		



Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Segmentation. Virtual Memory: Hardware and Control Structures.		
<b>Unit V</b>	<b>Disk Scheduling and File Management</b>	<b>06Hours</b>
Disk Scheduling(FIFO, SSTF, SCAN, C-SCAN, LOOK, C-LOOK), Disk structure. File Management: Overview, File Organization and Access, Allocation methods, File Directories, File Sharing, Free space management.		
<b>Unit VI</b>	<b>The LINUX Operating System</b>	<b>06 Hours</b>
Linux Design Principles, Linux Booting Process, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output, Inter-process Communication		
<b>Learning Resources:</b>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition</li> <li>2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, WILEY, ISBN 978-1-118-06333-0 , 9th Edition</li> <li>3. Andrew S. Tanenbaum &amp; Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition</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. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978-0-471-68723-8</li> <li>4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project</li> </ol>		
<b>e-Books: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.getfreebooks.com/xv6-a-simple-unix-like-teaching-operating-system/">https://www.getfreebooks.com/xv6-a-simple-unix-like-teaching-operating-system/</a></li> <li>2. <a href="https://www.pdfdrive.com/operating-systems-e18726938.html">https://www.pdfdrive.com/operating-systems-e18726938.html</a></li> </ol>		
<b>MOOC Courses: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.coursera.org/courses?query=operating%20system">https://www.coursera.org/courses?query=operating%20system</a></li> <li>2. <a href="https://www.classcentral.com/tag/operating-systems">https://www.classcentral.com/tag/operating-systems</a></li> <li>3. <a href="https://www.udacity.com/course/introduction-to-operating-systems--ud923">https://www.udacity.com/course/introduction-to-operating-systems--ud923</a></li> </ol>		

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310916A: Elective-I-Mobile Computing</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisites:</b> <ul style="list-style-type: none"> <li>Basic knowledge of Programming Language and data base system.</li> <li>Concept of Networking</li> </ul>		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To understand mobile computing</li> <li>To understand different generation of mobile</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, student will be able to– <b>CO1:</b> Describe the concept and technique of Wireless telephony. <b>CO2:</b> Explain the concept of wireless networking. <b>CO3:</b> Describe data management issue of mobile wireless network. <b>CO4:</b> Discuss the mobile operating system. <b>CO5:</b> Design Android mobile application. <b>CO6:</b> Manage database and features of mobile application.		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction of Mobile Computing</b>	<b>08 Hours</b>
Introduction, issues in mobile computing, overview of wireless telephony: Cellular networks, Cellular concept, Mobile Phone Technologies (1G, 2G, 3G,4G,5G) , GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS. Protocols Localization and calling, Handover, Value Added Services – SMS, Cell Broadcast Service, MMS, Location Services.		
<b>Unit II</b>	<b>Wireless Networking</b>	<b>07 Hours</b>
Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11 Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.		
<b>Unit III</b>	<b>Mobile Data management</b>	<b>07 Hours</b>
Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.		
<b>Unit IV</b>	<b>Introduction to Operating System</b>	<b>07 Hours</b>
Introduction of Operating System: Palm OS, Windows CE, Embedded Linux, J2ME, Symbian, Android development: Overview of Android, Devices running android, Why Develop for Android, Features of android, Architecture of Android, Libraries, Software development kit Designing the user interface: Introducing views and view groups, Introducing layouts, Creating new views, Creating and using Menus.		
<b>Unit V</b>	<b>Android Application</b>	<b>07 Hours</b>

Android Application: Introducing Intents, Adapters, Introducing Dialogs, Capturing Date and Time, Validating and Handling Input data Accessing Location Based Services Application: Selecting Location Provider, Finding your location, Creating map based activities Data Storage, retrieval and Sharing: File system in android, Internal and external storage, Saving and loading files, File Management tools.		
<b>Unit VI</b>	<b>Management and Trends of Application</b>	<b>06 Hours</b>
Introduction of SQLite database, Peer to peer communication: Accessing Telephony Hardware, Introducing Android Messaging, GTalk Service : Using, binding & Making connection, Managing chat Sessions, Sending and receiving Data messages. Managing Application Data, Performance, Scalability, Modifiability, Availability and Security of Mobile Applications, Testing Methodologies for Mobile Applications, Future Mobile Generations. Introducing Sensor Manager , Android Telephony, Manage network and Wi-Fi connections.		
<b>Books:</b>		
<b>Text Books:</b>		
<ol style="list-style-type: none"> <li>1. Mobile Computing: Prasant Pattnaik, Rajib Mall, PHI Publication</li> <li>2. Mobile Computing: Raj kamal, Oxford</li> <li>3. Android Application Development: Carmen Delessio, <a href="#">PEARSON INDIA</a></li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1.Mobile Communications J. Schiller, Addition Wesley Publication</li> <li>2. GSM System Engineering A.Mehrotra, Addition Wesley Publication</li> <li>3. Understanding WAP M. Heijden, M. Taylor, Artech House Publication</li> <li>4. Professional Android Application Development Wrox Publications, Reto Meier</li> <li>5. Upadhyaya, Mobile Computing, Springer</li> <li>6. Sams teach yourself Android application development, Lauren Dercy and Shande Conder, Sams publishing</li> <li>7. Mobile Computing: Asoke K Talukdar, Roopa R. Yavagal, TataMcGrawHill</li> <li>8. Principles of Mobile Computing , Hansmann, Merk, Nicklous, Stober, Springer, second edition</li> </ol>		
<b>e-Books: &lt;web links&gt;</b>		
<ol style="list-style-type: none"> <li>1. <a href="http://freecomputerbooks.com/mobileDeviceProgrammingBooks.html">http://freecomputerbooks.com/mobileDeviceProgrammingBooks.html</a></li> <li>2. <a href="http://www.freebookcentre.net/mobile-technology/mobile-technology-books.html">http://www.freebookcentre.net/mobile-technology/mobile-technology-books.html</a></li> </ol>		
<b>MOOC Courses: &lt;web links&gt;</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://www.coursera.org/courses?query=mobile%20cloud%20computing">https://www.coursera.org/courses?query=mobile%20cloud%20computing</a></li> <li>2. <a href="https://www.ed.youth4work.com/course/479-mobile-computing-online-course">https://www.ed.youth4work.com/course/479-mobile-computing-online-course</a></li> </ol>		

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310916B: Elective I- Artificial Intelligence</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisite courses, if any:</b> Discrete Mathematics Data Structure and Algorithms <b>Companion Course, if any:</b> NA		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To present an overview of artificial intelligence (AI) principles and approaches.</li> <li>Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.</li> <li>To understand Natural language processing and Expert systems</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Describe the modern view of AI as the study of agents that receive precepts from the Environment and perform actions. <b>CO2:</b> Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning. <b>CO3:</b> Describe the use of various search techniques <b>CO4:</b> Develop knowledge of decision making methods <b>CO5:</b> Explain about AI techniques for logical planning <b>CO6:</b> Explain the concept of Expert systems		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction to Artificial Intelligence</b>	<b>06 Hours</b>
Introduction: What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, and Applications of AI. Intelligent Agents and Environments: Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents, How the components of agent programs work.		
<b>Unit II</b>	<b>Search Techniques</b>	<b>06 Hours</b>
Solving Problems by Searching: Study and analysis of Various searching algorithms. Implementation of Depth-first search Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search Informed (Heuristic) Search Strategies: Greedy best first search A* search: Minimizing the total estimated solution cost, Conditions for optimality: Admissibility and consistency, Optimality of A*, Heuristic Functions		
<b>Unit III</b>	<b>Knowledge Representation</b>	<b>06 Hours</b>
Definition of knowledge, properties for knowledge representation system, predicate calculus-connectives, variables and quantification, Predicates and arguments, TMS(truth maintenance system), Statistical and probabilistic reasoning		
<b>Unit IV</b>	<b>Planning</b>	<b>06 Hours</b>

Introduction : Search in planning, search vs planning, planning as problem solving, components of a planning, Forward planning, Nonlinear planning using constraint posting, Hierarchical planning		
<b>Unit V</b>	<b>Learning</b>	<b>06 Hours</b>
Introduction, Learning methods, Introduction to Neural Networks, Working of a Neuron, The basic components of ANN, Issues related to Neural computation, Feedforward Networks, Backpropagation Algorithm, Applications of Neural Networks		
<b>Unit VI</b>	<b>Expert System</b>	<b>06 Hours</b>
Utilization and Functionality, Architecture of Expert system, Components of expert system, steps for building expert system, Case study on expert system		
<b>Learning Resources:</b>		
<b>Text Books:</b>		
1. Artificial Intelligence: A Modern Approach by Peter and Norvig ISBN-0-13- 103805		
<b>Reference Books:</b>		
1. Artificial Intelligence by Elaine Rich, Kevin Knight and Nair ISBN-978-0-07- 008770-5, TMH,		
2. Artificial Intelligence by Saroj Kausik ISBN:- 978-81-315-1099-5, Cengage Learning		
3. Artificial Intelligence and Intelligent Systems by Padhy, Oxford University Press,		
<b>e-Books: &lt;web links&gt;</b>		
1. <a href="https://www.cin.ufpe.br/~tfl2/artificial-intelligence-modern-approach.9780131038059.25368.pdf">https://www.cin.ufpe.br/~tfl2/artificial-intelligence-modern-approach.9780131038059.25368.pdf</a>		
<b>MOOC Courses: &lt;web links&gt;</b>		
1. <a href="https://nptel.ac.in/courses/106/105/106105077/">https://nptel.ac.in/courses/106/105/106105077/</a>		

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310916C: Elective I ( Cyber Security)</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisites: if any:</b> NA		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To prepare students with the technical knowledge and skills needed to protect and defend computer systems and networks.</li> <li>To develop students that can plan, implement, and monitor cyber security mechanisms to help ensure the protection of information technology assets.</li> <li>To develop graduates that can identify, analyze, and remediate computer security breaches</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Analyze and evaluate the cyber security needs of an organization. <b>CO2:</b> Conduct a cyber security risk assessment. <b>CO3:</b> Measure the performance and troubleshoot cyber security systems. <b>CO4:</b> Implement cyber security solutions. <b>CO5:</b> Be able to study cyber security, information assurance, and cyber/computer forensics software/tools. <b>CO6:</b> Identify the key cyber security vendors in the marketplace.		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Overview of Cyber Security</b>	<b>06 Hours</b>
Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.		
<b>Unit II</b>	<b>Vulnerabilities and Access Control</b>	<b>06 Hours</b>
Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.		
<b>Unit III</b>	<b>Intrusion detection and Prevention</b>	<b>06 Hours</b>
Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.		
<b>Unit IV</b>	<b>Cryptography</b>	<b>06 Hours</b>
Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.		
<b>Unit V</b>	<b>Roles and Regulations</b>	<b>06 Hours</b>
Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.		

<b>Unit VI</b>	<b>Cyber Forensics</b>	<b>06 Hours</b>
Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.		
<b>Learning Resources:</b>		
<b>Text Books:</b> 1.The Hacker Playbook: Practical Guide To Penetration Testing – @Peter Kim. 2.Applied Network Security Monitoring: Collection, Detection, and Analysis – @Chris Sanders, @Jason Smith.		
<b>Reference Books:</b> 1. Network Security Through Data Analysis: Building Situational Awareness – Michael Collins.		
<b>e-Books: &lt;web links&gt;</b> 1. <a href="https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf">https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf</a> 2. <a href="http://larose.staff.ub.ac.id/files/2011/12/Cyber-Criminology-Exploring-Internet-Crimes-and-Criminal-Behavior.pdf">http://larose.staff.ub.ac.id/files/2011/12/Cyber-Criminology-Exploring-Internet-Crimes-and-Criminal-Behavior.pdf</a> 3. <a href="http://docshare04.docshare.tips/files/21900/219006870.pdf">http://docshare04.docshare.tips/files/21900/219006870.pdf</a>		
<b>MOOC Courses: &lt;web links&gt;</b> 1. <a href="https://swayam.gov.in/nd2_ccc20_cs15/preview">https://swayam.gov.in/nd2_ccc20_cs15/preview</a>		



<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310916D: Elective-I Block Chain</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<b>Prerequisite courses, if any:</b> Data Structures and Algorithms <b>Companion Course, if any:</b> Computer Network <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>Understand how block chain systems (mainly Bitcoin and Ethereum) work,</li> <li>To securely interact with them,</li> <li>Design, build, and deploy smart contracts and distributed applications,</li> <li>Integrate ideas from block chain technology into their own projects.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, students will be able to– <b>CO1:</b> Understand the structure of a block chain and why/when it is better than a simple distributed database; <b>CO2:</b> Analyze the incentive structure in a block chain based system and critically assess its functions, benefits and vulnerabilities; <b>CO3:</b> Explain Nakamoto consensus. Describe differences between proof-of-work and proof-of-stake consensus. <b>CO4:</b> Understand what constitutes a “smart” contract, what are its legal implications and what it can and cannot do, now and in the near future, <b>CO5:</b> Attain awareness of the new challenges that exist in monetizing businesses around block chains and smart contracts, <b>CO6:</b> State-of-the-art, open research challenges, and future directions.		
Course Contents		
Unit I	Distributed Computing	06 Hours
Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature -ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.		
Unit II	Introduction	06 Hours
Block chain: Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.		
Unit III	Distributed Consensus	06 Hours
Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.		
Unit IV	Cryptocurrency	06 Hours
History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin		

<b>Unit V</b>	<b>Cryptocurrency Regulation</b>	<b>06Hours</b>
Stakeholders, Roots of Bitcoin, Legal Aspects – Crypto currency Exchange, Black Market and Global Economy. Internet of Things, Medical Record Management System, Domain Name Service and future of Block chain.		
<b>Unit VI</b>	<b>Hyperledger Fabric</b>	<b>06 Hours</b>
Introduction to Hyperledger, Architecture, Membership, Transaction, Chaincode, Features of Hyperledger		
<b>Learning Resources:</b>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Wattenhofer, The Science of the Blockchain.</li> <li>2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.</li> <li>2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.</li> <li>3. Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.2014.</li> <li>4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts</li> <li>5. Josh Thomson, The Blockchain for Beginners Guide to Blockchain Technology and Leveraging Blockchain Programming</li> </ol>		
<b>e-Books: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://books.google.co.in/books?id=ogu4DgAAQBAJ&amp;lpg=PR1&amp;dq=blockchain%20ebook&amp;pg=PR1#v=onepage&amp;q&amp;f=false">https://books.google.co.in/books?id=ogu4DgAAQBAJ&amp;lpg=PR1&amp;dq=blockchain%20ebook&amp;pg=PR1#v=onepage&amp;q&amp;f=false</a></li> <li>2. <a href="https://books.google.co.in/books?id=49VqDwAAQBAJ&amp;lpg=PP1&amp;dq=blockchain%20ebook&amp;pg=PT10#v=onepage&amp;q&amp;f=false">https://books.google.co.in/books?id=49VqDwAAQBAJ&amp;lpg=PP1&amp;dq=blockchain%20ebook&amp;pg=PT10#v=onepage&amp;q&amp;f=false</a></li> </ol>		
<b>MOOC Courses: &lt;web links&gt;</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.my-mooc.com/en/categorie/blockchain-and-cryptocurrency">https://www.my-mooc.com/en/categorie/blockchain-and-cryptocurrency</a></li> <li>2. <a href="https://www.coursera.org/specializations/blockchain">https://www.coursera.org/specializations/blockchain</a></li> </ol>		

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310916E:Open Elective</b>		
<b>Teaching Scheme:</b> <b>TH: 03 Hours/Week</b>	<b>Credit</b> <b>03</b>	<b>Examination Scheme:</b> <b>Internal: 30 Marks</b> <b>External : 70 Marks</b>
<p>Open elective proposal can be offered with Industry partner. A proposal with syllabus, (Program educational Outcomes) PEO's be forwarded to the Chairman BOS, before June / December every year. Approved syllabus through appropriate procedure can be taught in various colleges. Industry person and Teacher appointed together conduct the course</p>		

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310917: Database Management System Laboratory</b>		
<b>Teaching Scheme:</b> <b>PR: 04 Hours/Week</b>	<b>Credit</b> <b>02</b>	<b>Examination Scheme:</b> <b>Term work: 25 Marks</b> <b>Practical : 50 Marks</b>
<b>Companion Course:</b> Database Management System		
<b>Guidelines for Instructor's Manual</b>		
The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references		
<b>Guidelines for Student Journal</b>		
The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and <b>handwritten write-up</b> of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, Design, test cases, conclusion/analysis. <b>Program codes with sample output of all performed assignments are to be submitted as softcopy.</b> As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.		
<b>Guidelines for Assessment</b>		
Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.		
<b>Guidelines for Practical Examination</b>		
Both internal and external examiners should jointly set problem statements. During practical		
<b>Suggested List of Laboratory Assignments</b> <b>( Instructor may design a newer one)</b>		
<b>Group A- Database Programming Languages – SQL, PL/SQL</b>		
1	Implementation of DDL commands of SQL with suitable examples <ul style="list-style-type: none"> <li>• Create table</li> <li>• Alter table</li> <li>• Drop Table</li> </ul>	
2	Implementation of DML commands of SQL with suitable examples <ul style="list-style-type: none"> <li>• Insert</li> <li>• Update</li> <li>• Delete</li> </ul>	
3	Implementation of different types of function with suitable examples <ul style="list-style-type: none"> <li>• Number function</li> </ul>	

	<ul style="list-style-type: none"> <li>• Aggregate Function</li> <li>• Character Function</li> <li>• Conversion Function</li> <li>• Date Function</li> </ul>
4	Implementation of different types of operators in SQL <ul style="list-style-type: none"> <li>• Arithmetic Operators</li> <li>• Logical Operators</li> <li>• Comparison Operator</li> <li>• Special Operator</li> <li>• Set Operation</li> </ul>
5	Implementation of different types of Joins <ul style="list-style-type: none"> <li>• Inner Join</li> <li>• Outer Join</li> <li>• Natural Join etc..</li> </ul>
6	Study and Implementation of <ul style="list-style-type: none"> <li>• Group By &amp; having clause</li> <li>• Order by clause</li> <li>• Indexing</li> </ul>
7	Study & Implementation of <ul style="list-style-type: none"> <li>▪ Sub queries</li> <li>▪ Views</li> </ul>
8	Study & Implementation of PL/SQL
9	Study & Implementation of SQL Cursors
10	Study & Implementation of SQL function and procedure
11	Study & Implementation of SQL Triggers
<b>Group B Large Scale Databases</b>	
1	Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution)
2	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)
3	Design and Implement any 5 query using MongoDB
4	Create simple objects and array objects using JSON

<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310918- Operating System Lab</b>		
<b>Teaching Scheme:</b> <b>PR: 02 Hours/Week</b>	<b>Credit</b> <b>01</b>	<b>Examination Scheme:</b> <b>Term Work : 50 Marks</b>
<b>Prerequisite courses, if any:</b> Data structures and Algorithms <b>Companion Course, if any:</b> Operating System  <b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To introduce and learn Linux commands required for administration.</li> <li>To learn shell programming concepts and applications.</li> <li>To demonstrate the functioning of OS basic building blocks like processes, threads</li> <li>To demonstrate the functioning of OS concepts in user space like concurrency control (process synchronization, mutual exclusion &amp; deadlock) and file handling in LINUX.</li> <li>To aware paging simulation</li> <li>To demonstrate the functioning of OS concepts in kernel space like embedding the system call in any LINUX kernel.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Understand the basics of Linux commands and program the shell of Linux. <b>CO2:</b> Develop various system programs for the functioning of operating system. <b>CO3:</b> Implement basic building blocks like processes, threads <b>CO4:</b> Develop various system programs for the functioning of OS concepts in user space like concurrency control and file handling in Linux. <b>CO5:</b> Implement page replacement algorithm. <b>CO6:</b> Develop the system program for the functioning of OS concepts in kernel space like embedding the system call in any Linux kernel.		
<b>Guidelines for Instructor's Manual</b>		
The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references		
<b>Guidelines for Student Journal</b>		
The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and <b>handwritten write-up</b> of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, Design, test cases, conclusion/analysis. <b>Program codes with sample output of all performed assignments are to be submitted as softcopy.</b> As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.		

<b>Guidelines for Assessment</b>
Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.
<b>Guidelines for Practical Examination</b>
Both internal and external examiners should jointly set problem statements. During practical
<b>Suggested List of Laboratory Assignment</b>
<p><b>Assignment No. 1:</b> Basic Linux commands and their utility</p> <p><b>Assignment No. 2:</b> Shell programming</p> <p>Write a program to implement an address book with options given below:</p> <p>a) Create address book. b) View address book. c) Insert a record. d) Delete a record. e) Modify a record. f) Exit.</p> <p><b>Assignment No. 3:</b> Process control system calls: The demonstration of FORK, EXECVE and WAIT system calls along with zombie and orphan states.</p> <p><b>Assignment No. 4:</b> Implement multithreading for Matrix Multiplication using threads.</p> <p><b>Assignment No. 5:</b> Thread synchronization using counting semaphores. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.</p> <p><b>Assignment No. 6:</b> Implement Bankers algorithm and find safe sequence of processes</p> <p><b>Assignment No. 7:</b> Inter process communication in Linux using following.</p> <p>a. Pipes: Full duplex communication between parent and child processes. Parent process writes a pathname of a file (the contents of the file are desired) on one pipe to be read by child process and child process writes the contents of the file on second pipe to be read by parent process and displays on standard output.</p> <p><b>Assignment No. 8:</b> Implement paging simulation using FIFO/LRU/Optimal page replacement algorithm.</p> <p><b>Assignment No. 9:</b> Implement an assignment using File Handling System Calls (Low level system calls like open, read, write, etc).</p> <p><b>Assignment No. 10:</b> Implement a new system call in the kernel space, add this new system call in the Linux kernel by the compilation of this kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of this embedded system call using C program in user space.</p>



<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310919: Java Programming Laboratory</b>		
<b>Teaching Scheme:</b> <b>PR: 04 Hours/Week</b>	<b>Credit</b> <b>02</b>	<b>Examination Scheme:</b> <b>Term Work: 25 Marks</b> <b>Practical : 50 Marks</b>
<b>Prerequisites:</b> Basic Computer Programming Concepts		
<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, learner will be able to– <b>CO1:</b> Describe the core concept of Java programming <b>CO2:</b> Discover the need for working with the multithreading and file handling <b>CO3:</b> Illustrate the purpose of applet and AWT in Java programming <b>CO4:</b> Indicate the use of database connectivity using Java Programming <b>CO5:</b> Articulate the networking concepts in Java <b>CO6:</b> Implement Java Servlet and JSP concept in Java		
<b>Guidelines for Instructor's Manual</b> The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references		
<b>Guidelines for Student Journal</b> The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and <b>handwritten write-up</b> of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, Design, test cases, conclusion/analysis. <b>Program codes with sample output of all performed assignments are to be submitted as softcopy.</b> As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.		
<b>Guidelines for Assessment</b> Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.		

<b>Suggested list of Assignments</b>	
	Set up Java Programming development environment by using i. Command Prompt ii. Any IDE like Eclipse, Notepad++, JCreator etc And Test Java Programming development environment by implementing a small program
	Implementing the Operations of stack and queue using package and interface
	Write a program to implement an object oriented system and multithreaded processes as per needs and specifications
	Write a program to implement student information in a file and perform the operations on it
	Working with shape motion by Applet programming
	Write a program to design Registration process form using Applet and AWT components
	Write a program to connect to any database and to execute the SQL query operation on command prompt
	Write a program to connect to any database and to execute the SQL query operation using GUI Interface
	Write a program to demonstrate socket programming. E.g. send hello world to server from client.
	Write a program to chat between client and server
	Write a Servlet code to demonstrate GET and POST methods with suitable example
	Write a program to demonstrate the use of JSP
<b>Books:</b>	
<b>Text Books:</b>	
1. Programming with Java , A primer ,Forth edition , By E. Balagurusamy	
2. Herbert Schilt, "JAVA Complete Reference", 7th Edition, Tata McGraw Hill, ISBN: 9780070636774	
3. Java 2 programming black books, Steven Horlznar	
<b>Reference Books:</b>	
1. Eckel B., "Thinking in Java", 3rd Edition, Pearson Education	
2. "Complete Reference Java" by Herbert Schildt(5th edition)	
3. Core Java 2 Volume - I Cay S Horstmann, Fary Cornell	
4. Core Java 2 Volume - II Cay S Horstmann, Fary Cornell	
5. Developing Java Servlets James Goodwill	
6. Beginning Java Networking Chad Darby, John Griffin & others	
<b>Websites links</b>	
1. <a href="http://tutorialpoint.com">http://tutorialpoint.com</a>	
2. <a href="http://www.w3schools.in/java-tutorial">http://www.w3schools.in/java-tutorial</a>	

<p align="center"><b>Savitribai Phule Pune University, Pune</b>  <b>First year of MCA (2020 Course)</b>  <b>310920: Project Based Learning-I</b>  <b>(Mini Project- I)</b></p>		
<b>Teaching Scheme:</b> <b>PR: 02 Hours/Week</b>	<b>Credit</b> <b>01</b>	<b>Examination Scheme:</b> <b>Term Work: 50 Marks</b>
<p><b>Prerequisite courses, if any:</b>  Basics Programming(C,C++, JAVA, etc) , DBMS(MS-Access, MySql, Oracle etc) , Software Engineering</p> <p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>To identify and solve problems considering social, ethical and legal issues</li> <li>To enhance analytical and computational skills</li> <li>To inculcate leadership and managerial skills through team work.</li> <li>To understand software/system development life cycle</li> <li>To gain insight of testing and deployment of applications</li> </ul>		
<p><b>Course Outcomes:</b>  On completion of the course, learner will be able to–  <b>CO1:</b> Able to analyze and solve problems by applying programming knowledge  <b>CO2:</b> Prepare requirements and Design Documents  <b>CO3:</b> Develop Inter-personal and leadership qualities  <b>CO4:</b> Demonstrate system with results and interpretation  <b>CO5:</b> Describe software testing methods  <b>CO6:</b> Design and develop technical documentation</p>		
<p align="center"><b>Course Execution details</b></p>		
<p><b>1. Formulation of Team and Topic Finalization:</b></p> <ul style="list-style-type: none"> <li>Students should form a group of 3 to 4 members</li> <li>Staff and Students should discuss the relevant problem statement.(Prefer real world problems having some social impact and application)</li> <li>Each team should be allocated a guide.</li> <li>Students should submit Synopsis(should contain Flowchart, Usage of the logic, algorithm, functions and suitable data structure for implementing the solution)</li> </ul> <p><b>2. Development</b></p> <ul style="list-style-type: none"> <li>Select any suitable programming platform (Open source, window, web, mobile applications or any other suitable )</li> <li>Prefer open source technologies for development.</li> <li>Students can select any programming language they have learnt or in which they are competent.</li> </ul> <p><b>3. Design and Documentation</b></p> <ul style="list-style-type: none"> <li>SDLC has to be followed for design and development</li> <li>Prepare Analysis Specification Document, Input Specification and Design Specification Documents(use Data Design, DFD, Flowcharts, UML diagrams, Data Dictionary, ER dig etc)</li> <li>Follow SDD,SRS</li> <li>Provide Test Specifications(test cases, test results, test methodology etc)</li> </ul>		

- Report Generations if needed.

### **3. Report and Presentation**

- Students should present the working model of the project to the guide and panel of the college.
- They should prepare a report comprising the above mentioned terminologies.
- Submit Hard copy/Soft copy of the report which should contain certificate signed by guide , HOD and principal (prefer soft copy)

### **Learning Resources:**

#### **Reference Books:**

1. “Software Engineering: A practitioner’s approach” by Roger S Pressman

**Savitribai Phule Pune University, Pune****First year of MCA (2020 Course)****310921A: Audit Course-2-I Foreign Language- Japanese****About course:**

With changing times, the competitiveness has gotten into the nerves and Being the Best at all times is only the proof of it. Nonetheless, being the best differs significantly from Communicating the best,,. The best can merely be communicated whilst using the best suited Language! Japanese is the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major centre of Japanese Education in India while increasing the precedence for Japanese connoisseurs. Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the resume since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages. It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an on-going process and ultimately soldier on it. The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

**Course Objectives:**

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

**Course Outcomes:**

On completion of the course learner will

- Have ability of basic communication.
- Have the knowledge of Japanese script.
- Get introduced to reading , writing and listening skills
- Will develop interest to pursue professional Japanese Language course.

**Course Contents**

1: Introduction to Japanese Language. Hiragana basic Script, colors, Days of the week.  
 2: Hiragana : modified Kana, double consonant, Letters combined with ya, yu, yo Long vowels, Greetings and expressions  
 3: Self Introduction, Introducing other person, Numbers, Months, Dates, Telephone numbers, Stating one's age.  
 In continuation with this advance Japanese Language.

**Reference Books:**

1. Minna No Nihongo, "Japanese for Everyone", Elementary Main Text book 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.
2. <http://www.tcs.com>([http://www.tcs.com/news\\_events/press\\_releases/Pages/TCS-Inaugurates-Japancentric-Delivery-Center-Pune.aspx](http://www.tcs.com/news_events/press_releases/Pages/TCS-Inaugurates-Japancentric-Delivery-Center-Pune.aspx))

**Savitribai Phule Pune University, Pune****First year of MCA (2020 Course)****310921A: Audit Course-2-I-Foreign Language- FRENCH****About course:**

This course is designed for students of First Year M.C.A. students, who have never studied the French language (total beginners) or who have studied it for a short while in school or in a language institute. Russian is one of the important Foreign Languages in India. SPPU is one of the few centres in India, where Russian language and literature are taught at post graduate level as well as for research degrees. Ph.D. The courses offered in SPPU for post graduate degree cover a broad base of Language, Literature and Culture Studies courses. While designing the course an attempt has been made to encourage interest of the Learners towards academic research in interdisciplinary areas. Certain skill based courses are added so as to enhance the employability of the Learners

**Course Objectives:**

- 1) To introduce French as a foreign language.
- 2) To make the students acquaintance with basic knowledge of the French language and literature
- 3) To develop the skills of translation among the Students

**Course Outcomes:**

On completion of the course learner will

- Have ability of basic communication.
- Have the knowledge of French script.
- Get introduced to reading , writing and listening skills
- Will develop interest to pursue professional French Language course.

**Course Contents**

1: Introduction to French Language. Months of year, colors, Days of the week  
 2: vowels, Greetings-Good Day, hello, good morning etc. and expressions  
 3: Self Introduction, Introducing other person, Numbers, Months, Dates, Telephone numbers.  
 4.counting, Communicative skills: 1) How to greet 2) Locating objects and places 3) How to ask and answer questions (reply, refute)

**Reference Books:**

1. Apprenons le Francais-Simran Batra and Mahitha Ranjit-New saraswati house pvt. Ltd.
2. Nouvel en Échanges, 3rd Revised edition, 2012: Neelima Raddi & Anjali Paranjpye. Published by Oxford University Press, New Delhi.

**Savitribai Phule Pune University, Pune****First year of MCA (2020 Course)****310921B: Audit Course-2-II-Environmental Studies**

The Environment is about the surrounding external conditions influencing development or growth of people, animal or plants; living or working conditions etc. Environment belongs to all living beings and is thus important for all. As given by Environment Protection Act 1986, Environment is the sum total of land, water, air, interrelationships among themselves and also with the human beings and other living organisms.

**Course Objectives :-**

- Creating the awareness about environmental problems among people.
- Imparting basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and environment improvement.

**Course Outcomes :-**

On completion of the course, learner will be able to—

**CO1:** Recognize the physical, chemical, and biological components of the earth's systems and show how they function.

**CO2:** See how natural systems and human-designed systems work together, as well as in conflict with each other.

**CO3:** Correlate the human population growth and its trend to the environmental degradation.

**CO4:** Identify different types of environmental pollution and control measures

**CO5:** Correlate the exploitation and utilization of conventional and non-conventional resources.

**Course Contents**

- 1.Natural Resources : Introduction, Renewable and non-renewable, Forest, water, mineral, food, energy and land resources, Individual and conservation of resources, Equitable use of resources.
- 2.Ecosystems: Concept, Structure, Function, Energy flow, Ecological succession, Forest, grassland, desert and aquatic ecosystems -Introduction, characteristic features, structure and function.
- 3.Biodiversity: Genetic, Species and ecological diversity, Biogeographical classification of India, Value and hot spots, Biodiversity at global, national and local levels, India as mega-biodiversity nation, Threats to biodiversity, Endangered and endemic species of India, Conservation of Biodiversity, Endangered and endemic species, Conservation of biodiversity.
- 4.Pollution: Definition, Causes, effects and control measures of the pollution –Air, soil, Noise, Water, Marine and Thermal and Nuclear Pollution, Solid waste management, Role of Individual in Prevention of Pollution, Pollution case studies, Disaster Management

**Learning Resources:****Reference Books:**

1. Bharucha, E., —Textbook of Environmental StudiesII, Universities Press (2005), ISBN-10:81737154082.
2. Mahua Basu, —Environmental StudiesII, Cambridge University Press, ISBN-978-1-107-5317-3



<b>Savitribai Phule Pune University, Pune</b> <b>First year of MCA (2020 Course)</b> <b>310921C: Audit Course-2-III-Augmented Reality and Virtual Reality</b>		
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>This course provides students with an opportunity to explore idea on Augmented Reality and Virtual Reality (AR &amp;VR).</li> <li>It also makes the students know the basic concept and framework of virtual reality.</li> </ul>		
<b>Course Outcomes:</b> On completion of the course, learner will be able to– <b>CO1:</b> Apply virtual reality concepts <b>CO2:</b> Understand the concepts of IO interface and visual computation <b>CO3:</b> Develop augmented reality applications using various tools and framework.		
<b>Course Contents</b>		
<b>Unit I</b>	<b>Introduction</b>	<b>06 Hours</b>
Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality.		
<b>Unit II</b>	<b>I / O Interface</b>	<b>06 Hours</b>
Multiple Models of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices.		
<b>Unit III</b>	<b>Visual Computation</b>	<b>06 Hours</b>
Visual Computation in Virtual Reality: Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering. Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.		
<b>Unit IV</b>	<b>Development Tools and Framework</b>	<b>06 Hours</b>
Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools etc.		
<b>Unit V</b>	<b>Applications of VR</b>	<b>06 Hours</b>
Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.		
<b>Unit VI</b>	<b>Augmented Reality</b>	<b>06 Hours</b>
Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems		
<b>Learning Resources:</b>		
<b>Text Books:</b> <ol style="list-style-type: none"> <li>Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.</li> <li>Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.</li> </ol>		

**Reference Books:**

1. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
2. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”, 2005.
3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA, 2005.
4. Oliver Bimber and Ramesh Raskar, “Spatial Augmented Reality: Merging Real and Virtual Worlds”, 2005.
5. 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.

**Savitribai Phule Pune University, Pune****First year of MCA (2020 Course)****310922: Non Credit Course -2: MOOC Course-II- Swayam/Spoken Tutorial /NPTEL**

**SWAYAM** is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

(**NPTEL**) National Programme on Technology Enhanced Learning is a project of MHRD initiated by seven Indian Institutes of Technology (**Bombay, Delhi, Kanpur, Kharagpur, Madras, Guwahati and Roorkee**) along with the Indian Institute of Science, Bangalore in 2003, to provide quality education to anyone interested in learning from the IITs. The main goal was to create web and video courses in all major branches of engineering and physical sciences at the undergraduate and postgraduate levels and management courses at the postgraduate level.

**Spoken Tutorial** is an initiative of national mission on education through ICT, MHRD, Govt. of India to promote IT literacy through Open Source Software. It is a multi-award winning educational content portal. Here one can learn various Free and Open Source Software all by oneself. Anybody with a computer and a desire for learning can learn from any place, at any time and in any language of their choice.

**About Course and Grade**

**Non Credit course** is compulsory. No grade points are associated with non-credit courses and are not accounted in the calculation of the performance indices SGPA & CGPA. Result of assessment will be PP or NP. Set of non-credit courses offered is provided. **Conduction and assessment of performance in said course is to be done at institute level.**

**PP and NP Grade** - The student registered and completed non credit MOOC course shall be awarded the grade PP after satisfactory completion of credit course and shall be included in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory internal assessment performance and secured a passing grade in that course. Student who is unable to complete MOOC course will be awarded as NP grade.

**Guidelines for Conduction**

Students have to enrol themselves for any one course which will be on going and complete the assignments. Grades will be given on the basis of submitted assignments and marks obtained. If student wants to earn a verified certificate, he/she will have to fill the online exam registration form and take the proctored exam conducted by NPTEL/Spoken Tutorial in person at any of the designated exam centres

**Suggested List of Courses (Any One)**

1. Introduction To Soft Computing-8 weeks
2. RDBMS Postgre SQL -6 weeks
3. Privacy and Security in Online Social Media -8 weeks
4. Employment Communication A Lab based course – 8 weeks
5. PHP and MySQL (Spoken tutorial)
6. Scilab (Spoken tutorial)

**Institute may choose any one of suggested MOOC Course or decide any other MOOC course at Institute level.**

**Learning Resources:**

**MOOC Courses: <web links>**

1. <https://nptel.ac.in/course.html>
2. <https://swayam.gov.in/explorer>
3. <https://spoken-tutorial.org/tutorial-search>