Faculty of Science and Technology
Savitribai Phule Pune University
Maharashtra, India

Curriculum for

Third Year Master of Computer

Applications (MCA)

(Course 2019)

(With effect from 2021-2022)

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 **a**ctivities.

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 c 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.

Course Structure of TYMCA (Semester5)

Course Code	Course	Teaching Scheme Hours/Week		Examination Scheme						Credit	
		TH	PR	In-Sem	End Sem	TW	OR	PR	Total Marks	TH	PR
510901	Data Mining & Business Intelligence	3	-	30	70	-	-	-	100	3	-
510902	Cloud Computing	3	-	30	70	-	-	-	100	3	-
510903	Software Testing & Quality Assurance	4	-	30	70	-	-	-	100	4	-
510904	Operations Research	3	-	30	70	-	-	-	100	3	-
510905	Elective- II	3	-	30	70	-	-	-	100	3	-
510906	Seminar and Technical Communication Skills - II	-	2	-	-	50	-	-	50	-	1
510907	Data Mining & Business Intelligence Laboratory	-	4	-	-	50	-	50	100	-	2
510908	Software Testing & Quality Assurance Laboratory	-	2	-	-	50	-	-	50	-	1
510909	Project Stage-I	-	4	-	-	50	--	-	50	-	2
510910	Industrial Internship $		--	--	--	50	--	--	50	-	2
	Total	16	12	150	350	250	--	50	800	24	
510911	Audit Course 5: AC5-IEntrepreneurshipDevelopment (510911A) AC5-II: MOOC- Learn New Skills (510911B)									**Grade**	

$ - Industrial Internship to be undertaken in the vacation after 4th Semester. Preferably, the same company should be continued for project work. Necessary proofs and documents are to be maintained by the student and department. Work to be evaluated by the concerned staff. Students should present to the peers and department the work undertaken and submit a report of the same.

ELECTIVE-II
Machine Learning (510905A)
Big Data Analytics (510905B)
Blockchain Technology (510905C)
Open Elective (510905D)

Course Structure of TYMCA (Semester6)

Course Code	Course	Teaching Scheme Hours/Week		Examination Scheme						Credit
		TH	PR	In-Sem	End _Sem	TW	OR	PR	Total Marks	
510912	Project Stage-II	--	28	--	--	100	150	--	250	14
	Total	--	28	--	--	100	150	--	250	14
510913	Audit Course 6: AC6-IEntrepreneurshipDevelopment (510913A) AC6-II: MOOC- Learn New Skills (510913B)									**Grade**

SEMESTER V

Savitribai Phule Pune University Third year of MCA (2019 Course) 510901: Data Mining and Business Intelligence		Home
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03 Hours/Week	**03**	**Internal: 30 Marks** **External : 70 Marks**

Prerequisite courses, if any:
   Data Structures (310902), Database Management System(310912)

Companion Course, if any:
   Data Mining &Business Intelligence Laboratory (510907)

Course Objectives:

- To introduce the concept of data mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage.

- To enable students to effectively identify sources of data and process it for data mining.

- To make students well versed in all data mining algorithms, methods, and tools.

- To learn how to gather and analyze large sets of data to gain useful business understanding.

- To impart skills that can enable students to approach business problems analytically by identifying opportunities to derive business value from data.

Course Outcomes:

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

CO1: Demonstrate an understanding of the importance of data mining and statistical description of data.

CO2: Prepare the data needed for data mining algorithms in terms of attributes and using different pre-processing methods.

CO3: Implement the appropriate association mining on large data sets.

CO4: Define and apply different classification and prediction methods.

CO5: Demonstrate an understanding of different clustering methods and outliers.

CO6: Explain Business Intelligence architecture and its applications.

Course Contents		
Unit I	**Introduction to Data Mining and Data Exploration**	**06 Hours**
What is Data Mining; Kind of patterns to be mined; Data Mining Technologies used; Major issues in Data Mining; Types of Attributes; Statistical Description of Data; Data Visualization; Measuring similarity and dissimilarity.		
Unit II	**Data Pre-processing**	**06 Hours**
Why Pre-processing? Data Cleaning; Data Integration; Pre-processing Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling; Data Transformation & Data Discretization:		

Normalization, Binning, Histogram Analysis and Concept hierarchy generation.

Unit III	Frequent Pattern Mining	06 Hours

Market Basket Analysis, Frequent Itemsets, Closed Mining Itemsets, and Association Rules;, Efficient and Scalable Frequent Itemset Mining Methods, The Apriori Algorithm for finding Frequent Itemsets Using Candidate Generation, Generating Association Rules from Frequent Itemsets, From Association Mining to Correlation Analysis.

Unit IV	Classification and Prediction	06 Hours

What is classification and prediction? – Issues regarding Classification and prediction:
Classification methods: Decision tree, Bayesian Classification, Rule based, CART , Neural Network
Predictionmethods:Linearandnonlinearregression,LogisticRegression; Introduction of tools such as DBMiner /WEKA/DTREGDM Tools

Unit V	Clustering and Outlier Analysis	06 Hours

Cluster Analysis: Basic Concepts; Partitioning Methods: K-Means, K-Mediods; Hierarchical Methods: Agglomerative, Divisive, BIRCH; Density-Based Methods: DBSCAN, OPTICS;
Outlier Analysis: What are outliers? Types, Challenges; Outlier Detection Methods: Supervised, Semi Supervised, Unsupervised, Proximity based, Clustering Based.

Unit VI	Business Intelligence and BI Applications	06 Hours

What is BI? Effective and timely decisions; Data, Intelligence information and knowledge; The role of mathematical models; Business intelligence architectures; Enabling factors in business intelligence project; Development of a business intelligence system; Ethics and business intelligence. Data mining for business Applications like Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance CRM etc.

Learning Resources:

Reference Books:
1. Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3 nd Edition
2. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", 1 st Edition, Wiley India.
3. Business Intelligence: Data Mining and Optimization for Decision Making by Carlo Vercellis ,Wiley India Publications
4. P. N. Tan, M. Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education
5. Michael Berry and Gordon Linoff "Data Mining Techniques", 2nd Edition Wiley Publications.

e-Books: <web links>
1. **https://mitmecsept.files.wordpress.com/2017/04/data-mining-concepts-and-techniques-2nd-edition-impressao.pdf**

MOOC Courses: <web links>
1. **https://www.coursera.org/specializations/data-mining**
2. **https://www.coursera.org/learn/data-mining-pipeline**

Savitribai Phule Pune University Third year of MCA (2019 Course) 510902: Cloud Computing		Home
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03 Hours/Week	**03**	**Internal: 30 Marks** **External : 70 Marks**

Prerequisite courses, if any:

      Computer Networks (410903)

Course Objectives:

- To understand the concept of cloud computing.
- To learn basics of virtualization.
- To illustrate various issues in cloud computing.
- To evaluate cloud computing capabilities.
- To appreciate the emergence of cloud as the next generation computing paradigm.

Course Outcomes:

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

CO1: Understand need of cloud computing in current scenario.

CO2: Learn and understand various security related issues in cloud environment.

CO3: Understand challenges for cloud computing.

CO4: Aware of upcoming trends in cloud computing.

CO5: Explain virtualization and implementation levels of virtualization.

CO6: Demonstrate Open Source Cloud Implementation and Administration.

Course Contents		
Unit I	**Basics of Cloud Computing**	**06 Hours**
Introduction, Cloud Characteristics, Cloud computing architecture, Advantages and Disadvantages of Cloud Computing. Grids, Utility Computing, client-server model, P-to-P Computing, Cloud computing Service delivery model, Cloud Types – Private, Public and Hybrid, Cloud API.		
Unit II	**Cloud computing Services**	**06 Hours**
Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, DBaaS (Database as a services) , Comparison of various cloud computing providers/ Softwares.		
Unit III	**Virtualization**	**06 Hours**
Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation. Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP),Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security.		

Unit IV	Resource Management and Applications of Cloud	06 Hours

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources. Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, Office Services, Google Apps.

Unit V	Cloud Security	08 Hours

Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Hardened Virtual Server Images.
Cloud Issues: Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, Agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability.

Unit VI	Future of Cloud Computing	06 Hours

How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing. Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.

Learning Resources:

Text Books:
1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922.
3. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, *ISBN*: 9780511778476

Reference Books:
1. 1. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication, ISBN10: 8126536039
2. Buyya, "Mastering Cloud Computing", Tata McGraw Hill, ISBN-13: 978-1-25-902995-0,
3. Barrie Sosinsky,"Cloud Computing", Wiley India, ISBN: 978-0-470-90356-8
4. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press
5. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Pearson, 1st Edition, ISBN :978 9332535923, 9332535922
6. Tim Mather, Subra K, Shahid L., Cloud Security and Privacy, Oreilly, ISBN-13 978-81-8404-815-5.

e-Books: <web links>
1. http://www.freebookcentre.net/Networking/Cloud-Computing-Books.html

MOOC Courses: <web links>
1. NPTEL course on " Cloud Computing " by By Prof. SoumyaKanti Ghosh , IIT Kharagpur https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://www.udemy.com/course/introduction-to-cloud-computing/

Savitribai Phule Pune University Third year of MCA (2019 Course) 510903: Software Testing and Quality Assurance		
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 04 Hours/Week	**04**	**Internal: 30Marks** **External : 70Marks**

Prerequisite courses, if any:

     Basics of Software Engineering

Companion Course, if any:

     Software Testing & Quality Assurance Laboratory (510908)

Course Objectives:

- To learn the importance of software quality & assurance and software systems development.

- To introduce basic concepts of software testing.

- To understand of white box and block box testing techniques.

- To get acquainted the knowledge of various testing types.

- To know in detail automation testing and tools.

Course Outcomes:

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

CO1: Illustrate different approaches of quality management, assurance, and quality standard to software

     system.

CO2: Describe fundamental concepts in software testing such as manual testing and design & develop

     project test plan, test cases, test data, and conduct test operations.

CO3: Apply the concept of white box and block box testing techniques.

CO4: Showcase the use of various testing types.

CO5: Explore the test automation concepts and apply recent automation tools for various software testing..

Course Contents		
Unit I	**Fundamentals of Software Quality Assurance**	**06 Hours**

FUNDAMENTALS OF SOFTWARE QUALITY:

Definition of Quality, QA, QC, SQA, SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, CMM, CMMI, Test Maturity Models, Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness.

Unit II	Basics of Software Testing	06 Hours

SOFTWARE TESTING BASICS: Definition & Objectives of testing, testing life cycle, Software testing principles, The tester's role in a software development organization, Verification and Validation, Defect management process, develop defect repository.

TEST PLAN AND TEST CASES: Preparation, Management and execution of Test Plan, Definition, Test Case Designing of Test Cases, prepared Test report.

Unit III	Software Testing Methodologies	06 Hours

WHITE-BOX TESTING METHODOLOGIES: Static testing: by humans, using static analysis tools, Structural Testing: unit/code functional testing, Code coverage Testing, Code Complexity testing, Mutation Testing.

BLACK-BOX TESTING METHODOLOGIES: Requirement based testing, Positive and negative testing, Boundary Value analysis, Equivalence Partitioning, State based or Graph-based Testing, Compatibility Testing, User Documentation Testing, Domain Testing.

Unit IV	Software Testing Types	06 Hours

Integration testing, System and Acceptance testing, Scenario testing, Performance Testing, Regression testing, Ad hoc Testing, Usability and Accessibility Testing, GUI testing, Validation testing, Specification-based testing, Testing Object Oriented Software, Testing Web Based Applications, Database Testing.

Unit V	Software Test Automation	06Hours

INTRODUCTION TO AUTOMATION TESTING:
Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging, Difference between manual testing and automated testing,

Unit VI	Selenium Tool	06 Hours

Introduction of Selenium, Brief History of The Selenium Project, Selenium's Tool Suite, Selenium IDE, Selenium RC, Selenium Web Driver, Selenium Grid, Test Design Considerations.

Learning Resources:

Text Books:
 1. Srinivasan Desikan, Gopalaswamy Ramesh, and Software Testing: Principles and Practices Pearson.
 2. Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley.
 3. Tamres L, "Introducing Software Testing", Pearson Education, 2007.
 4. Mathur A.P, "Fundamentals of Software Testing", Pearson Education, 2008.
 5. Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education, 2009.

Reference Books:
1. Software Testing and Quality Assurance – Theory and Practice, Kshirasagar Naik, Priyadashi Tripathy, Wiley India,2010
2. Rajani & Oak, "Software Testing: Methodology, Tools and Processes" Tata McGraw-Hill,2007
3. Software Automation Testing Tools for Beginners, Rahul Shende, Shroff Publishers and Distributors, 2012
4. Software Testing Techniques Boris Beizer, dreamTech pub,2nd Edition

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e-B ooks: <weblinks>
   1.   **https://www.softwaretestinghelp.com/software-testing-books/**

MOOC Courses: <web links>

1.   **https://www.my-mooc.com/en/mooc/software-testing-fundamentals/**
2. **https://nptel.ac.in/courses/106/105/106105150/**
3. **https://onlinecourses.nptel.ac.in/noc19_cs71/preview**

Savitribai Phule Pune University Third year of MCA (2019 Course) 510904: Operations Research		Home
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03 Hours/Week	**03**	**Internal: 30 Marks** **External :70 Marks**

Prerequisite courses, if any:
   Discrete Mathematics (310901) , Data Structures (310902)

Course Objectives:
- To understand the basics of Linear Programming Problem.
- To solve Allocation and Assignment Problems in industries.
- To understand the Shortest Path and the duration using network analysis techniques.
- To make decision in various situation.
- To implement Random Number Generation and the simulation techniques.

Course Outcomes:
On completion of the course, learner will be able to–
CO1: Apply linear Programming Problem by Graphical and Analytical Method.

CO2: Solve various Transportation Problems.

CO3: Analyze the network and find the shortest path and the duration.

CO4: Apply decision making techniques in various situations.

CO5: Use random numbers for simulation purpose.

Course Contents		
Unit I	**Introduction to Linear Programming**	**06 Hours**
Operation Research Models , Solving the OR models , Basic terms in Linear Programming Problem, Two variable LP model , Graphical LP Solution , The Simplex Method: - The Simplex Algorithm, Artificial Starting Solutions, Special cases in Simplex Methods, Definitions of Dual Problem, Primal - Dual Relationships.		
Unit II	**Transportation Model**	**06 Hours**
Definition of the Transportation Model, Nontraditional Transportation Models, The Transportation Algorithm, The Assignment Model, The Transshipment Model.		
Unit III	**Network Model**	**06 Hours**
Definition of Network Model, Minimal Spanning Tree Algorithm, Shortest Route Problem, Maximal Flow Model, Sequential model & related problems, processing n jobs through – 1 machine &2 machines.		

Unit IV	CPM and PERT	06 Hours
Basic differences between CPM and PERT, Arrow Networks, Time estimates, earliest completion time, Latest allowable occurrences time, Forward Press Computation, Backward Press Computation, Representation in tabular form, Critical Path, Probability of meeting the scheduled date of completion, Various floats for activities.		
Unit V	**Decision Analysis**	**06 Hours**
Decision Making Under Certainty – Analytic Hierarchy Process, Decision Making under Risk, Decision Making Uncertainty.		
Unit VI	**Simulation Modelling**	**06 Hours**
Monte Carlo Simulation, Generation of Random Numbers, Method for Gathering Statistical observations , Problem based on Statistical Observations.		
Learning Resources:		
Text Books: 1.Taha H., "Operations Research: An Introduction", 7th Edition, 2004		
Reference Books: 1. Winston W., "Operations Research", 3rd Ed.; Windows Lindo Logo, 1997 2. Hillier F., Lieberman G., "Introduction to Operations Research", 7th Edition, Tata McGraw-Hill, 2001,		
e-Books: <web links> 1. **https://www.cgaspirants.com/2018/09/pdf-operations-research-by-hira-gupta-ebook-free-download.html**		
MOOC Courses: <web links> **1. https://nptel.ac.in/courses/112/106/112106134/**		

Savitribai Phule Pune University Third year of MCA (2019 Course) 510905A: Elective II: Machine Learning		Home
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03 Hours/Week	**03**	**Internal: 30 Marks** **External : 70 Marks**

Prerequisite courses, if any:

　　Data Science with R (410914)

Course Objectives:

- To introduce machine learning techniques.

- To understand Human learning aspects.

- To understand primitives and methods in learning process by computer.

- To analyze nature of problems to be solved with Machine Learning.

- To learn various logic based and algebraic models in machine learning.

- To aware of state-of--art trends in machine learning.

Course Outcomes:

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

CO1: Explain the learning primitives.

CO2: Evaluate a given problem and apply appropriate machine learning technique to gain knowledge from the problem.

CO3: Tackle real world problems in the domain of Data Mining and Big Data Analytics, Information Retrieval, Computer vision, Linguistics and Bioinformatics.

CO4: Develop machine learning models for real time applications.

CO5: Build insights using the machine learning model.

CO6: Develop skills using recent machine learning techniques and solve practical problems.

Course Contents		
Unit I	**Introduction to Machine Learning**	**06 Hours**
Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation? Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning. Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis.		
Unit II	**Classification**	**06 hours**
Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs. One, One vs. Rest Linear Models: Perceptron, Support Vector		

Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity.		
Unit III	**Regression and Generalization**	**06 Hours**

Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves Case Study of Polynomial Curve Fitting.

Unit IV	**Logic Based and Algebraic Models**	**06 Hours**

Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Distance based clustering algorithms - K-means and K-medoids, Hierarchical clustering. Rule Based Models: Rule learning for subgroup discovery, Association rules mining – Apriori Algorithm, Confidence and Support parameters. Tree Based Models: Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy, Best Split.

Unit V	**Probabilistic Models**	**06 Hours**

Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Discriminative Learning with Maximum Likelihood. Probabilistic Models with Hidden variables: Expectation-Maximization methods, Gaussian Mixtures.

Unit VI	**Trends in Machine Learning**	**06 Hours**

Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties Deep Learning: The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons.

Learning Resources:

Text Books:
 1. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
 2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

Reference Books:

1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
2. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.
3. Parag Kulkarni: Reinforcement Learning and Systemic Machine Learning for Decision Making, IEEE Press, Reprint 2015.
4. Nikhil Buduma: Fundamentals of Deep Learning, O'Reilly Media, June 2017.
5. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012.
6. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.

MOOC Courses: <web links>

 1. **https://www.coursera.org/learn/machine-learning**

Savitribai Phule Pune University Third year of MCA (2019 Course) 510905B: Elective II- Big Data Analytics		Home
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03 Hours/Week	**03**	**Internal: 30 Marks** **External : 70 Marks**

Prerequisite courses, if any:
 Database Management System (310912)

Companion Course, if any:
 Data Mining & Business Intelligence (510901)

Course Objectives:
 - To provide an overview of current industry of big data analytics.
 - To gain knowledge of different tools required to analyze big data like Hadoop, NoSql MapReduce.
 - To learn fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
 - To acquire skills to solve complex real world problems related to decision support.

Course Outcomes:

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

CO1: Understand the key issues in big data management and its associated applications for business decisions and strategies.

CO2: Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop, Mapreduce and NoSQL in big data analytics.

CO3: Collect, manage, store, query and analyze various forms of Big Data.

CO4: Apply software tools for big data analytics.

CO5: Adapt adequate perspectives of big data analytics in various applications like recommender systems, social media applications.

CO6: Solve complex real world problems in various applications like recommender systems, social media applications.

Course Contents		
Unit I	**Introduction to Big Data**	**06 Hours**

Big data overview, BI versus Data Science, Drivers of Big data, Emerging big data ecosystem and a new approach to analytics.

Unit II	Supervised learning and Unsupervised Learning	06 Hours
Supervised Learning: Structure of Regression Model, Linear Regression, Logistics Regression, Time series analysis, Support Vector Machine. **Association Rule:** Structure of Association Rule, Apriori Algorithm, evaluation of candidate rules **Clustering:** Clustering Methods, Partition Methods, Hierarchical Methods.		
Unit III	Recommendation Systems and Mining Social-Network Graphs	06 Hours
A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering. Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities.		
Unit IV	Big Data Visualization	06 Hours
Introduction to Data visualization, Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Analytical techniques used in Big data Visualization		
Unit V	Introduction Hadoop	06 Hours
Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.		
Unit VI	Hadoop Architecture	06 Hours
Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.		
Learning Resources:		

Text Books:
 1. David Dietrich, Barry Hiller, "Data Science & Big Data Analytics", EMC education services, Wiley publications, 2012.
 2. Chris Eaton, Dirk deroos et al., "Understanding Big data ", McGraw Hill, 2012.
 3. Anand Rajaraman and Jeff Ullman "Mining of Massive Datasets", Cambridge University Press
 4. Tom White, "HADOOP: The definitive Guide", O Reilly 2012.

Reference Books:
1. .Vignesh Prajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013.
2. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press, 2014.
3. JyLiebowitz, "Big Data and Business analytics", CRC press, 2013.
4. Business Intelligence – Data Mining and Optimization for Decision Making – Carlo Vercellis – Wiley Publications.
5. Big Data & Analytics – Seema Acharya & Subhashini Chellappan – Wiley Publications
6. Big Data (Black Book) – DT Editorial Services – Dreamtech Press.
7. Data Mining: Concepts and Techniques Second Edition – Jiawei Han and Micheline Kamber – Morgan KaufMan Publisher
8. Alex Holmes "Hadoop in Practice", Manning Press, Dreamtech Press
9. Ashutosh Nandeshwar , "Tableau Data Visualization Codebook", Packt Publishing, ISBN 978-1-84968-978-6

e-Books: \<web links\>
1. http://www.bigdatauniversity.com/
2. http://index-of.co.uk/Big-Data-Technologies/Hadoop%20in%20Practice%202nd%20Edition%20%7BPRG%7D.pdf
3. http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf

MOOC Courses: \<web links\>
1. https://nptel.ac.in/courses/106/107/106107220/
2. https://nptel.ac.in/courses/106/104/106104189/

<table>
<tr><td colspan="3">**Savitribai Phule Pune University**
Third Year of MCA (2019 Course)
510905C: Elective- II- Blockchain Technology</td><td>Home</td></tr>
<tr><td colspan="2">**Teaching Scheme:**</td><td>**Credit**</td><td>**Examination Scheme:**</td></tr>
<tr><td colspan="2">**TH: 03 Hours/Week**</td><td>**03**</td><td>**Internal: 30 Marks**
External :70 Marks</td></tr>
</table>

Prerequisite courses, if any:
  Data Structures and algorithm (310902), Computer Networks (410903)

Course Objectives:

- To introduce the concepts of blockchain technologies.

- To familiarize the technical aspects of crypto currencies, blockchain technologies, and distributed consensus.

- To understand how blockchain systems work.

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

CO1: Understand emerging abstract models for Blockchain Technology.

CO2: Understand security models for Blockchain Technology.

CO3: Analyze the concept of bitcoin and mathematical background behind it.

CO4: Design, build, and deploy smart contracts and distributed applications.

CO5: Apply tools for understanding the background of crypto currencies.

CO6: Understand latest advances and applications of BlockChain Technology.

Course Contents		
Unit I	**Introduction**	**06 Hours**

Basic of Blockchain Architecture – Challenges – Applications – Blockchain Design Principles -The Blockchain Ecosystem - De-centralized web- The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).

Unit II	**Cryptographic Fundamentals**	**06 Hours**

Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256,signature schemes, encryption schemes and elliptic curve cryptography- Introduction to Hyperledger-Hyperledger framework - Public and Private Ledgers.

Unit III	**Bit coin**	**06 Hours**

Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin. Bitcoin blockchain, the

challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.

Unit IV	Ethereum	06 Hours

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts.

Unit V	Cryptocurrency Regulation	06Hours

Stakeholders, Roots of Bitcoin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Unit VI	Block chain Recent Trend	06 Hours

Blockchain Implementation Challenges- Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms, Hyperledger Fabric.

Learning Resources:

Text Books:

1. Melanie Swan, "BlockChain: Blueprint for a New Economy", O'Reilly, first edition – 2015.
2. Daniel Drescher, "BlockChain Basics", Apress; 1stedition, 2017
3. Anshul Kaushik, "BlockChain and Crypto Currencies", Khanna Publishing House, Delhi.
4. Imran Bashir, "Mastering BlockChain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, first edition – 2012.

Reference Books:
   1. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and BlockChain", Packt Publishing.
   2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

e-Books: <web links>
1. https://developer.ibm.com/patterns/create-and-deploy-block chain-network-using fabric-sdk-java/
2. **https://docs.docker.com/get-started/https:/console.ng.bluemix.net/docs/services/block%2520chain/index. html**

MOOC Courses: <web links>
   1. https://nptel.ac.in/courses/106/104/106104220/
   2. https://swayam.gov.in/nd1_noc20_cs01/preview
   3. https://nptel.ac.in/courses/106/105/106105184/
   4. https://www.youtube.com/playlist?list=PLHRLZtgrF2jl8yqucJsMFqh5XpRLTgCI4

Savitribai Phule Pune University Third year of MCA (2019 Course) 510905D:Elective – II -Open Elective		Home
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03 Hours/Week	**03**	**Internal: 30 Marks** **External : 70 Marks**
Open elective proposal can be offered by the college along-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.		

Savitribai Phule Pune University Third year of MCA (2019 Course) 510906: Seminar and Technical Communication		Home
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 02 Hour/Week	**01**	**TW:50Marks**

Course Objectives:
- To explore the basic principles of communication (verbal and non verbal) and active, empathetic listening, speaking and writing techniques.

Course Outcomes:
On completion of the course, learner will be able to –
- Familiar with basic technical writing concepts and terms, such as audience analysis, jargon, formats, visuals, and presentation.
- Improve skills to read, understand, and interpret material on technology.
- Improve communication and writing skills.

Guidelines:
- EachstudentwillselectatopicintheareaofComputerApplicationpreferably keeping track with recent technological trends and development beyond scope of syllabus avoiding repetition in consecutive years.
- The topic must be selected in consultation with the institute guide.
- Each student will make a seminar presentation using audio/visual aids
  For a duration of 20-25minutes and submit the seminar report prepared in Latex only.
- Student will submit two copies of the seminar report in a prescribed format provided by the host institution duly signed by the guide and the head of the department.
- Attendance for all seminars by all students is compulsory.
- A panel of staff members of the institute will assess the seminar internally.

Guidelines for Assessment:
Panel of staff members along with a guide would be assessing the seminar work based on these parameters-Topic, Contents and Presentation, regularity, Punctuality and Timely Completion, Question and Answers, Report, Paper presentation/ Publication, Attendance and Active Participation.

Recommended Format of the Seminar Report:
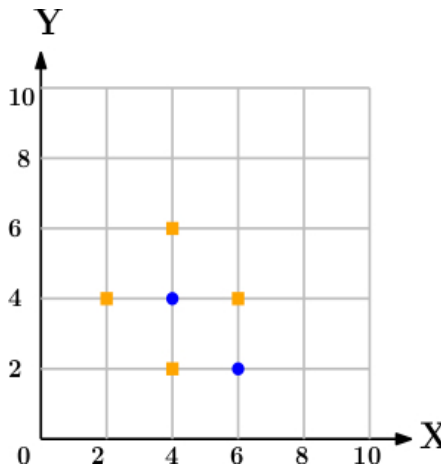
- Title Page with Title of the topic, Name of the candidate with Exam Seat Number / Roll Number, Name of the Guide, Name of the Department, Institution and Year & University.

- Seminar Approval Sheet / Certificate.

- Abstract and Keywords.

- Acknowledgements.

- Table of Contents, List of Figures, List of Tables and Nomenclature.

- Chapters Covering topic of discussion- Introduction with section including organization of the report, Literature Survey/Details of design/technology/Analytical and/or experimental work, if any, Discussions and Conclusions, Bibliography/References.

- Plagiarism Check report.

- Report Documentation page.

References:
1. RebeccaStott,CordeliaBryan,ToryYoung,"SpeakingYourMind:OralPresentationandSeminarSkills (Speak-Write Series)",Longman,ISBN-13:978-0582382435
2. Johnson-Sheehan, Richard, "Technical Communication", Longman.ISBN0-321-11764-6
3. VikasShirodka,"FundamentalskillsforbuildingProfessionals",SPD,ISBN978-93-5213-146-5

<table>
<tr><td colspan="3">
Savitribai Phule Pune University
Third year of MCA (2019 Course)
510907: Data Mining & Business Intelligence Laboratory
</td><td></td></tr>
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Teaching Scheme:	Credit	Examination Scheme:
PR: 04 Hours/Week	02	TW: 50 Marks PR : 50 Marks

Prerequisite courses, if any:

    Data Structures (310902), Database Management System (310912)

Companion Course, if any:

    Data Mining & Business Intelligence (410914)

Course Objectives:

- Learn data preprocessing and data mining algorithms.

- Identify the appropriateness and need of analysis of the data.

- Understand various methods, techniques and algorithms in Business Intelligence.

Course Outcomes:

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

CO1: Apply data pre-processing techniques.

CO2: Implement different Mining Techniques to find Associations, and Correlations.

CO3: Explore different Classification Techniques Prediction techniques.

CO4: Analyze the data using Clustering Techniques.

CO5: Identify and use BI tools and techniques.

CO6: Apply Data Mining Techniques to build real world applications.

Suggested List of Laboratory Assignments

1.	Perform the following operations using Python on the given data sets

Region	Age	Income	Online Shopper
India	49	86400	No
Brazil	32	57600	Yes
USA	35	64800	No
Brazil	43	73200	No
USA	45		Yes
India	40	69600	Yes
Brazil		62400	No
India	53	94800	Yes
USA	55	99600	No
India	42	80400	Yes

	a) Importing the libraries b) Importing the Dataset c) Handling of Missing Data d) Handling of Categorical Data e) Splitting the dataset into training and testing datasets f) Feature Scaling	
2.	Apply a-priori algorithm to find frequently occurring items from given data and generate strong association rules using support and confidence thresholds for the given dataset. **Support threshold=50%, Confidence= 60%**	

Transaction	List of items
T1	I1,I2,I3
T2	I2,I3,I4
T3	I4,I5
T4	I1,I2,I4
T5	I1,I2,I3,I5
T6	I1,I2,I3,I4

3.	**Assignment on Decision Tree Classifier:** Adatasetcollectedinacosmeticsshopshowingdetailsofcustomersandwhetherornottheyrespond edtoaspecialoffertobuyanewlip-stickisshownintablebelow.Usethisdatasetto build a decision tree, with Buys as the target variable, to help in buying lip-sticks in the future. Find the root node of decision tree .According to the decision tree you have made from previous training data set, what is the decision for the test data: [Age < 21, Income = Low, Gender =Female, Marital Status =Married]?

ID	Age	Income	Gender	Marital Status	Buys
1	< 21	High	Male	Single	No
2	< 21	High	Male	Married	No
3	21-35	High	Male	Single	Yes
4	>35	Medium	Male	Single	Yes
5	>35	Low	Female	Single	Yes
6	>35	Low	Female	Married	No
7	21-35	Low	Female	Married	Yes
8	< 21	Medium	Male	Single	No
9	<21	Low	Female	Married	Yes
10	> 35	Medium	Female	Single	Yes
11	< 21	Medium	Female	Married	Yes
12	21-35	Medium	Male	Married	Yes
13	21-35	High	Female	Single	Yes
14	> 35	Medium	Male	Married	No

4.	**Assignment on k-NN Classification:** In the following diagram let blue circles indicate positive examples and orange squares indicate negative examples. We want to use k-NN algorithm for classifying the points. If k=3, find the class of the point (6, 6). Extend the same example for Distance-Weighted k-NN and Locally weighted Averaging
5.	**Assignment on Linear Regression:** The following table shows the results of a recently conducted study on the correlation of the number of hours spent driving with the risk of developing acute backache. Find the equation of the best fit line for this data. | Number of hours spent driving (x)	Risk score on a scale of 0-100 (y)
10	95
9	80
2	10
15	50
10	45
16	98
11	38
16	93	
6.	**Assignment on K-Means Clustering:** We have given a collection of 8 points. P1=[0.1,0.6]P2=[0.15,0.71]P3=[0.08,0.9]P4=[0.16,0.85]P5=[0.2,0.3]P6=[0.25,0.5]P7=[0.24, 0.1]P8=[0.3,0.2].Performthek-meanclustering with initial centroids as m1=P1=Cluster#1=C1andm2=P8=cluster#2=C2.Answerthefollowing a) WhichclusterdoesP6belongsto? b) Whatisthepopulationofclusteraroundm2? c) What is updated value of m1and m2?
7.	Study and implement OPEN SOURCE BUSINESS INTELLIGENCE TOOLS using suitable data set.

8.	**Mini-Project1onAssociation Mining :** Apply Market Basket Analysis & Recommendation System Using Association Rules on any real time data. For Example: Retail Industry Data
9.	**Mini-Project 2 on Classification and Prediction:** Apply data mining techniques to Predict Student's performance by modelling small dataset size.
10.	**Mini-Project3onClustering Analysis:** Apply Clustering Technique to classify any real time data. For Example: Pattern and Trend Analysis

Savitribai Phule Pune University Third year of MCA (2019 Course) 510908: Software Testing and Quality Assurance Laboratory			Home
Teaching Scheme:	**Credit**	**Examination Scheme:**	
PR: 02 Hours/Week	**01**	**Internal: 50 Marks (TW)**	

Prerequisite courses, if any:
- Basics of Software Engineering

Course Objectives:
- To learn the importance of software quality & assurance and software systems development.
- To understand the basic concepts of software testing.
- To aware of white box and block box testing techniques.
- To get acquainted with the knowledge of various testing types.
- To explain in detail automation testing and tools.

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

CO1: Illustrate different approaches of quality management, assurance, and quality standard to

software system.

CO2: Describe fundamental concepts in software testing such as manual testing and design and develop

Project test plan, test cases, test data, and conduct test operations.

CO3: Apply the concepts of white box and block box testing techniques.

CO4: Showcase the use of various testing types.

CO5: Explore the test automation concepts and apply recent automation tools for software testing.

Guidelines for instructor's Manual

Theinstructor'smanualistobedevelopedasahands-onresourceandreference.Theinstructor'smanualneedto 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, 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 Laboratory Conduction

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 software testing concept and tools, proper indentation and comments. Use of open source software is to be encouraged.

Set of Suggested Assignment List

1. Students need to create groups. These group need to create a small application by selecting relevant system environment / platform and programming languages for performing testing exercise.

2. Consider any real-life problem. Implement it by using any programming language. Identify and write 8 to 10 test scenario.

3. Implementation of case study for Test plan.

4. Consider any real-life problem. Implement it by using any programming language. Develop a set of test cases that would test the program adequately.

5. Prepare Test Reports based on Test Pass/Fail Criteria and judge the acceptance of application Developed.

6. Implementation of case studies for Defect Repository based on defects which are raised after execution of test cases

7. Manual Implementation of white box testing methods for various coding patterns of particular Application.

8. Manual Implementation of black box testing methods for particular applications.

9. Manual Implementation of GUI testing for particular application. Find more than 10 defects (layout inconsistencies, spelling errors, and the like) in the application.

10. Implementation of case studies for narrate scripts in order to perform regression test using any testing tool.

11. Implementation of web applications through selenium IDE based on UI and flow. Generate test reports encompassing exploratory testing.

12. Implementation of web applications through selenium WebDriver based on their coding part. Generate test reports encompassing exploratory testing.

Savitribai Phule Pune University Third year of MCA (2019 Course) 510909: Project Stage I		Home
Teaching Scheme:	**Credit**	**Examination Scheme:**
PR: 04 Hours/Week	**02**	**TW: 50 Marks**

Course Objectives:

- To apply the knowledge for solving realistic problem.

- To develop problem solving ability.

- To reflect upon the experience gained and lessons learned.

- To locate relevant social, ethical and legal issues.

- To work in team and learn professionalism.

- To develop plans with the help of team members to achieve the project's goals.

- To apply communication skills to effectively promote ideas, goals or products.

Course Outcomes:

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

CO1: Solve real life problems by applying knowledge gained.

CO2: Analyze alternative approaches, apply and use most appropriate one for feasible solution.

CO3: Write precise reports and technical documents in a nutshell.

CO4: Participate effectively in heterogeneous teams exhibiting team work, Inter- personal

   relationships and leadership quality.

CO5: Apply communication skills effectively

Guidelines

Project work Stage – I is an integral part of the Project work. MCA (Engineering) Projects can be application oriented and/or will be based on some innovative/ theoretical work. In this, the student shall complete the work of the Project which will consist of problem statement, literature review, SRS, Design and implementation. The student is expected to complete the project at least up to the implementation phase. As a part of the progress report of project work Stage-I, the candidate shall deliver a presentation on selected project topic. The student shall submit the duly certified progress report of Project work Stage-I in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute. The project will be undertaken preferably by a group of 3-4 students who will jointly work and Implement the project. The examinee will be assessed by a panel of internal examiners .The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.

Savitribai Phule Pune University **Third Year of MCA (2019 Course)** **510910: Industrial Internship**		Home
Credit	**Examination Scheme:**	
02	**TW: 50 Marks**	

Course Objectives:

- To apply knowledge gained through graduate information system studies in a real-world working environment.
- To provide practical learning experiences in professional settings.
- To learn, understand and sharpen the real time technical / managerial skills required at the job.
- To expose to the current technological developments relevant to the subject area of training.
- To expose the students to future employers.

Course Outcomes:

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

CO1: Apply domain knowledge in proposing solution for IT problem.

CO2: Develop/implement the design with appropriate techniques and tools to deliver the solution.

CO3: Work in independently or in collaborative environment.

CO4: Develop project with communications skills, make presentations and prepare technical document.

CO5: Adapt easily to the industry environment.

CO6: Motivate for lifelong learning.

Guidelines for Internship

- The students should undergo an internship for 4 weeks during the vacation soon after the 4th semester University Examination.
- The internship shall be carried out in an Industry/R&D labs or Educational Institution of repute.
- The Institute may also suggest the students to enroll for the Internshala platform for free internship. (https://internshala.com)
- On Completion of Industrial Internship by the student, the student is required to submit the following to the respective department.
    a) Internship Completion certificate from the industry / organization authorities.
    b) Internship report of the report in a standard format which is prescribed by the department.
- The student should submit the internship report and make the presentation to the internal panel.

- Internship should be presented along with the report by the end of 6 weeks and shall be evaluated by the internal panel for 50 marks each.

- The student shall prepare a report and submit the same to the guide allotted by the institute.

- The report format for the internship shall be as equivalent as the Project Report as prescribed by the University.

- The student shall present the progress about the internship to the panel of members constituted by the Head of the Department (HoD).

- The internal panel will evaluate the internship work for 50 Marks.

- In case of unavailability of Industrial Internship, students are permitted to complete one online certification course through Massive Open Online Courses (MOOCs) offered by reputed Universities / Government Organizations duly approved by the Head of the Department.

- On completion of Online Certification Course by the student, the student is required to submit Online Certification Course completion certificate to the respective department.

Assessment procedure

- The student has to deliver power point presentation before the committee on the work during Industrial Internship.

- Committee examines the student and the marks are awarded as follows:-

Description	Max. Marks
Hard copy of the Report	25
Power Point Presentation	15
Viva-Voce	10
Total	**50**

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Savitribai Phule Pune University

Third Year of MCA (2019 Course)

510911A: Audit Course 5
AC5 – I: Entrepreneurship Development

Home
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</table>

This Course Aims at Instituting Entrepreneurial skills in the students by giving an overview of, who the entrepreneurs are and what competences are needed to become an entrepreneur.

Course Objectives:
- To introduce the aspects of Entrepreneurship.
- To acquaint with legalities in product development.
- To understand IPR, Trademarks, Copyright and patenting.
- To know the facets of functional plans, Entrepreneurial Finance and Enterprise Management.

Course Outcome:
On completion of the course, learner will be able to–
- Understand the legalities in product development.
- Undertake the process of IPR, Trademarks, Copyright and patenting.
- Understand and apply functional plans.
- Manage Entrepreneurial Finance.
- Inculcate managerial skill as an entrepreneur.

Course Contents:

1. **Introduction:** Concept and Definitions, Entrepreneur v/s Intrapreneur; Role of entrepreneurship in economic development; Entrepreneurship process; Factors impacting emergence of entrepreneurship; Managerial versus entrepreneurial Decision Making; Entrepreneur v/s Investors; Entrepreneurial attributes and characteristics; Entrepreneurs versus inventors; Entrepreneurial Culture; Women Entrepreneurs; Social Entrepreneurship; Classification and Types of Entrepreneurs; EDP Programmers; Entrepreneurial Training; Traits / Qualities of an Entrepreneurs.

2. **Creating Entrepreneurial Venture :** Generating Business idea- Sources of Innovation, methods of generating ideas, Creativity and Entrepreneurship; Business planning process; Drawing business plan; Business plan failures; Entrepreneurial leadership – components of entrepreneurial leadership; Entrepreneurial Challenges; Legal issues – forming business entity, considerations and Criteria, requirements for formation of a Private / Public Limited Company, Intellectual Property Protection-Patents Trademarks and Copyrights.

3. **Functional plans:** Marketing plan–for the new venture, environmental analysis, steps in preparing marketing plan, marketing mix, contingency planning; Organizational plan – designing organization structure and Systems; Financial plan – pro forma income statements, Ratio Analysis.

4. **Entrepreneurial Finance:** Debt or equity financing, Sources of Finance - Commercial banks, private placements, venture capital, financial institutions supporting entrepreneurs; Lease

Financing; Funding opportunities for Startups in India.

5. **Enterprise Management:** Managing growth and sustenance- growth norms; Factors for growth; Time management, Negotiations, Joint ventures, Mergers and acquisitions.

Books:
1. Kumar, Arya, ``Entrepreneurship: Creating and Leading an Entrepreneurial Organization‟‟, Pearson ISBN-10: 8131765784; ISBN-13: 978-8131765784...
2. Hishrich., Peters, ``Entrepreneurship: Starting, Developing and Managing a New Enterprise‟,ISBN0-256-14147-9
3. IrwinTaneja,``Entrepreneurship,‟‟GalgotiaPublishers.ISBN:978-93-84044-82-4
4. Charantimath, Poornima, ``Entrepreneurship Development and Small Business Enterprises, ‟Pearson Education,ISBN,8177582607, 9788177582604.

Savitribai Phule Pune University
Third Year MCA (2019 Course)
510911B: Audit Course 5
AC5 – II : MOOC-learn New Skill

Course Objectives:

- To promote interactive user forums to support community interactions among students, professors, and experts.
- To promote learning additional skills anytime and anywhere.
- To enhance teaching and learning on campus and online.

Course Outcome:

On completion of the course, learner will acquire additional knowledge and skills.

About Course:

MOOCs (Massive Open Online Courses) provide affordable and flexible way to learn new skills, pursue lifelong interests and deliver quality educational experiences at scale. Whether you're interested in learning for yourself, advancing your career or leveraging online courses to educate your workforce, SWYAM, NPTEL or similar ones can help.

World's largest SWAYAM MOOCs, a new paradigm of education for anyone, anywhere, anytime, as per your convenience, aimed to provide digital education free of cost and to facilitate hosting of all the interactive courses prepared by the best more than 1000 specially chosen faculty and teachers in the country. SWAYAM MOOCs enhances active learning for improving lifelong learning skills by providing easy access to global resources.

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.

This is done through an indigenous developed IT platform that facilitates hosting of all the courses, taught in classrooms from 9th class till post-graduation to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to the residents in India. More than 1,000 specially chosen faculty and teachers from across the Country have participated in preparing these courses.

The courses hosted on SWAYAM is generally in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology. In order to ensure best quality content are produced and delivered, seven National Coordinators have been appointed: They are NPTEL for engineering and UGC for post-graduation education.

Guidelines:

Instructors are requested to promote students to opt for courses (not opted earlier) with proper

mentoring. The departments will take care of providing necessary infrastructural and facilities for the learners.

References:
1. https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/
3. https://www.edx.org

SEMESTER VI

Savitribai Phule Pune University Third year of MCA (2019 Course) 510912: Project Stage II		
Teaching Scheme:	**Credit**	**Examination Scheme:**
PR: 28 Hours/Week	**14**	**TW: 100 Marks** **OR: 150 Marks**

Course Objectives:

- To expose students to product development cycle using industrial experience, use of state of art technologies.
- To evaluate the various validation and verification methods.
- To work in team and learn professionalism.
- To consolidate the work as a furnished report.
- To apply communication skills to effectively promote ideas, goals or products.

Course Outcomes:

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

CO1: Learn team work and professionalism.

CO2: Apply SDLC to develop the project.

CO3: Apply communication and presentation skills.

CO4: Recognize the importance of documentation.

Guidelines

Project Stage II is Major Project with Industrial Internship, the student shall undergo industrial training and work on real life application as a project work. Student shall apply Software Development Life Cycle to project, draw design diagrams using tools, implement the system and test it before deployment.
The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is the duly certified by the concerned guide and head of the Department/Institute.

- Progress of project work is monitored regularly on weekly project slot/project day. Regular interval presentations are to be arranged to review and assess the work. During process of monitoring and continuous assessment AND evaluation the individual and team performance is to be measured.
- Project work is monitored and continuous assessment is done by guide and authorities.
- During university examination internal examiner and External examiners jointly, evaluate the project work.
- Recommended performance measure parameters may include-Problem definition and scope of the project, Exhaustive and Rational Requirement Analysis, Comprehensive Implementation-Design, modelling, documentation, Usability, Optimization considerations(Time, Resources,

Costing), Thorough Testing, Project Presentation and Demonstration(ease of use and usability), Presentation of work in the form of Project Report(s), Understanding individual capacity, Role & involvement in the project, among other parameters.

- The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.

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Savitribai Phule Pune University
Third Year of MCA (2019 Course)
510913A Audit Course 6:
AC6-I Entrepreneurship Development
</td><td>Home</td></tr>
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The course aims at developing conceptual understanding of the topic among the students and comprehends the environment of making of an Entrepreneur.

Course Objectives:

- To inculcate entrepreneurship skills to students.

- To aware about industry structure and how to start up a company.

- To acquaint types of enterprise and ownership structure.

- To know the facets of enterprise management.

- To understand the government policies development of entrepreneurship.

Course Outcomes:

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

CO1: Know entrepreneurships and entrepreneurship development process.

CO2: Describe types of enterprises and ownership structure.

CO3: Explain the legalities in product development.

CO4: Understand and apply functional plans.

CO5: Manage Entrepreneurial Finance.

CO6: Inculcate managerial skills as an entrepreneur.

Course Contents

Entrepreneurship: Definition, requirements to be an entrepreneur, entrepreneur and intrapreneur, entrepreneur and manager, growth of entrepreneurship in India, women entrepreneurship, rural and urban entrepreneurship.

Entrepreneurial Motivation: Motivating factors, motivation theories-Maslow's Need Hierarchy Theory, McClelland's Acquired Need Theory, government's policy actions towards entrepreneurial motivation, entrepreneurship development programmes.

Types of Enterprises and Ownership Structure: Small scale, medium scale and large scale enterprises, role of small enterprises in economic development; proprietorship, partnership, Ltd. companies and co-operatives: their formation, capital structure and source of finance.

Projects: Identification and selection of projects; project report: contents and formulation, concept of project evaluation, methods of project evaluation: internal rate of return method and net present value method.

Management of Enterprises: Objectives and functions of management, scientific management, general and strategic management; introduction to human resource management: planning, job analysis, training, recruitment and selection, etc.; marketing and organizational dimension of enterprises; enterprise financing : raising and managing capital, shares, debentures and bonds, cost of capital; break- even analysis, balance sheet its analysis..

Institutional Support and Policies: institutional support towards the development of entrepreneurship in India, technical consultancy organizations, government policies for small scale enterprises.

Learning Resources:

Text Books:
1. Ram Chandran, 'Entrepreneurial Development', Tata McGraw Hill, New Delhi
2. Saini, J. S., 'Entrepreneurial Development Programmes and Practices', Deep & Deep Publications (P), Ltd.
3. Khanka, S S. 'Entrepreneurial Development', S Chand & Company Ltd. New Delhi

Reference Books:
1. Badhai, B 'Entrepreneurship for Engineers', Dhanpat Rai& co. (p) Ltd.
2. Desai, Vasant, 'Project Management and Entrepreneurship', Himalayan Publishing　　　House, Mumbai, 2002.
3. Gupta and Srinivasan, 'Entrepreneurial Development', S Chand & Sons, New Delhi.

Savitribai Phule Pune University Third year of MCA (2019 Course) **510913B Audit Course 6:** **AC6-II: MOOC -Learn New Skills**	Home

Course Objectives

- Enables the student to directly engage and learn from the best faculty around the world in that particular subject.

- To inculcate employability skills among students.

- To gain experience of independent studying and also promote learning of additional skills anytime and anywhere.

- To enhance teaching and learning on campus and on-line.

Course Outcomes

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

CO1: Apply additional knowledge and skills for real world applications.

CO2: Bring out the self-learning initiatives through their own motivation to drive them to complete the course and not external compulsions. This fosters the habit of keeping oneself updated always by means of self-study.

About Course

This course aims to create an excellent opportunity for students to acquire the necessary skill set for employability through massive on-line courses where the world famous experts from academics and industry are available.

MOOCs (Massive Open On-line Courses) provide affordable and flexible way to learn new skills. MOOCs are on-line and accessible to all for free. MOOCs typically comprise video lessons, readings, assessments, and discussion forums. Some of the MOOCs platforms are:-

1. **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.

2. **National Programme on Technology Enhanced Learning (NPTEL)** 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 is 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.

3. **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.

MOOCs platforms like SWAYAM, NPTEL, Spoke Tutorial, EDX, Coursera, Udemy, Udacityetc can help students in acquiring knowledge and also advancement in career.

Guidelines

Student can choose the audit course either from courses available on SWAYAM, NPTEL or any other MOOC platform. Evaluation of audit course will be done at Institute level. The duration of the course should not be more than 8 weeks.

Instructors are requested to promote students to opt for courses (not opted earlier) with proper mentoring. The department will take care of providing necessary infrastructural and facilities for the learners.

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.

After successful completion of the MOOC course, the students shall provide their successful completion certificate to the Course Coordinator of the Institute.

If student wants to earn a verified certificate, he/she will have to fill the on-line exam registration form and take the proctored exam conducted by NPTEL/Spoken Tutorial in person at any of the designated exam centers.

Suggest List of Course (any one)

- Introduction to Industry 4.0 and Industrial Internet of Things
- Employment Communication a Lab based course
- Privacy and Security in On-line Social Media
- Scilab (Spoken tutorial)
- Emotional Intelligence
- LaTex for report writing (Spoken tutorial)

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

Learning Resources

1. Swayam- https://swayam.gov.in/
2. NPTEL- https://onlinecourses.nptel.ac.in/
3. Spoken Tutorial -https://spoken-tutorial.org/tutorial-search
4. Mooc- http://mooc.org/
5. Edx - https://www.edx.org/
6. Coursera- https://www.coursera.org/