SEMESTER – VI

Savitribai Phule Pune University, Pune
Third Year of Artificial Intelligence and Machine Learning (2020 Course)
318552: Machine Intelligence for Data Science

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 3 hrs/week	03 Credits	Mid_Semester : 30 Marks End_Semester : 70 Marks

Prerequisite Courses: 218553:Fundamentals of Artificial Intelligence and Machine Learning

Companion Course: 318556:Software Lab II (Machine Intelligence for Data Science & ANN)

Course Objectives:
- To learn data collection and preprocessing techniques for data science
- To understand basis of statistics and mathematics for Machine Learning
- To understand and learn regression models, interpret estimates and diagnostic statistics
- To understand and learn different classification models and its algorithms
- To learn decision tree and ensembles methods
- To understand and learn clustering methods

Course Outcomes:

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

CO1: Apply data preprocessing methods on open access data and generate quality data for analysis

CO2: Apply appropriate statistical measure for machine learning applications.

CO3: Apply regression techniques to machine learning problems.

CO4: Apply and build classification models using SVM.

CO5: Apply decision tree and ensembles methods to solve real time applications.

CO6: Apply and build clustering models using clustering methods and its corresponding algorithms.

COURSE CONTENTS

Unit I	INTRODUCTION TO DATA SCIENCE	(06 hrs)

Defining data science and big data, Recognizing the different types of data, Gaining insight into the data science process, Data Science Process: Overview, Different steps, Machine Learning Definition and Relation with Data Science.

Mapping of Course Outcomes for Unit I	CO1

Unit II	STATISTICS AND PROBABILITY BASICS FOR DATA ANALYSIS	(06 hrs)

Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational **Caveats, Correlation and Causation**
Probability : Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem

Mapping of Course Outcomes for Unit II	CO2

Unit III	REGRESSION MODELS	(06 hrs)
Overview of statistical linear models, residuals, regression inference, Generalized linear models, logistic regression, Interpretation of odds and odds ratios, Maximum likelihood estimation in logistic regression, Poisson regression, Examples, Interpreting logistic regression, Visualizing fitting logistic regression curves.		
Exemplar/Case Studies	Remote sensing and GIS-based landslide hazard analysis and cross-validation using multivariate logistic regression model	
Mapping of Course Outcomes for Unit III	CO3	
Unit IV	CLASSIFICATION METHODS	(06 hrs)
Support Vector Machine classification algorithm, hyper plane, optimal separating hyper planes , kernel functions, kernel selection, applications, Introduction to ensemble and its techniques, Bagging and Bootstrap ensemble methods, Introduction to random forest, growing of random forest, random feature selection.		
Exemplar/Case Studies	Face recognition using SVM Or Product review case study in area of sentimental analysis using SVM and random forest classifiers	
Mapping of Course Outcomes for Unit IV	CO4	
Unit V	DECISION TREES & ENSEMBLES METHODS	(06 hrs)
Decision Trees: What Is a Decision Tree? Entropy, The Entropy of a Partition, Creating a Decision Tree, Random Forests, **Algorithms:** ID4, C4.5, CART. **Ensembles Methods:** Bagging & boosting and its impact on bias and variance, C5.0 boosting, Random forest, Gradient Boosting Machines and XGBoost		
Mapping of Course Outcomes for Unit V	CO5	
Unit VI	CLUSTERING METHODS	(06 hrs)
Overview of clustering and unsupervised learning**,** Introduction to clustering methods: Partitioning methods, Density-Based Spatial Clustering, Hierarchical clustering methods: Agglomerative Hierarchical clustering technique, Roles of dendrograms and Choosing number clusters in Hierarchical clustering, Divisive clustering techniques.		
Exemplar/Case Studies	Case study on DNA sequencing and hierarchical clustering to find the phylogenetic tree of animal evolution	
Mapping of Course Outcomes for Unit VI	CO6	
Text Books:		

1. Tom M. Mitchell, "Machine Learning", India Edition 2013, McGraw Hill Education.
2. S.P. Gupta, "Statistical Methods", Sultan Chand and Sons, New Delhi, 2009,
3. Douglas Montgomery, Elizabeth A. Peck, and G. Geoffrey Vining, "Introduction to Linear Regression Analysis", 5th edition, Wiley publication.
4. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013

Reference Books:
1. Peter Harrington, Machine Learning In Action, DreamTech Press 2.ISBN: 9781617290183   2. Alpaydin, Ethem. Machine learning: the new AI. MIT press, 2016, ISBN: 9780262529518   3. Stephen Marsland, Machine Learning An Algorithmic Perspective, CRC Press, ISBN: : 978-1-4665-8333-7   4. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, Vovost Foster, Fawcett Tom
E Books / E Learning References :
E Books: 1. Charu C. Aggarwal, Chandan K. Reddy, "Data Clustering Algorithms and Applications", CRC Press   **MOOCs Courses link:**   1. https://nptel.ac.in/courses/106/106/106106139/   2. https://nptel.ac.in/courses/106/105/106105152/

Savitribai Phule Pune University, Pune Third Year of Artificial Intelligence and Machine Learning (2020 Course) **318553: Data Mining & Warehousing**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH) : 3 hrs/week	03 Credits	Mid_Semester : 30 Marks End_Semester : 70 Marks

Prerequisite Courses: Database Management Systems

Course Objectives:

- Learn how to build a data warehouse and query it (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics).
- Learn to perform data mining tasks using a data mining toolkit (such as open source WEKA).
- Understand the data sets and data preprocessing.
- Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression.
- Exercise the data mining techniques with varied input values for different parameters.
- To obtain Practical Experience Working with all real data sets.
- Emphasize hands-on experience working with all real data sets.

Course Outcomes:

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

CO1: Ability to understand the various kinds of tools.

CO2: Apply frequent pattern and association rule mining techniques for data analysis

CO3: Apply appropriate classification and clustering techniques for data analysis

CO4: Apply frequent pattern and association rule mining techniques for data analysis & Study Warehouse with design and Components.

CO5: Apply suitable pre-processing and visualization techniques for data analysis

CO6: Design a Data warehouse system and perform business analysis with OLAP tools.

COURSE CONTENTS		
Unit I	**INTRODUCTION TO DATA MINING**	**(07 hrs)**

Definition of data mining- Data Mining Techniques – Issues – applications- Data Objects and attribute types-knowledge discovery Process, Data Mining Functionalities, Classification of Data Mining Systems , Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures. Data Mining Task Primitives, Mining Frequent Patterns, Associations, Market Basket Analysis, Apriori Algorithm, Association rules from frequent item set, Text Mining and Web Mining.

Mapping of Course Outcomes for Unit I	CO1

Unit II	CLASSIFICATION AND PREDICTION	(07 hrs)

Introduction, Classification by Decision Tree Induction, Attribute selection measures, Bayesian Classification , Bayes Theorem ,Naïve Bayesian Classification , Rule-Based Classification, If then rules for classification, Rule Extraction from decision tree, Classification by Back propagation, Support Vector Machines. Mining

Data Mining-frequent Pattern Analysis: Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

Case Study	WEKA Tool
Mapping of Course Outcomes for Unit II	CO2

Unit III	CLUSTER ANALYSIS AND BUSINESS INTELLIGENCE	(07 hrs)

Introduction to Cluster Analysis-Types, Categorization of Major Clustering Methods, Clustering techniques: - Partitioning (k-means, k-means++, Mini-Batch k-means, k-medoids), Hierarchical (Agglomerative and Divisive), Density based (DBSCAN), Grid Based Methods, Outlier analysis-outlier detection methods,

Business Intelligence: Introduction to Data, Information, and Knowledge, Design and implementation aspect of OLTP, Introduction to Business Intelligence and Business Models, BI Definitions & Concepts, Business Applications of BI, Role of DW in BI, BI system components, Components of Data Warehouse Architectures.

Case Study	**Learn Different ETL Tools**
Mapping of Course Outcomes for Unit III	CO3,CO4

Unit IV	INTRODUCTION TO DATA WAREHOUSING	(07 hrs)

Introduction to Decision Support System, Need for data warehousing, Operational & informational data, Data Warehouse definition and characteristics, Data Warehouse Architecture.

Warehouse Design: The Process of Data Warehouse Design, A Three-Tier Data Warehouse Architecture, Conceptual modelling of data warehouse, Differences between operational database and data warehouse, Data warehouse implementation, Data marts, Components of data warehouse, Need for data warehousing ,Trends in data warehousing

Mapping of Course Outcomes for Unit IV	CO4

Unit V	DATA WAREHOUSE COMPONENTS	(07 hrs)

Architectural components: ETL Process, Data Preprocessing: Why Preprocess Data? Data Life Cycle, Data Cleaning Techniques, Data Integration and Transformation, Data Reduction strategies overview, Discretization and Concept Hierarchy Generation for numerical data techniques binning, histogram analysis, For categorical data techniques concept hierarchies, Significant role of metadata, Data warehouse applications and usage.

Case Study	**Graph Mining and Social Network Analysis**

Mapping of Course Outcomes for Unit V	CO5	
Unit VI	**OLAP IN THE DATA WAREHOUSE**	**(07 hrs)**
A Multidimensional Data Model, Schemas for Multidimensional Databases: Stars, Snowflakes, and Fact Constellations Measures, Concept Hierarchies, OLAP Operations in the Multidimensional Data Model, Need for OLAP, OLAP tools, Types-ROLAP, MOLAP, HOLAP.		
Case Study	**Mining Spatial, Multimedia, Text and Web Data**	
Mapping of Course Outcomes for Unit VI	CO6	

Text Books:
1. Data Mining Concepts and Techniques by Han, Kamber, Morgan Kaufmann , MK publication.
2. Data Mining: Concepts and Techniques by Margaret Dunham, Morgan Kaufmann Publication.
3. Data Warehousing Fundamentals by Paul Punnian, John Wiley Publication.
4. Data Warehousing, Data Mining and OLAP by Alex Berson, S.J. Smith, Tata McGraw Hill
Reference Books:
1. The Data Warehouse Lifecycle Toolkit by Ralph Kimball, John Wiley
2. Business Intelligence: A Managerial Approach (2nd Ed,) Turba. N, Sharda, Delen, King.Wiley Publication

Savitribai Phule Pune University, Pune
Third Year of Artificial Intelligence and Machine Learning (2020 Course)
318554: Artificial Neural Networks

Teaching Scheme	Credit Scheme	Examination Scheme
Theory (TH) : 3 hrs/week	**03Credits**	**Mid_Semester : 30 Marks** **End_Semester :70 Marks**

Prerequisite Courses: Linear Algebra, Matrix Algebra, Probability

Companion Course: -----

Course Objectives:
- To understand Learning tasks, Patterns, Pattern Recognition Problems and Learning Paradigms.
- To understand Learning types in Neural Networks
- To study neural network architectures and their applications

Course Outcomes:

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

CO1: Recognize Learning Tasks and Learning Problems

CO2: Differentiate between Learning in humane and Learning in Artificial Neural Networks.

CO3: Understand Predictive learning with Feed Forward Neural Networks and Limitations

CO4: Analyze Neural network architectures for solving Optimization Problems

CO5: Investigate neural network architecture for descriptive tasks

CO6: Understand learning type in Deep Neural Networks and their Applications

COURSE CONTENTS

Unit I	BASICS OF NEURAL NETWORKS	(06 hrs)

Review of Transistor as a switch, Logic gates and Truth Tables. Characteristic of Neural Networks, Historical Development of Neural Networks, Biological Neuron and their artificial Model, McCulloch Pitts Neuron Model, Thresholding Logic functions, Neural Network Learning rules, Perceptron Learning Algorithm, Perceptrons Model, Simulation of logic gates, Limitations of Pereceptron Learning.

Mapping of Course Outcomes for Unit I	CO1

Unit II	LEARNING TASKS	(06hrs)

Trends in Computing, Data and Patterns, Pattern Recognition Tasks, Pattern Recognition Problem , Methods for Pattern Recognition Tasks. Learning Tasks in humane: Descriptive Tasks- Clustering and Associations, Predictive Tasks- Regression and Classification. Learning Paradigms- Supervised, Unsupervised and Reinforcement Learning.

Mapping of Course Outcomes for Unit II	CO2

Unit III	FEED FORWARD NEURAL NETWORKS	(06hrs)
Multilayer Perceptrons (MLPs), Architectures of Neural Networks, Feed Forward Neural Networks and Representation Power of MLPs, Learning in Feed Forward Neural Networks- Descriminant Functions-Sigmoid Neurons, Error Back Propagation Algorithm, Learning Factors and Performance issues. Gradient Descent(GD), Momentum Based GD, Stochastic GD. Applications of FF Neural Networks.		
Mapping of Course Outcomes for Unit III	CO3	
Unit IV	FEEDBACK NEURAL NETWORKS	(06 hrs)
Architecture of FeedBack Neural Netwoks, Auto associative FF Networks, Pattern Storage Networks, Stochastic Networks and Simulated Annealing, Hope field Networks and Boltzman Machines. Recurrent Neural Networks and Applications.		
Mapping of Course Outcomes for Unit IV	CO4	
Unit V	COMPETITIVE LEARNING NETWORKS	(07hrs)
Components of competitive Learning, Self-Organizing Maps (SOM), Semantic Networks, Pattern Clustering Networks, Feature Mapping Networks, Applications of SOM. Adaptive Resonance Theory (ART) and Networks, Applications of ART.		
Mapping of Course Outcomes for Unit V	CO5	
Unit VI	DEEP LEARNING NEURAL NETWORKS	(06hrs)
Architectures of Deep Learning Networks, Input Layer, Hidden Layers, Output Layer, Deep Convolutional Neural Networks(CNN), Deep Recurrent Neural Networks (RNN), LSTM Networks, Difference between Traditional Machine Learning and Learning in Deep Neural Networks, Applications of Deep Learning Networks.		
Mapping of Course Outcomes for Unit VI	CO6	
Text Books:		
1. Artificial Neural Networks by B YegnaNarayana, PHI. 2. Introduction to Artificial Neural Systems, J M Zurada, West Publishing Company,		
Reference Books:		
1. Neural Networks, Fuzzy logic and Genetic Algorithms , S. Raj sekaran, VijayalakshmiPari 2. Artificial Neural Networks : An Introduction –Kevin.L.Priddy,PaulE.Keller		

Savitribai Phule Pune University, Pune
Third Year of Artificial Intelligence and Machine Learning (2020 Course)
318555: Elective II (A) : Industrial Internet of Things

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 3 hrs/week	**03 Credits**	**Mid_Semester : 30 Marks** **End_Semester :70 Marks**

Prerequisite Courses, if any:

Companion Course, if any:

Course Objectives:

- Study of Building blocks of IOT and its various components
- Study of protocols in IOT
- Analyze the security issues in IOT
- Select proper IOT technology for application.
- Design simple IOT based application

Course Outcomes:

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

CO1: Describe Industrial Internet of Things and Cyber Physical manufacturing

CO2: Demonstrate Cyber Physical and Cyber Manufacturing systems

CO3: Describe Architectural design patterns for industrial Internet of Things

CO4: Analyze AI and data Analytics for Industrial Internet of Things

CO5: Evaluation of Workforce and Human Machine Interaction and Application of Industrial Internet of Things

CO6: Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability.

COURSE CONTENTS		
Unit I	**UNDERSTANDING INDUSTRIAL INTERNET OF THINGS (IIOT)**	**(06 hrs)**

Industrial Internet of Things and Cyber Manufacturing Systems, Application map for Industrial Cyber Physical Systems, Cyber Physical Electronics production.

Mapping of Course Outcomes for Unit I	CO1

Unit II	**MODELING OF CPS AND CMS**	**(07 hrs)**

Modeling of Cyber Physical Engineering and manufacturing, Model based engineering of supervisory controllers for cyber physical systems, formal verification of system, components, Evaluation model for assessments of cyber physical production systems.

Mapping of Course Outcomes for Unit II	CO2

Unit III	ARCHITECTURAL DESIGN PATTERNS FOR CMS AND IIOT	(07 hrs)
CPS-based manufacturing and Industries, Integration of Knowledge base data base and machine vision, Interoperability in Smart Automation, Enhancing Resiliency in Production Facilities through CPS. Communication and Networking of IIoT.		
Mapping of Course Outcomes for Unit III	CO3	
Unit IV	ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS FOR MANUFACTURING	(08 hrs)
Application of CPS in Machine tools, Digital production, Cyber Physical system Intelligence, Introduction to big data and machine learning and condition Monitoring		
Mapping of Course Outcomes for Unit IV	CO4	
Unit V	EVALUATION OF WORKFORCE AND HUMAN MACHINE INTERACTION	(06 hrs)
Worker and CPS, Strategies to support user intervention. Introduction to Advance manufacturing and Innovation Ecosystems.		
Mapping of Course Outcomes for Unit V	CO5	
Unit VI	APPLICATION OF IIOT	(06 hrs)
Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IIOT in Manufacturing Sector.		
Mapping of Course Outcomes for Unit VI	CO6	
Text Books:		

1.
   abina Jeschke, Christian Brecher Houbing Song , Danda B. Rawat Editors Industrial Internet of Things Cyber Manufacturing Systems
2.
   akima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Willy Publications Olivier Hersent, David Boswarthick, Omar Elloumi,
3.
   he Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications
4.
   nside the Internet of Things (IoT), Deloitte University Press

| Reference Books: |
|---|
| 1. Internet of Things- From Research and Innovation to Market Deployment; By Ovidiu & Peter; River Publishers Series |
| 2. Five thoughts from the Father of the Internet of Things; by Phil Wainewright - Kevin Ashton |
| 3. How Protocol Conversion Addresses IIoT Challenges: White Paper By RedLion. |
| 4. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014 |
| |
| **E Books / E Learning References :** |
| 1. https://nptel.ac.in/courses/106105195 |
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Savitribai Phule Pune University, Pune **Third Year of Artificial Intelligence and Machine Learning (2020 Course)** **318555: Elective II (B) : Brain Computer Interface**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH) : 3 hrs/week	**03 Credits**	**Mid_Semester : 30 Marks** **End_Semester :70 Marks**

Prerequisite Courses, if any: ---

Companion Course, if any:---

Course Objectives:

- Understand the biophysical basis of non-invasive brain signals
- To apply signal processing, discrimination, and classification tools to interpret these signals
- To implement these tools into a control system for a brain-computer interface.

Course Outcomes:

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

CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: Evaluate concept of BCI.
CO3: Assign functions appropriately to the human and to the machine.
CO4: Select appropriate feature extraction methods
CO5: Use machine learning algorithms for translation.
CO6: Learn the various applications of BCI

COURSE CONTENTS		
Unit I	**INTRODUCTION TO BCI**	**(07 hrs)**

Introduction - Brain structure and function, Brain Computer Interface Types - Synchronous and Asynchronous -Invasive BCI -Partially Invasive BCI - Non Invasive BCI, Structure of BCI System, BCI Monitoring Hardware, EEG, ECoG, MEG, fMRI.

Mapping of Course Outcomes for Unit I	CO1	
Unit II	**BRAIN ACTIVATION**	**(06 hrs)**

Brain activation patterns - Spikes, Oscillatory potential and ERD, Slow cortical potentials, Movement related potentials-Mu rhythms, motor imagery, Stimulus related potentials - Visual Evoked Potentials – P300 and Auditory Evoked Potentials, Potentials related to cognitive tasks.

Mapping of Course Outcomes for Unit II	CO2	
Unit III	**FEATURE EXTRACTION METHODS**	**(7 hrs)**

Data Processing – Spike sorting, Frequency domain analysis, Wavelet analysis, Time domain analysis, Spatial filtering -Principal Component Analysis (PCA), Independent Component Analysis (ICA), Artefacts reduction, Feature Extraction - Phase synchronization and coherence

Mapping of Course Outcomes for Unit III	CO3	
Unit IV	**MACHINE LEARNING METHODS FOR BCI**	**(7 hrs)**

Classification techniques –Binary classification, Ensemble classification, Multiclass Classification, Evaluation of classification performance, Regression - Linear, Polynomial, RBF's, Perceptron's, Multilayer neural networks, Support vector machine, Graph theoretical functional connectivity analysis.

Mapping of Course Outcomes for Unit IV	CO4	
Unit V	**BCI BASED ON ONSET AND OFFSET VEP**	**(7 hrs)**

Introduction- Methods- Peak-to-valley amplitudes in the onset and offset FVEPs, Determination of gazed target, Usability of Transient VEPs in BCIs- VEPs, Availability of transient VEPs, Machine learning approach.

Mapping of Course Outcomes for Unit V	CO5	
Unit VI	**APPLICATIONS OF BCI**	**(7 hrs)**

Case Studies - Invasive BCIs: decoding and tracking arm (hand) position, controlling prosthetic devices such as orthotic hands, Cursor and robotic control using multi electrode array implant, Cortical control of muscles via functional electrical stimulation. Noninvasive BCIs:P300 Mind Speller, Visual cognitive BCI, Emotion detection. Ethics of Brain Computer Interfacing.

Mapping of Course Outcomes for Unit VI	CO6	
	Text Books:	

1. Reza Fazel-Rezai, "Recent Advances in Brain-Computer Interface Systems",Intech Publications, First Edition, 2011.
2. Theodre Berger W, John k Chapin et all, "Brain computer interfaces, An International assessment of research and developmental trends", Springer, First Edition, 2008.
3. Rajesh.P.N.Rao, Brain-Computer Interfacing: An Introduction, Cambridge University Press, First edition, 2013.
4. Jonathan Wolpaw, Elizabeth Winter Wolpaw, Brain Computer Interfaces: Principles and practice, Oxford University Press, USA, Edition 1, January 2012.

Reference Books:
1. Ella Hassianien, A &Azar.A.T (Editors), "Brain-Computer Interfaces Current Trends and Applications", Springer, 2015.
2. Bernhard Graimann, Brendan Allison, GertPfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010
3. Ali Bashashati, Mehrdad Fatourechi, Rabab K Ward, Gary E Birch," A survey of signal Processing algorithms in brain–computer interfaces based on electrical brain signals" Journal of Neural Engineering, Vol.4, 2007, PP.32-57
4. Arnon Kohen, "Biomedical Signal Processing", Vol I and II, CRC Press Inc, Boca Rato, Florida.
5. Bishop C.M., "Neural networks for Pattern Recognition", Oxford, Clarendon Press, 1995.
6. Andrew Webb, "Statistical Pattern Recognition", Wiley International, Second Edition, 2002.
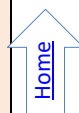
Savitribai Phule Pune University, Pune Third Year of Artificial Intelligence and Machine Learning (2020 Course) 318555: Elective II (C) - AI for Cyber Security		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory (TH) : 3 hrs/week	**03 Credits**	**Mid_Semester : 30 Marks** **End_Semester : 70 Marks**

Prerequisite Courses: 318548: Elective - I –Information Security

Companion Course: 318557: Software Laboratory III

Course Objectives:
- To learn the fundamental of AI and Cyber Security.
- To understand the cyber security threats and malware threats with AI.
- To understand and learn network anomaly detection techniques to machine learning problems.
- To understand and learn various algorithms to protect the sensitive information.
- To learn tools for the various GANs attacks.
- To understand and learn the evaluation of algorithms

Course Outcomes:

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

CO1: Understand the fundamental of AI and Cyber Security.

CO2: Analyze the cyber security threats and malware threats with AI.

CO3: Analyze and apply network anomaly detection techniques to machine learning problems.

CO4: Apply various algorithms to protect the sensitive information.

CO5: Understand and apply tools for the various GANs attacks.

CO6: Understand to evaluate algorithms.

COURSE CONTENTS		
Unit I	**INTRODUCTION**	**(06 hrs)**

Applying AI in cyber security, The evolution from expert systems to data mining and AI, The different forms of automated learning, The characteristics of algorithm training and optimization, Introducing AI in the context of cyber security, security measures using AI.

Mapping of Course Outcomes for Unit I	**CO1**	
Unit II	**DETECTING CYBER SECURITY THREATS WITH AI**	**(07 hrs)**

Detecting Email Cyber security Threats with AI: How to detect spam with Perceptrons, Image spam detection with support vector machines (SVMs), Phishing detection with logistic regression and decision trees, Spam detection with Naive Bayes, Spam detection adopting NLP. **Malware Threat Detection:** Introducing the malware analysis methodology, different malware families apart, Decision tree malware detectors, Detecting metamorphic malware with Hidden Markov Models (HMMs), Advanced malware detection with deep learning.

Mapping of Course Outcomes for Unit II	CO2	
Unit III	NETWORK ANOMALY DETECTION WITH AI	(06 hrs)

Network Anomaly Detection with AI: Network anomaly detection techniques, How to classify network attacks, Detecting botnet topology, Different machine learning (ML) algorithms for botnet detection.

Mapping of Course Outcomes for Unit III	CO3	
Unit IV	PROTECTING SENSITIVE INFORMATION AND ASSETS	(06 hrs)

Securing User Authentication: Authentication abuse prevention, Account reputation scoring, User authentication with keystroke recognition, and Biometric authentication with facial recognition,

Fraud Prevention with Cloud AI Solutions: leverage machine learning (ML) algorithms for fraud detection, bagging and boosting techniques can improve an algorithm's effectiveness.

Mapping of Course Outcomes for Unit IV	CO4	
Unit V	GANS – ATTACKS AND DEFENSES	(06 hrs)

The fundamental concepts of GANs and their use in attack and defense scenarios, The main libraries and tools for developing adversarial examples, Attacks against deep neural networks (DNNs) via model substitution, Attacks against intrusion detection systems (IDS) via GANs, Attacks against facial recognition procedures using adversarial examples.

Mapping of Course Outcomes for Unit V	CO5	
Unit VI	EVALUATING ALGORITHMS	(06 hrs)

Feature engineering best practices in dealing with raw data, evaluate a detector's performance using the ROC curve, split sample data into training and test sets, manage algorithms' overfitting and bias–variance trade-offs with cross.

Mapping of Course Outcomes for Unit VI	CO6	
Text Books:		

1. Daniel Ventre, "Artificial Intelligence, Cyber security and Cyber Defense", Wiley-ISTE publication
2. Clarence Chio, David Freeman " Machine Learning and Security", O'Reilly Media, Inc

Reference Books:

1. Alessandro Parisi, "Hands-On Artificial Intelligence for Cybersecurity", Packt Publishing.
2. Gupta, Brij Sheng, Quan Z, "Machine learning for computer and cyber security principles, algorithms, and practices" CRC Press, ISBN - 978-1-138-58730-4

SavitribaiPhule Pune University, Pune
Third Year of Artificial Intelligence and Machine Learning (2020 Course)
318555: Elective II (D) -: Video Analytics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 3 hrs/week	**03 Credits**	**Mid_Semester : 30 Marks** **End_Semester : 70 Marks**

Prerequisite Courses, if any: ---

Companion Course, if any:---

Course Objectives:

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

1. Understand the need for video Analytics
2. Understand the basic configuration of video analytics
3. Understand the functional blocks of a video analytic system
4. Get exposed to the various applications of video analytics

Course Outcomes:

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

CO1: Understand the algorithms available for performing analysis on video data and address the challenges
CO2: Design video analytic algorithms for security applications
CO3: Design video analytic algorithms for business intelligence
CO4: Design custom made video analytics system for the given target application
CO5: Analyse the Images using various Coding Techniques

COURSE CONTENTS		
Unit I	**VIDEO ANALYTIC COMPONENTS**	**(06 hrs)**

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction- classifier - Pre-processing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features

Mapping of Course Outcomes for Unit I	CO1	
Unit II	**FOREGROUND EXTRACTION**	**(06 hrs)**

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation- Tracking in a multiple camera environment.

Mapping of Course Outcomes for Unit II	CO2	
Unit III	**CLASSIFIERS**	**(06 hrs)**

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier-HMM based classifier.

Mapping of Course Outcomes for Unit III	CO3	
Unit IV	VIDEO ANALYTICS FOR SECURITY	(06 hrs)

Abandoned object detection- human behavioural analysis -human action recognition- perimeter security-crowd analysis and prediction of crowd congestion.

Mapping of Course Outcomes for Unit IV	CO4	
Unit V	VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFIC MONITIRING AND ASSISTANCE	(06 hrs)

Customer behaviour analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

Mapping of Course Outcomes for Unit V	CO5	
Unit VI	VIDEO ANALYSIS ACTION RECOGNITION	(06 hrs)

Video Analysis Action Recognition, Video based rendering, Context and scene understanding. Case Study: Surveillance - Advanced Driver Assistance System

Mapping of Course Outcomes for Unit VI	CO6	

Text Books:
1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2011.
2. Raeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing , Kluwer academic publisher, 2001
3. Ilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), Applied Video Processing in Surveillance and Monitoring Systems (IGI global) 2016

Reference Books:
1. Hihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014
2. Aifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012
3. Murat Tekalp, "Digital Video Processing", Second Edition, Prentice Hall, 2015.
4. Oguslaw Cyganek,"Object Detection and Recognition in Digital Images: Theory and Practice", Wiley 2013

Savitribai Phule Pune University, Pune		
Third Year of Artificial Intelligence and Machine Learning (2020 Course)		
318556: Software Laboratory II		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical (PR) : 04 hrs./week	**1 Credit**	**PR : 25 Marks** **TW : 50 Marks**

Companion Course: 318552: Machine Intelligence for Data Science, 318554: Artificial Neural Network

Course Objectives :

- Students will demonstrate proficiency with statistical analysis of data.
- Students will execute statistical analyses with professional statistical software.
- Students will apply data science concepts and methods to solve problems.

Course Outcomes :

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

CO1: Demonstrate proficiency with statistical analysis of data.

CO2: Use statistical analyses with professional statistical software.

CO3: Apply data science concepts and methods to solve problems.

Guidelines for Instructor's Manual

Lab Assignments: Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for their respective courses at their level. Beyond curriculum assignments, the mini-project is also included as a part of laboratory work. The Inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and Comparative / complexity analysis (as applicable).

Guidelines for Student's Lab Journal

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

Guidelines for Lab /TW Assessment

Term work is continuous assessment that evaluates a student's progress throughout the semester. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been achieved. It is recommended to conduct an internal monthly Oral examination as part of continuous assessment.

Guidelines for Laboratory Conduction

Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for respective courses at their level. Beyond curriculum assignments may be included as a part of laboratory work. 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. The Inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable). Batch size for practical and tutorials may be as per guidelines of authority. **Use of open source software is to be encouraged.**

Guidelines for Practical Examination

Students' work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.

List of Laboratory Assignments

Group A (Any 4) (Based on Machine intelligence for Data Science)

Assignment 1: Access an open source dataset "Titanic". Apply pre-processing techniques on the raw dataset.

Assignment 2: Text classification for Sentimental analysis using KNN. (Refer any dataset like Titanic, Twitter, etc.)

Assignment 3: Write a program to recognize a document is positive or negative based on polarity words using suitable classification method.

Assignment 4: Download Abalone dataset. (URL: http://archive.ics.uci.edu/ml/datasets/Abalone)

  a) Predict the number of rings either as a continuous value or as a classification problem.
  b) Predict the age of abalone from physical measurements using linear regression

Assignment 5: 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]
   Perform the k-mean clustering with initial centroids as m1=P1 =Cluster#1=C1 and m2=P8=cluster#2=C2.
   Answer the following
   1] Which cluster does P6 belong to?

2] What is the population of cluster around m2?

3] What is updated value of m1 and m2?

Group B (Any 4) (Based on Artificial Neural Network))

Assignment 1: Write a program to scheme a few activation functions that are used in neural networks

Assignment 2: Write a program to show back propagation network for XOR function with binary input and output

Assignment 3: Write a program for producing back propagation feed forward network

Assignment 4: Write a program to demonstrate ART

Assignment 5: Write a program to demonstrate the perceptron learning law with its decision region using python. Give the output in graphical form

Savitribai Phule Pune University, Pune Third Year of Artificial Intelligence and Machine Learning (2020 Course) **318557: Software Lab III- DMW & Industrial Internet of Things**		
Teaching Scheme: **Practical (PR) : 04 hrs/week**	**Credit Scheme:** **01 Credit**	**Examination Scheme:** PR : 25 Marks TW : 50 Marks
Prerequisites:		
Course Objectives :		

Course Objectives :

- Understand the detailed aspects of data warehousing and data mining.
- Fully understand IoT/IIoT workflow. Gain deep knowledge in cloud computing (IBM, PTC), IoT dashboards.
- Understand the crucial points in IIoT.
- Strengthen fundamental knowledge for Electrical Engineering, Computer Science and Business Administration specializations.

Course Outcomes :

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

CO1: Ability to understand the various kinds of tools.

CO2: Demonstrate the classification, clustering and etc. in large data sets.

CO3: Ability to add mining algorithms as a component to the exiting tools.

CO4: To learn physical design, logical design and enabling technologies of internet of things.

CO5: To acquire knowledge about IoT platforms.

Guidelines for Instructor's Manual
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.
Guidelines for Student's Lab Journal
1. Student should submit term work in the form of handwritten journal based on specified list of assignments. 2. Practical Examination will be based on the term work. 3. Candidate is expected to know the theory involved in the experiment. 4. The practical examination should be conducted if and only if the journal of the candidate is complete in all aspects.
Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc. 2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to the theory & implementation of the experiments he/she has carried out. 3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

Guidelines for Laboratory Conduction
As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory. It is expected that student should implement concept of Data Mining and Warehousing. The open source Data Mining Tools like Rapid Miner, Weka etc. can be used to implement the concept of Data Mining and Warehousing.
Guidelines for Practical Examination
1. There will be 2 problem statements options and student will have to perform any one.   2. All the problem statements carry equal weightage.
List of Laboratory Assignments
Group A(DMWL)
Any seven Assignments are compulsory*   **Assignment No 1:** Build Data Warehouse and Explore WEKA   **Assignment No 2:** Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets   **Assignment No 3:** Demonstration of classification rule process on WEKA data-set using Naive Bayes algorithm.   **Assignment No 4:** Implementation of OLAP operations   **Assignment No 5:** Demonstrate performing Regression on data sets   **Assignment No 6:** Demonstration of clustering rule process on data-set iris.arff using simple k-means   **Assignment No 7:** Demonstration of any ETL tool   **Assignment No 8:** Write a program of Apriori algorithm using any programming language.   **Assignment No 9:** Case Study on Text Mining or any commercial application.
List of Laboratory Assignments
Group B(IIOTL)
Following practical can be performed on Raspberry Pi &/ Arduino Board(Any 3)   1. Making On and OFF of LED.   2. Interfacing of LCD.   3. Reading and displaying Analogue input voltage.   4. LED intensity variation depending upon potentiometer variation.   5. Speed variation of dc motor.

Any two on application like

1. Interfacing of Raspberry Pi &/ Arduino Board with computer using any protocol.
2. Interfacing of sensor and sending data to mobile as SMS or to computer.
3. Wireless communication between two boards.
4. Sending sensor data to google sheets or any spread sheet. Etc

Text Books

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

2. Bernd Scholz-Reiter, Florian 2. Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer

3. Data Mining: Concepts and Techniques by Margaret Dunham, Morgan Kaufmann Publication.

4. Data Warehousing Fundamentals by Paul Punnian, John Wiley Publication.

Industrial Internet of Things

1.
   rshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.

2.
   Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications.

3.
   drian McEwen , Designing The Internet of Things, Willy Pubication.

4.
   aj Kamal, Internet of Things, McGraw Hill Education. 5. Nuno Corriea and Ajay N, Internet of Things with SAP HANA: Build Your IoT Use Case With Raspberry PI, Arduino Uno, HANA XSJS and SAPUI5, publisher UI5 Community Network.

5.
   Timothy Chou, Precision Internet of Things, Mcgraw Hill Education.

Reference Books

1. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Willy Publications

2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications

3. Inside the Internet of Things (IoT), Deloitte University Press.

4. Data Warehousing, Data Mining and OLAP by Alex Berson, S.J. Smith, Tata McGraw Hill

5. Daniel Kellmereit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things", Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN13: 978- 0989973700.

6. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Network: An information processing approach", Elsevier, ISBN: 978-81-8147-642-5.

Savitribai Phule Pune University, Pune
Third Year of Artificial Intelligence and Machine Learning (2020 Course)
318557: Software Lab III- DMW & Brain Computer Interface

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 04 hrs/week	**01 Credit**	**PR : 25 Marks**
		TW : 50 Marks

Prerequisites:

Course Objectives :

- Understand the detailed aspects of data warehousing and data mining.
- Understand the basic concepts of brain computer interface, interface types, EEG signals.
- Study the state of art in neuroimaging-based approaches and their related applications and Brain Computer Interface system.
- Demonstrate the concept of Data Streaming and Data Processing using suitable tool.
- Understand the ethical issues pertaining to the development and use of Brain Computer Interface technology.

Course Outcomes :

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

CO1: Demonstrate the classification, clustering and etc. in large data sets.

CO2: Ability to add mining algorithms as a component to the exiting tools.

CO3: Study the utilization of drives system related to the electroencephalogram (EEG) signals for neuro rehabilitation.

CO4: Understand the concept of Brain Computer Interface Systems that can be designed and developed with the overall goal of supporting a wide range of users for a wide range of applications.

CO5: Process multi-channel EEG data using a suitable tool in the computing environment which will be helpful for developing, prototyping and testing Brain Computer Interface approaches.

 CO6: Solve the interoperability and standardization issues of Brain Computer Interface software platforms and to identify and design new applications of Brain Computer Interface.

Guidelines for Instructor's Manual
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.
Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all aspects.

Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.   2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to the theory & implementation of the experiments he/she has carried out.   3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.
Guidelines for Laboratory Conduction
As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory. It is expected that student should implement concept of Data Mining and Warehousing. The open source Data Mining Tools like Rapid Miner, Weka etc. can be used to implement the concept of Data Mining and Warehousing.
Guidelines for Practical Examination
1. There will be 2 problem statements options and student will have to perform any one.   2. All the problem statements carry equal weightage.
List of Laboratory Assignments
Group A(DMWL)
Any seven Assignments are compulsory*   **Assignment No 1:** Build Data Warehouse and Explore WEKA   **Assignment No 2:** Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets   **Assignment No 3:** Demonstration of classification rule process on WEKA data-set using Naive Bayes algorithm.   **Assignment No 4:** Implementation of OLAP operations   **Assignment No 5:** Demonstrate performing Regression on data sets   **Assignment No 6:** Demonstration of clustering rule process on data-set iris.arff using simple k-means   **Assignment No 7:** Demonstration of any ETL tool   **Assignment No 8:** Write a program of Apriori algorithm using any programming language.   **Assignment No 9:** Case Study on Text Mining or any commercial application.

List of Laboratory Assignments
Group B(Brain Computer Interface)
Mini Project(Any One)

Application with innovative idea is expected

Continuous Assessment based on a minimum of 3 reviews.

Sample projects that can be given to students to be implemented using Python, Raspberry Pi, Arduino etc.

1. Brain Controlled Home Automation using Raspberry Pi
2. Brain Controlled Robotic Arm
3. Brain Control Robot using Arduino
4. BCI Virtual Keyboard using Raspberry Pi
5. BCI Based Password Validation

Text Books

6. Data Mining: Concepts and Techniques by Margaret Dunham, Morgan Kaufmann Publication.
7. Data Warehousing Fundamentals by Paul Punnian, John Wiley Publication. Brain-Computer Interfaces Current Trends and Applications, Aboul Ella Hassanien, Ahmad Taher Azar, Volume 74, Springer International Publishing2015, ISBN: 978-3-319-10977-0, DOI:10.1007/978-3- 319-10978-7
8. Brain Computer Interfaces-Applying Your Minds to Human-Computer Interaction, Desney S. Tan, Anton Nijholt, ISBN: 978-1-84996-271-1, DOI: 10.1007/978-1-84996-272-8
9. Brain–Computer Interfaces Handbook-Technological and Theoretical Advances, Chang S. Nam,Anton Nijholt, Fabien Lotte, Taylor & Francis 2018, ISBN: 13: 978-1-4987-7343-0

Reference Books

1. Data Warehousing, Data Mining and OLAP by Alex Berson, S.J. Smith, Tata McGraw Hill
2. Brain-Computer Interfacing -an Introduction, Rajesh P. N. Rao, 2013, ISBN: 978-0-521-76941-9

Savitribai Phule Pune University, Pune **Third Year of Artificial Intelligence and Machine Learning (2020 Course)** **318557: Software Lab III- DMW & AI for Cyber Security**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical (PR) : 04 hrs/week	**01 Credit**	**PR : 25 Marks** **TW : 50 Marks**

Prerequisites: ---

Course Objectives :
- Students will demonstrate proficiency with statistical analysis of data.
- Students will execute statistical analyses with professional statistical software.
- Students will apply data science concepts and methods to solve problems.
- Understand the detailed aspects of data warehousing and data mining.

Course Outcomes :

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

CO1: Ability to understand the various kinds of tools.

CO2: Demonstrate the classification, clustering and etc. in large data sets.

CO3: Ability to add mining algorithms as a component to the exiting tools.

CO4: Demonstrate proficiency with statistical analysis of data.

CO5: Use statistical analyses with professional statistical software.

CO6: Apply data science concepts and methods to solve problems.

Guidelines for Instructor's Manual
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.
Guidelines for Student's Lab Journal
1. Student should submit term work in the form of handwritten journal based on specified list of assignments.   2. Practical Examination will be based on the term work.   3. Candidate is expected to know the theory involved in the experiment.   4. The practical examination should be conducted if and only if the journal of the candidate is complete in all aspects.
Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.   2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to the theory & implementation of the experiments he/she has carried out.   3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.
Guidelines for Laboratory Conduction

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory. It is expected that student should implement concept of Data Mining and Warehousing. The open source Data Mining Tools like Rapid Miner, Weka etc. can be used to implement the concept of Data Mining and Warehousing.

Guidelines for Practical Examination
1. There will be 2 problem statements options and student will have to perform any one.   2. All the problem statements carry equal weightage.
List of Laboratory Assignments
Group A(DMWL)

Any seven Assignments are compulsory*

Assignment No 1: Build Data Warehouse and Explore WEKA

Assignment No 2: Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets

Assignment No 3: Demonstration of classification rule process on WEKA data-set using Naive Bayes algorithm.

Assignment No 4: Implementation of OLAP operations

Assignment No 5: Demonstrate performing Regression on data sets

Assignment No 6: Demonstration of clustering rule process on data-set iris.arff using simple k-means

Assignment No 7: Demonstration of any ETL tool

Assignment No 8: Write a program of Apriori algorithm using any programming language.

Assignment No 9: Case Study on Text Mining or any commercial application.

List of Laboratory Assignments
Group B(AI for Cyber Security)

Assignment 1: Build a spam filter using Python and the Naive Bayes algorithm.

Assignment 2: Classify DDoS attacks with Artificial Intelligence.

Assignment 3: Split sample data into training and test sets. (Use suitable data set).

Assignment 4: Perform feature engineering operations on raw data. (Use suitable data set).

Text Books

1.
    ata Mining: Concepts and Techniques by Margaret Dunham, Morgan Kaufmann Publication.
2.
    ata Warehousing Fundamentals by Paul Punnian, John Wiley Publication.
3. Daniel Ventre, "Artificial Intelligence, Cyber security and Cyber Defense", Wiley-ISTE publication
4. Clarence Chio, David Freeman " Machine Learning and Security", O'Reilly Media, Inc.

Reference Books

1.
  ata Warehousing, Data Mining and OLAP by Alex Berson, S.J. Smith, Tata McGraw Hill
 2.
  lessandro Parisi, "Hands-On Artificial Intelligence for Cyber Security", Packt Publishing.
 3.
  upta, Brij Sheng, Quan Z, "Machine Learning for Computer and Cyber Security Principles, Algorithms, and Practices" CRC Press, ISBN - 978-1-138-58730-4

Savitribai Phule Pune University, Pune
Third Year of Artificial Intelligence and Machine Learning (2020 Course)
318557: Software Lab III- DMW & Video Analytics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 04 hrs/week	**01 Credit**	**PR : 25 Marks** **TW : 50 Marks**

Prerequisites:

Course Objectives :
- To develop critical thinking and engineering problem solving skills amongst the students.
- To explain the roles and responsibilities of IT engineers to the solution of engineering problems within the social, environmental and economic context.
- Understand the detailed aspects of data warehousing and data mining.

Course Outcomes :

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

CO1: Design solution to real life problems and analyze its concerns through shared cognition.

CO2: Apply learning by doing approach in Video Analytics to promote lifelong learning.

CO3: Tackle technical challenges for solving real world problems with team efforts.

CO4: Collaborate and engage in multi-disciplinary learning environments.

CO5: Demonstrate the classification, clustering and etc. in large data sets.

CO6: Ability to add mining algorithms as a component to the exiting tools.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all aspects.
5. For Video Analytics Mini project, group structure should enable students to work in mentor–monitored groups. The students plan, manage and complete a task/project / activity which address the stated problem.
6. There should be a team of 3 to 4 students who will work cohesively.
7. A Mentor should be assigned to individual groups who will help them with learning and development process.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking

some questions related to the theory & implementation of the experiments and mini project he/she has carried out.

3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

Guidelines for Laboratory Conduction

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory. It is expected that student should implement concept of Data Mining and Warehousing. The open source Data Mining Tools like Rapid Miner, Weka etc. can be used to implement the concept of Data Mining and Warehousing.

Guidelines for Practical Examination

1. There will be 2 problem statements options and student will have to perform any one.
2. All the problem statements carry equal weightage.

List of Laboratory Assignments

Group A(DMWL)

Any seven Assignments are compulsory*

Assignment No 1: Build Data Warehouse and Explore WEKA

Assignment No 2: Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets

Assignment No 3: Demonstration of classification rule process on WEKA data-set using Naive Bayes algorithm.

Assignment No 4: Implementation of OLAP operations

Assignment No 5: Demonstrate performing Regression on data sets

Assignment No 6: Demonstration of clustering rule process on data-set iris.arff using simple k-means

Assignment No 7: Demonstration of any ETL tool

Assignment No 8: Write a program of Apriori algorithm using any programming language.

Assignment No 9: Case Study on Text Mining or any commercial application.

List of Laboratory Assignments

Group B(Video Analytics)-Mini Project

Application with innovative idea is expected
Continuous Assessment based on a minimum of 3 reviews.

Sample projects that can be given to students to be implemented using OpenCV/Python/Octave/C/Java etc:

1. Image enhancement applications

2. Object/image recognition applications based on digital image transforms

3. Image analysis systems for visual inspection tasks (object recognition)

4. Image compression, Image Fusion

5. Image Steganography, Watermarking

6. Applications of Image Intelligence in: Medicine, Microscopy, Remote sensing, Astronomy, Materials science, Security, Robotics, Optical character recognition, Metallography etc

7. Defense– Smart Surveillance and Tracking

8. ADAS – Sign Board Detection, Traffic Monitoring, Fatigue Detection, Navigation, Lane detection

9.Image Captioning and Visual Question Answering

10.Gesture Recognition

Text Books
1. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", ThirdEdition, Academic Press, 2012. 2. Data Mining: Concepts and Techniques by Margaret Dunham, Morgan Kaufmann Publication. 3. Data Warehousing Fundamentals by Paul Punnian, John Wiley Publication.
Reference Books
1. Data Warehousing, Data Mining and OLAP by Alex Berson, S.J. Smith, Tata McGraw Hill 2. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010
E Books / E Learning References
Links for image database-Video Analytics: 1. http://homepages.inf.ed.ac.uk/rbf/CVonline/Imagedbase.htm 2. https://www.cs.cmu.edu/~cil/v-images.html 3. http://www.imageprocessingplace.com/root_files_V3/image_databases.htm 4. https://gengo.ai/datasets/20-best-image-datasets-for-computer-vision

Savitribai Phule Pune University, Pune		
Third Year of Artificial Intelligence and Machine Learning (2020 Course)		
318558: Internship / Skill Development / Global Certification Program		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical (PR) : 8 hrs/week	**06**	**Term Work(TW): 50 Marks** **Oral(OR): 50 Marks**

Prerequisites: Permission of the College Internship Coordinator/TPO.

Course Objectives :

Internship provides an excellent opportunity to learner to see how the conceptual aspects learned in classes are integrated into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

- To encourage and provide opportunities for students to get professional/personal experience through internships.
- To learn and understand real life/industrial situations.
- To get familiar with various tools and technologies used in industries and their applications.
- To nurture professional and societal ethics.
- To create awareness of social, economic and administrative considerations in the working environment of industry organizations.

Course Outcomes :

On completion of the course, learners should be able to

CO1: To demonstrate professional competence through industry internship.

CO2: To apply knowledge gained through internships to complete academic activities in a professional manner.

CO3: To choose appropriate technology and tools to solve given problem.

CO4: To demonstrate abilities of a responsible professional and use ethical practices in day to day life.

CO5: Creating network and social circle, and developing relationships with industry people.

CO6: To analyze various career opportunities and decide carrier goals.

About the Course

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are

proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.

Guidelines for Instructor's

Internship Work Evaluation:

Instructor should keep track on internship activities and maintain the record of internship in the form of Internship Diary/ Internship Workbook.

The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, and the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.

Recommended evaluation parameters-Post Internship Internal Evaluation -50 Marks + Internship Diary/Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

Depth of knowledge and skills: Communication and Presentation Skills

- Team Work
- Creativity
- Planning and Organizational skills
- Adaptability
- Analytical Skills
- Attitude and Behavior at work
- Societal Understanding
- Ethics
- Regularity and punctuality
- Attendance record
- Diary/Work book
- Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria: Proper and timely documented entries Adequacy & quality of information recorded Data recorded Thought process and recording techniques used Organization of the information.

The report shall be presented covering following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details

- Index/Table of Contents
- Introduction
- Title/Problem statement/objectives
- Motivation/Scope and rationale of the study
- Methodological details
- Results / Analysis /inferences and conclusion
- Suggestions / Recommendations for improvement to industry, if any
- Attendance Record
- Acknowledgement
- List of reference (Library books, magazines and other sources)

Feedback from internship supervisor (External and Internal)

Post internship, faculty coordinator should collect feedback about student with following recommended parameters-

Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership…..

Guidelines for Student's

Duration:

Internship is to be completed after semester 5 and before commencement of semester 6 of at least 4 weeks; and it is to be assessed and evaluated in semester 6.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry [1].

Students must register at Internshala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the Vth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their Vth semester examination and before academic schedule of semester VI.

Student can take internship work in the form of the following but not limited to:

Working for consultancy/ research project, Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /Learning at Departmental Lab/Tinkering Lab/ Institutional workshop, Development of new product/ Business Plan/ registration of start-up, Industry / Government Organization Internship, Internship through Internshala, In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship, Research internship under professors, IISC, IIT's, Research organizations, NGOs or Social Internships, rural internship, Participate in open source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor. Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

References
1. https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf   2. https://internship.aicte-india.org/

Savitribai Phule Pune University, Pune **Third Year of Artificial Intelligence and Machine Learning (2020 Course)** **318559: Seminar & Technical Communication**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Tutorial (TUT) : 01 hr/week	**1 Credit**	**OR : 25 Marks** **TW : 25 Marks**

Course Objectives :
- To explore the basic principles of communication (verbal and non-verbal) and active empathetic Listening, speaking and writing techniques
- To explore the latest technologies
- To enhance the communication skills
- To develop problem analysis skills.

Course Outcomes :

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

  CO1: Analyze a latest topic of professional interest.

  CO2: Enhance technical writing skills.

  CO3: Identify an engineering problem, analyze it and propose a work plan to solve it.

  CO4: Communicate with professional technical presentation skills.

Guidelines for Seminar Selection and Presentation

1) Student shall identify the area or topics in Information Technology referring to recent trends and developments in consultation with industry (for their requirement) and institute guide.

2) Student must review sufficient literature (reference books, journal articles, conference papers, white papers, magazines, web resources etc.) in relevant area on their topic as decided.

3) Seminar topics should be based on recent trends and developments. Guide should approve the topic by thoughtfully observing different techniques, comparative analysis of the earlier algorithms used or specific tools used by various researchers in the domain.

4) Research articles could be referred from IEEE, ACM, Science direct, Springer, Elsevier, IETE,CSI or from freely available digital libraries like Digital Library of India (dli.ernet.in), National Science Digital Library, JRD Tata Memorial Library, citeseerx.ist.psu.edu, getcited.org, arizona.openrepository.com, Open J-Gate, Research Gate, worldwidescience.org etc.

5) Student shall present the study as individual seminars in 20 – 25 minutes in English which is followed by Question Answer session.

6) Guide should ensure that students are doing literature survey and review in proper manner.

7) Guide should give appropriate instructions for effective presentation.

8) Attendance of all other students in the class for presentation is mandatory.

Timeline is suggested to follow throughout the semester:

1) Week– 01: Discussion to understand what is technical paper, how to search, where to search?

2) Week– 02: Download technical papers (minimum four), getting approved from Guide and Prepare abstract summary of all papers downloaded.

3) Week– 03 & 04: Read and understand in detail the decided research papers about the problem statement, techniques used, experimental details and results with conclusion from identified papers.

4) Week– 05: Review of the studied papers by Guide / Panel.

5) Week – 06 & 07: Search / Find equivalent techniques (other than the one proposed in technical paper)

so performance / complexities can be improved (by amortized analysis, not actual implementation).
6) Week – 08 & 09: Prepare presentation with outline as The topic, its significance, The research problem, Studied solutions (through research papers) with strengths and weaknesses of each solution, comparison of the solutions to research problem, future directions of work, probable problem statement of project, tentative plan of project work
7) Week – 10: Write Seminar report.
8) Week – 11: Deliver Presentation to Guide/ Panel.
9) Week –12: Verification of Seminar report and Submission

Guidelines for Seminar Report

1. Each student shall submit two copies of the seminar report in appropriate text editing tool/software as per prescribed format duly signed by the guide and Head of the department/Principal.
2. Broad contents of review report (20-25 pages) shall be
    a) 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, Year & University.
    b) Seminar Approval Sheet/Certificate.
    c) Abstract and Keywords.
    d) Acknowledgments.
    e) Table of Contents, List of Figures, List of Tables and Nomenclature.
    f) Chapters need to cover topic of discussion-
        i. Introduction with section including organization of the report,
        ii. Literature Survey
        iii. Motivation, purpose and scope and objective of seminar
        iv. Details of design/technology/Analytical and/or experimental work, if any/
        v. Discussions and Conclusions,
        vi. Bibliography/References (in IEEE Format),
        vii. Plagiarism Check report,
3. Students are expected to use open source tools for writing seminar report, citing the references and plagiarism detection.

Guidelines for Lab /TW Assessment

1. A panel of reviewers constituted by seminar coordinator (where guide is one of the member of the panel) will assess the seminar during the presentation.
2. Student's attendance for all seminars is advisable.
3. Rubric for evaluation of seminar activity:
        i. Relevance + depth of literature reviewed - 05 Marks
        ii. Seminar report (Technical Content)   - 05 Marks
        iii. Seminar report (Language)   - 05 Marks
        iv. Presentation & Communication Skills   - 05 Marks
        v. Question and Answers   - 05 Marks

Guidelines for Oral Examination

Both internal and external examiners should jointly conduct Oral examination. During assessment, the examiners should refer the rubrics given. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective communication.

Reference Books:

1. Rebecca Stott, Cordelia Bryan, Tory Young, "Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series)", Longman, ISBN-13: 978-0582382435

2. Johnson-Sheehan, Richard, "Technical Communication", Longman. ISBN 0-321-11764-6
3. Vikas Shirodka, "Fundamental skills for building Professionals", SPD, ISBN 978-93-5213-146-5

Savitribai Phule Pune University, Pune
Third Year of Artificial Intelligence and Machine Learning (2020 Course)
318560(A): Mandatory Audit Course 4
The Science of Happiness

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	**Non Credit**	**Audit Course**

Prerequisite Courses, if any: --

Everybody wants to be happy. One can explore innumerable ideas about what happiness is and how we can get some. But not many of those ideas are based on science. That's where this course comes in. The subject "Science of Happiness" aims to teach the pioneering science of positive psychology, which explores the ancestry of a happy and meaningful life. Clinical psychologists have been dealing with miserable feelings since their discipline was established. In the last 30 years, neuroscientists have made major headway in the understanding of the sources of anger, depression, and fear.

Today, whole industries profit from this knowledge—producing pills for every sort of pathological mood disturbance. But until recently, few neuroscientists focused on the subject of happiness. This course focuses on discovering how cutting-edge research can be applied to their lives. Students will learn about the Intra-disciplinary research supporting this view, spanning the fields of psychology, neuroscience, evolutionary biology, and beyond. The course offers students practical strategies for tapping into and nurturing their own happiness, including trying several research-backed activities that foster social and emotional well-being, and exploring how their own happiness changes along the way.

Course Objectives:

At the end of the course, the students will be able to-
5. To understand the feeling of happiness
6. To study the sources of positive feelings
7. To analyze the anatomy of the happiness system
8. To study the effect of thoughts and emotions on the happiness system

Course Outcomes:

On completion of the course, students will be able to–
  CO1: **Understand** what happiness is and why it matters to you
  CO2: **Learn** how to increase your own happiness
  CO3: **Understand** of the power of social connections and the science of empathy
  CO4: **Understand** what is mindfulness and its real world applications

COURSE CONTENTS

1. Happiness: what is it? ,
2. The secret of smiling
3. The autonomy of positive feelings
4. Positive feelings as a compass
5. The happiness system
6. Foundations: Emotions, Motivation and nature of Wellbeing
7. Subjective well being
8. Love and well being
9. Optimal well being
10. Religion, Spirituality and wellbeing

Reference Books:
1.   Happier, Stefan Klein, "The Science of Happiness, How Our Brains Make Us Happy and what We Can Do to Get", Da Capo Press, ISBN 10: 156924328X, 13: 978-1569243282.
2. C. Compton, Edward Hoffman, "Positive Psychology: The Science of Happiness and Flourishing", William, Cengage Learning, 2012, ISBN10: 1111834121.

<table>
<tr><td colspan="3" align="center">**Savitribai Phule Pune University, Pune**
Third Year of Artificial Intelligence and Machine Learning (2020 Course)
Mandatory Audit Course 4
318560(B) - Emotional Intelligence</td></tr>
<tr><td>**Teaching Scheme:**</td><td>**Credit Scheme:**</td><td>**Examination Scheme:**</td></tr>
<tr><td>**01hrs/week**</td><td>**Non Credit**</td><td>**Audit Course**</td></tr>
</table>

Prerequisite Courses:

Course Objectives:
- To recognize the differences in the EI theories that is regularly applied in workplace initiatives.
- To understand the basic definitions, concerns and misunderstandings associated with emotional intelligence
- To understand Verbal and Non Verbal Communication Skill
- To acquire the social management skill and responsibility

Course Outcomes:

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

CO1: Analyze the differences in the EI theories that are regularly applied.

CO2: Describe components of emotional intelligence and identify them within behavior.

CO3: Acquire information and knowledge about responsibility for social management.

CO4: Communicate effectively (Verbal and Non Verbal) about emotional intelligence.

<table>
<tr><td colspan="3" align="center">**COURSE CONTENTS**</td></tr>
<tr><td align="center">**Unit I**</td><td align="center">**BASICS OF EMOTIONAL INTELLIGENCE**</td><td align="center">**(2 hrs)**</td></tr>
</table>

Emotional Intelligence: Concept of Emotional Intelligence, Understanding the history and origin of Emotional Intelligence, Contributors to Emotional Intelligence, Science of Emotional Intelligence, EQ and IQ, Scope of Emotional Intelligence.

<table>
<tr><td>**Mapping of Course Outcomes for Unit I**</td><td>CO1</td></tr>
<tr><td align="center">**Unit II**</td><td align="center">**COMPONENTS OF EMOTIONAL INTELLIGENCE**</td><td align="center">**(2 hrs)**</td></tr>
</table>

Components of Emotional Intelligence: Self-awareness, Self-regulation, Motivation, Empathy, Social skills. Emotional Intelligence Competencies, Elements of Emotional Intelligence, Models of Emotional Intelligence: The Ability-based Model, The Trait Model of Emotional Intelligence, Mixed Models of Emotional Intelligence.

<table>
<tr><td>**Mapping of Course Outcomes for Unit II**</td><td>CO2</td></tr>
</table>

Unit III	SOCIAL MANAGEMENT AND RESPONSIBILITY	(2 hrs)

Emotional Intelligence at Work place: Importance of Emotional Intelligence at Work place? Cost–savings of Emotional Intelligence, Emotionally Intelligent Leaders, Case Studies Measuring Emotional Intelligence: Emotionally Intelligence Tests, Research on Emotional Intelligence, Developing Emotional Intelligence.

Mapping of Course Outcomes for Unit III	CO3

Unit IV	VERBAL AND NON VERBAL COMMUNICATION SKILL	(2 hrs)

Verbal Communication skill: Focused listening, Asking questions, Communicating with flexibility and authenticity.
Non Verbal Communication skill: Body language: The signals you send others, It's not what you say, it's how you say it.

Mapping of Course Outcomes for Unit IV	CO4

Text Books:

1. The Emotionally Intelligent Manager: Author: David R. Caruso, Peter Salovey ,Publisher: John Wiley & Sons, Publish date: 2004
2. Working with Emotional Intelligence: Author: Daniel Goleman, Publisher: Bantam Doubleday Dell Group : 2000

Reference Books:

1. Emotional Intelligence at Work : Author: Hendrie Weisinger , Publisher: Jossey-Bass Publish Date: 1998
2. Emotional Intelligence Coaching: Author: Liz Wilson, Stephen Neale & Lisa Spencer-Arnell, Publisher: Kogan Page India Private Limited: 2012
3. The Student EQ Edge: Emotional Intelligence and Your Academic and Personal Success (Stein, Book & Kanoy)

Reference Books:

1. http://pdtraining.com.au/emotional-intelligence-training-course-in-brisbane-sydney-melbourne-canberra-adelaide-and-perth
2. In-house Training Instant Quote:
3. http://bookings.pdtraining.com.au/inhouseex1/quoterequestex1a.aspx

Evaluation:

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

SavitribaiPhule Pune University, Pune **Third Year of Artificial Intelligence and Machine Learning (2020 Course)** **318560(C)- Language study-Module IV**	

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	**Non Credit**	**Audit Course**

Prerequisite Courses, if any:
- Students must have already studied can read/write Hiragana and Katakana script
- Students must have studied Japanese for beginners that includes the syllabus of Audit course Module 1 to 3

Companion Course, if any:

Course Objectives:
- Japan Market needs: To meet the needs of ever growing industry with respect to the Japanese language support.
- Japanese Culture and Mindset: To get introduced to Japanese society and culture through language.
- Career opportunities: To know more about Higher studies, Career opportunities in Japan /Japanese Companies across the world.
- Soft skills and self-development: To learn the manners, business culture and develop the confidence by gaining the knowledge of global perspective and cross-cultural studies

Course Outcomes:

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

CO1: Do Better Communication in Japanese language.
CO2: Demonstrate knowledge of Japanese Language Scripts (Reading, Writing, etc).
CO3: Demonstrate knowledge of Japanese culture, lifestyle, etc.
CO4: Pursue advanced Professional Japanese Language course.

COURSE CONTENTS		
Unit I	JAPANESE GRAMMAR	Self-study) (3 hrs Lecture + 3 hrs

Receiving and Giving, Verb past tense, Negative, Make sentences using various adjectives, Culture/Others: Conversation/Essay about some place, Introduction to the tourism in Japan, Introduction to Business/Work culture in Japan, Kanjis: 41 to 50,Listening practice, Vocabulary and conversation practice

Mapping of Course Outcomes for Unit I	CO2	
Unit II	INTERACTIVE JAPANESE	(Self-study) (3 hrs Lecture + 3 hrs

Adverbs of degree, Stating like / dislike, Living and Non-living things, Stating wish/desire, Stating the present action (verb te form), Culture/Others: Introduction to Career Opportunities, Education and Higher studies in Japan,Kanjis: 51 to 60,Listening practice, Vocabulary and conversation practice

Mapping of Course Outcomes for Unit II	CO2	
Unit III	FORMAL JAPANESE	(Self-study) (3 hrs Lecture + 3 hrs

Counters , Making comparisons, Past tense of verbs ,Past tense of adjectives, Combining adjectives (i + i, na+i …), Culture/Others: Information about career forums and Job Fairs Introduction about Japanese companies recruitment process, Kanjis: 61 to 70, Listening practice, Vocabulary and conversation practice

Mapping of Course Outcomes for Unit III	CO3	
Unit IV	LIFE IN JAPAN	(3 hrs Lecture + 3 hrs)

Stating wish/desire (ga hoshi, verb tai form), Stating / combining multiple actions (verb te form), Stating the order of multiple actions (verb te kara form),Expressing "Permission" and "Prohibition" (te mo ii, tewa ikenai forms),Culture/Others: Preparation of a job interview for a Japanese company, Do's and Don'ts in a Job Interview ,Kanjis: 71 to 80,Listening practice, Vocabulary and conversation practice

Mapping of Course Outcomes for Unit IV	CO4

Text Books:
1. Minna no Nihongo I–MainText book with audio and video files (Books by Goyal Publishers – Available in shops / Online) **2.** Minna no Nihongo - Translation and grammatical notes for self-study(Books by Goyal Publishers Available in shops / Online) **3.** Nihongo Challenge – Kanji(Available with Japanese Language schools/teachers)

Reference Books:
1. Nihongo Shoho: For better understanding and practice of Basic Japanese Grammar **2.** Marugoto : For scenario based Japanese conversation practice

Savitribai Phule Pune University, Pune
Third Year of Artificial Intelligence and Machine Learning (2020 Course)
Mandatory Audit Course 4
318560(D)- MOOC- Learn New skills

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 1 hrs/week	**Non Credit**	**Audit Course**

Prerequisites: Basic Knowledge of computer and Programming Skills

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

Course Outcomes :

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

About the 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, edx 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. In order to ensure that best quality content is produced and delivered, nine National Coordinators have been appointed. Out of these nine National Coordinators, NPTEL (National Programme on Technology Enhanced Learning) is for Engineering

Guidelines for Instructor's

- Instructor/mentor is requested to promote students to opt for courses with proper mentoring.
- Instructor/Mentor who teach the course or in relevant discipline can be a mentor .Should enroll to the course
- Instructor/Mentor can only choose up to 2 courses.
- One mentor for every 50 to 60 students.
- Instructor/Mentors can see the assignment scores of mentees
- Instructor/Mentors can help with explaining gaps in taught concepts.
- Instructor/Mentors can give more practice assignments
- The departments will take care of providing necessary infrastructural facilities and other facilities for the learners.

Guidelines for Student's

- Students have to select the mentor on the portal

- NPTEL is offering the online courses with a timeline of 4, 8 or 12-weeks through an online portal.
- SPPU Student has to take 12 weeks course for 3 credits.
- Each week, you need to watch 3 to 6 video lectures (of length 20 to 30 minutes) and attempt one online Assignment quiz at your convenient time and submit with in a deadline. Also submit the same assignments to the mentor as a part of journal. This is **mandatory** for all the students who opted mandatory audit course 3 as MOOC-Learn new skills.
- The enrolment to and learning from these courses involves no cost watch video lectures and attempt. Assignment online quizzes.
- After 2-3 weeks of starting of the course, an option of Registration for Final Exam with the fees of Rs. 1000/1100 will be given. If you're confident enough, you can proceed to the Exam Registration. This is **optional** for students.
- If the student wish to opt an option of registration for final exam then E-certificate from organizing IIT/IISc will be given to the successful candidates of the Final score=25% assignment score (online) + 75% exam (offline) score. To be eligible for a certificate, the learner should have scored >=40% final score.
- E-verifiable certificates are made available on nptel.ac.in
- NPTEL conduct final (proctored) exam at different exam centers all over India.
- After completion of the exam, student must submit the E-certificate to the college/department.

References

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