Course Title	Machine Learning	Semester	VII
Course Code	MVJ20IS71	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	5 (L : T : P :: 4 : 1 : 0)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to: *This course will enable students to*

Define machine learning and problems relevant to machine learning.

Differentiate supervised, unsupervised and reinforcement learning

Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.

Perform statistical analysis of machine learning techniques

Module-1	L1,L2,L3	12 Hours

Syllabus Content:

Introduction: well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

Application:

Designing Supervised Learning Problems

Video Link:

http://web4.cs.ucl.ac.uk/staff/D.Barber/textbook/091117.pdf

http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

Module-2	L1,L2,L3	12 Hours
Syllabus Content Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. Application: Designing Supervised Learning Problems Video Link: http://web4.cs.ucl.ac.uk/staff/D.Barber/textbook/091117.pdf http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html		
Module-3	**L1,L2,L3**	**12 Hours**
Syllabus Content: Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron's, Backpropagation algorithm Application: Solving real time problems like Automatic Vehicle Design etc. Video Link: https://becominghuman.ai/understanding-decision-trees-43032111380f https://onlinecourses.science.psu.edu/stat507/node/59/		

Module-4	L1,L2,L3	12 Hours
Syllabus Content: Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm. Application: Cognitive detection, Sentimental analysis Video Link: https://onlinecourses.science.psu.edu/stat507/node/59/ https://towardsdatascience.com/naive-bayes-in-machine-learning-f49cc8f831b4		
Module-5	L1,L2,L3	12 Hours
Syllabus Content: Evaluating Hypothesis: Motivation, estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning . Application: Understanding and designing Unsupervised learning Problems. Video Link: https://becominghuman.ai/understanding-decision-trees-43032111380f https://towardsdatascience.com/naive-bayes-in-machine-learning-f49cc8f831b4		
Course outcomes:		
CO1	Identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.	
CO2	Explain theory of probability and statistics related to machine learning	
CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q, Question	

CO4	Identify and apply Machine Learning algorithms to solve real world problems
CO5	Perform statistical analysis of machine learning techniques.
Text/Reference Books:	
1.	Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
2.	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
3.	Ethem Alpaydın, Introduction to machine learning, second edition, MIT press

CIE Assessment:
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SEE Assessment:
Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3	3	3							
CO2	3		3		3							
CO3	3	3	3	3								
CO4	3	3	3									
CO5	3	3	3	3								

High-3, Medium-2, Low-1

Course Title	Bigdata & Hadoop	Semester	VII
Course Code	MVJ20IS72	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	5 (L : T : P :: 4 : 1 : 0)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to:

Understand Hadoop Distributed File system and examine MapReduce Programming

Explore Hadoop tools and manage Hadoop with Ambari

Appraise the role of Business intelligence and its applications across industries

Assess core data mining techniques for data analytics

Identify various Text Mining techniques

Module-1	L1,L2,L3	12 Hours

Hadoop Distributed File System Basics, Running Example Programs and Benchmarks, Hadoop MapReduce Framework, MapReduce Programming

Application: Students can get awareness of Distributed File System (Hadoop File System)

Video Link: https://www.youtube.com/watch?v=DpgGXN5ubk0

Module-2	L1,L2,L3	12 Hours

Essential Hadoop Tools, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures.

Application: Students can learn Hadoop YARN utility working model.

Video Link: https://www.youtube.com/watch?v=DMHf_xiSSgA

Module-3	L1,L2,L3	12 Hours

Business Intelligence Concepts and Application, Data Warehousing, Data Mining, Data Visualization

Application: Students can apply knowledge on Business Data. **Video Link:** https://www.youtube.com/watch?v=NOIfMY0KajE		
Module-4	L1,L2,L3	12 Hours
Decision Trees, Regression, Artificial Neural Networks, Cluster Analysis, Association Rule Mining. **Application:** Students can learn various algorithm related Machine Learning. **Video Link:** https://www.youtube.com/watch?v=guVvtZ7ZClw https://www.youtube.com/watch?v=3MnVCX94jJM		
Module-5	L1,L2,L3	12 Hours
Text Mining, Naïve-Bayes Analysis, Support Vector Machines, Web Mining, Social Network Analysis **Application:** Students can learn machine learning algorithms. **Video Link:** https://www.youtube.com/watch?v=efR1C6CvhmE		
Practical Experiments/hands on: To setup and install Hadoop in Pseudo-Distributed Mode Exploring various shell commands in Hadoop. Implement the following file management tasks in Hadoop: Adding Files and Directories, Retrieving Files, Deleting Files Practical example of handling files in HDFS Practical example of Map Reduce		

Course outcomes:	
CO1	To setup and install Hadoop in Pseudo-Distributed Mode
CO2	Exploring various shell commands in Hadoop.
CO3	Implement the following file management tasks in Hadoop: Adding Files and Directories, Retrieving Files, Deleting Files

CO4	Practical example of handling files in HDFS
CO5	Practical example of Map Reduce

Text/Reference Books:	
1.	Douglas Eadline,"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education, 2016. ISBN-13: 978-9332570351.
2.	Anil Maheshwari, "Data Analytics", 1st Edition, McGraw Hill Education, 2017. ISBN-13: 978- 9352604180.
3.	Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media, 2015.ISBN-13: 978-9352130672.
4.	Boris Lublinsky, Kevin T.Smith, Alexey Yakubovich,"Professional Hadoop Solutions", 1stEdition, Wrox Press, 2014ISBN-13: 978-8126551071.
5.	Eric Sammer,"Hadoop Operations: A Guide for Developers and Administrators",1stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2		2							
CO2	3	1	2	1	3							
CO3	3	3	3									
CO4	3	3	2									
CO5	3	3		2	1							

High-3, Medium-2, Low-1

Course Title	Data Science Using R	Semester	VII
Course Code	MVJ20IS731	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 1 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Understanding R for data science

Learn about requirement of data analysis

Can understand how machine learning algorithm works

How to visualize the data

Real world data analysis

Module -1	L1,L2,L3	12 Hours

What You Will Learn – What You Won't Learn – Prerequisites – Running R Code.

Data Visualization: Introduction – First Steps – Aesthetic mapping – Common Problems – Facets – Geometric Objects – Statistical Transformations – Position adjustments – Coordinate systems – Layered Grammar of Graphics.

Workflow Basics: Coding Basics – What's in a name? – Calling Functions – Exercises.

Data Transmission: Introduction – Filter rows with filter() – Arrange rows with arrange() – Select Columns with select() – Add new variables with mutate() – Grouped summaries with summarise() – Grouped mutates.

Workflow: Scripts.

Application: Data visualization can be used in storytelling of insight obtained from Bigdata.

Video Link:

https://nptel.ac.in/courses/111/104/111104100/

Module -2	L1,L2,L3	12 Hours
Exploratory Data Analysis: Introduction – Questions – Variation – Covariation – Patterns and models. Introduction: What is Data science? Big Data and Data Science Hype – Getting Past the Hype – Why Now: Datafication– The Current Landscape – A Data science Profile – Thought Experiment: Meta-Definition – What is a Data Scientist, Really? In Academia – In Industry Application: Banking, Health care, Transport, Manufacturing, Agriculture etc Video Link: https://www.digimat.in/nptel/courses/video/106106179/L08.html		
Module - 3	**L1,L2,L3**	**12 Hours**
Statistical Thinking in the Age of Big Data – Exploratory Data Analysis – The Data Science Process – Thought Experiment: How Would you Simulate Chaos? Algorithms: Machine Learning Algorithms – Three Basic Algorithms – Exercise: Basic Machine Learning Algorithms – Summing It All Up – Though Experiment: Automated Statistician. Application: Recommendation Systems(You tube) Video Link: https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs28/		
Module-4	**L1,L2,L3**	**12 Hours**
Thought Experiment: Learning by Example – Naïve Bayes – Fancy It Up: Laplace Smoothing – Comparing Naïve Bayes to K-NN – Sample Code in Bash – Scraping the Web: API and Other Tools – Jake's Exercise: Naïve Bayes for Article Classification. Data Visualization and Fraud Detection: Data Visualization History - What Is Data Science, Redux? - A Sample of Data Visualization Projects - Mark's Data Visualization Projects - Data Science and Risk - Data Visualization at Square - Ian's Thought Experiment - Data Visualization for the Rest of Us		

Application: Spam filter can be applied to get rid of unwanted spam messages in Email and SMS. Video Link: https://www.youtube.com/watch?v=9YXojHh_ZPY		
Module-5	L1,L2,L3	12 Hours
Social Network Analysis at Morning Analytics - Social Network Analysis - Terminology from Social Networks - Thought Experiment – Morning side Analytics - More Background on Social Network Analysis from a Statistical Point of View - Data Journalism Data Engineering: MapReduce, Pregel, and Hadoop Application: To find out the trending news for the day, Trending hash tags in face book or Twitter Video Link: https://www.youtube.com/watch?v=uEFbdGlSAfQ		
Practical Experiments: YouTube Data Analysis Machine Learning algorithms – Hands-On Training Share Market Analysis - Hands-On Training Fraud Analysis of Trade document using Data Science Identifying Revenue drop from customer behavior pattern in Banking Industry		

Course outcomes:

CO1	R programming for data science
CO2	Analyze the data
CO3	Machine learning algorithms
CO4	Visualize the different data with different form
CO5	Interpret, analytic and visualize read world data

Text/Reference Books:

1.	Hadley Wickham and Garrett Grolemund , R for Data Science, Publisher: O'Reilly Media

2.	Cathy O'Neil and Rachel Schutt, Doing Data Science Straight Talk from the Frontline, Publisher: O'Reilly Media
3.	Ricardo Anjoleto Farias, Nataraj Dasgupta, Vitor Bianchi Lanzetta, Hands-On Data Science with R, O'reilly, 2018.

CIE Assessment:

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Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3					2		
CO2	3	3	3	2	3					2		
CO3	3	3	2	2	3					2		
CO4	3	3	2	2	3					2		
CO5	3	3	3	2	3					2		

High-3, Medium-2, Low-1

Course Title	Deep Learning	Semester	VII
Course Code	MVJ20IS732	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Gain knowledge in Machine Learning Basics

Understand and apply Optimization on Deep Models and Networks

Understand and analyze Recurrent and Recursive Networks

Understand the representation of neural networks in machine learning.

Module-1	L1,L2,L3	12 Hours

Introduction : Historical Trends in Deep Learning -Linear Algebra: Scalars - Vectors - Matrices - Tensors - Matrices - Norms – Eigen decomposition -Probability and Information Theory: Random variable and distributed Probability - Bayes Rule - Information Theory and structured probabilistic models.

Application:

Self Driving Cars

News Aggregation and Fraud News Detection

Natural Language Processing

Virtual Assistants

Entertainment

Visual Recognition

Video Link:

https://www.youtube.com/watch?v=njKP3FqW3Sk&list=PLtBw6njQRU-rwp5__7C0oIVt26ZgjG9NI

Module-2	L1,L2,L3	12 Hours
Numerical Computation: Overflow and Underflow - Gradient based Optimization - Constrained Optimization - Learning Algorithms: Capacity – Over fitting - Under fitting - Bayesian Classification -Supervised - unsupervised algorithms - Building machine learning algorithm. Application: Traffic prediction: Speech Recognition Image Recognition Video Link: https://www.youtube.com/watch?v=hjh1iknScg		

Module-3	L1,L2,L3	12 Hours
Deep Feed forward Networks : Gradient based learning - Hidden Units - Architectural design - Back Propagation algorithms - Regularization for deep learning: Dataset Augmentation - Noise Robustes –Semi supervised learning -Multitask learning - Adserial training. Application: Process modeling and control Target Recognition Machine Diagnostics Portfolio Management Medical Diagnosis Video Link: https://www.youtube.com/watch?v=oJNHXPs0XDk		

Module-4	L1,L2,L3	12 Hours
Optimization for training Deep Models: Challenges in Neural Networks optimization - Basic Algorithms - Algorithms Adaptive learning Rates - Approximate Second Order Methods - Optimization Strategies and Meta Algorithms -Convolutional Networks: Motivation - Structured Output - Unsupervised features - Neuroscientific basics for Convolutional Networks. Application: Decoding Facial Recognition Analysing Documents Historic and Environmental Collections Understanding Climate Video Link: https://www.youtube.com/watch?v=10Su2eSDs1M		
Module-5	**L1,L2,L3**	**12 Hours**
Computational graphs - Recurrent Neural networks - Bidirectional RNN - Deep Recurrent Networks - Echo State Networks - Practical Methodology - Applications: Large Scale Deep Learning – Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression And deep networks. Application: Speech Recognition Generating Image Descriptions Video Tagging Text Summarization Call Center Analysis Face detection, OCR Applications as Image Recognition Other applications like Music composition		

Video Link: https://www.youtube.com/watch?v=fCMutAkBXBU
Practical Learning: Building Deep learning project/Case Study

Course outcomes:	
CO1	Analyze Deep learning Mathematical Models
CO2	Explore the Basic fundamentals of Machine Learning Algorithms
CO3	Elucidate the Deep Feed forward Networks
CO4	Apply knowledge for Optimization on Deep Models and Convolutional Networks
CO5	Elucidate the Recurrent and Recursive Networks and Natural language Processing

Text/Reference Books:	
1.	Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classication. Wiley-Interscience. 2nd Edition.2001
2.	Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.
3.	Russell, S. and Norvig, N. Articial Intelligence: A Modern Approach. Prentice Hall Series in Articial Intelligence. 2003.
4.	Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995
5.	Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.

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SEE Assessment:
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CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		2	2							
CO2	2	2		2	2							
CO3	3	3		3	3							
CO4	2	2		2	2							
CO5	2	2		2	2							

High-3, Medium-2, Low-1

Course Title	Blockchain Technology	Semester	VII
Course Code	MVJ20IS733	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

Understand how blockchain systems (mainly Bitcoin and Ethereum) work,

To securely interact with them,

Design, build, and deploy smart contracts and distributed applications,

Integrate ideas from blockchain technology into their own projects.

List and describe differences between proof-of-work and proof-of-stake consensus.

Module-1	L1,L2,L3	12 Hours

Syllabus Content:

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Application: Elliptic Curve Digital Signature

Video Link:

https://www.youtube.com/watch?v=jTwOeWgP2eU&list=PLbRMhDVUMngfxxy

Module-2	L1,L2,L3	12 Hours

Syllabus Content:

Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions

and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public Blockchain. Application: Supply chain and logistics monitoring Video Link: https://www.youtube.com/watch?v=eS39tn5Cy20		
Module-3	L1,L2,L3	12 Hours
Syllabus Content: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. Application: Approval of transactions on a chain. Video Link: https://www.youtube.com/watch?v=CdyDoCk8IKs		
Module-4	L1,L2,L3	12 Hours
Syllabus Content: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin Application : Writing code that controls money, and build. Cryptocurrency exchange. Video Link: https://www.youtube.com/watch?v=bEHBBLHEeAE		
Module-5	L1,L2,L3	12 Hours
Syllabus Content: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain. Application: Real-time IoT operating systems, Personal identity security Video Link: https://www.youtube.com/watch?v=u5AbhtoNMYs&list=PLbRMhDVUMngfxxy		

Practical Experiments:
Naive Blockchain construction, Memory Hard algorithm Hashcash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles

Course outcomes:	
CO1	Learn design principles of Bitcoin and Ethereum and Nakamoto consensus.
CO2	Explain the Simplified Payment Verification protocol.
CO3	Interact with a blockchain system by sending and reading transactions.
CO4	Design, build, and deploy a distributed application.
CO5	Evaluate security, privacy, and efficiency of a given blockchain system.

Text/Reference Books:	
1.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2.	Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
3	Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
4	DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
5	Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

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Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3		2							
CO2	2	2	3	3	2							
CO3	3		2	2								
CO4	3		2	3								
CO5	3	3	3	3	3							

High-3, Medium-2, Low-1

Course Title	NATURAL LANGUAGE PROCESSING	Semester	VII
Course Code	MVJ20IS734	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 1 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

Learn the fundamentals of natural language processing

Understand the use of CFG and PCFG in NLP

Understand the role of semantics of sentences and pragmatics

Gain knowledge in automated Natural Language Generation and Machine Translation

Module-1	L1,L2,L3	12 Hours

INTRODUCTION: Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM –Regular Expressions, Finite-State Automata – English Morphology, Transducers forlexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum EditDistance values of real symmetric matrices: Jacobi and Givens method.

Laboratory Session: Word Analysis

Applications: Text to Speech conversion

Video link : https://nptel.ac.in/courses/106/105/106105158/

Module-2	L1,L2,L3	12 Hours

WORD LEVEL AND SYNTACTIC ANALYSIS: Ngrams Models of Syntax - Counting Words - Unsmoothed Ngrams-Smoothing-Back off Deleted Interpolation – Entropy – EnglishWord Classes - Tag sets for English-Part of Speech Tagging-RuleBased Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging -Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Laboratory Session: Morphological Analyzer for a given word

Applications: Speech to text conversion

Video link :

https://nptel.ac.in/courses/106/105/106105158/

Module-3	L1,L2,L3	12 Hours
CONTEXT FREE GRAMMARS: Context-Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures Laboratory Sessions: Chunking for a given sentence Applications: Compiler Video link : https://www.youtube.com/watch?v=6b40kKe2SFg		
Module-4	**L1,L2,L3**	**12 Hours**
SEMANTICS AND PRAGMATICS: Representing Meaning - Meaning Structure of Language - First Order Predicate Calculus-Representing Linguistically Relevant Concepts – SyntaxDriven Semantic Analysis - Semantic Attachments –Syntax Driven Analyzer- Robust Analysis – Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation - Information Retrieval. Laboratory Session: Pragmatic Analysis of a given sentence Applications: Sentiment Analysis Video link : https://www.coursera.org/lecture/human-language/pragmatics-E8VXH		
Module-5	**L1,L2,L3**	**12 Hours**
LANGUAGE GENERATION AND DISCOURSEANALYSIS: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Co reference Resolution – Resources: Porter Stemmer, Lemmatize, Penn Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, and British National Corpus (BNC). Laboratory Session: Sentiment analysis on movie database Applications: Sentiment analysis Videolink:https://www.coursera.org/lecture/text-mining-analytics/5-6-how-to-do-sentiment-analysis-with-sentiwordnet-5RwtX		

Course outcomes:	
CO1	To tag a given text with basic Language features.
CO2	To design an innovative application using NLP components
CO3	To implement a rule-based system to tackle morphology/syntax of a language
CO4	To design a tag set to be used for statistical processing for real-time applications
CO5	To compare the use of different statistical approaches for different types of NLP applications

Text Books:	
1.	Daniel Jurafsky, James H. Martin–Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2	C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA:1999
Reference Books:	
	Steven Bird, Ewan Klein and Edward Loper, –Natural Language Processing with Python, First Edition, OReilly Media, 2009.
	Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S.Tiwary
	Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
CIE Assessment:	
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks)	

Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2								2	
CO2	3	3	3									
CO3	3	3	3									
CO4	3	3	3								2	
CO5	2	2	2									

High-3, Medium-2, Low-1

Course Title	Unified Object Oriented Modelling & Design	Semester	VII
Course Code	MVJ20IS741	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 1 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Understand Object Oriented Programming, Object Oriented Analysis and Modelling using the Unified Modeling Language (UML).

Familiarize themselves with the models used in UML, including static as well as dynamic (behavioural) models.

Appreciate the importance of system architecture and system design in product development.

Understand the important design principles including GRASP and SOLID.

Understand design Patterns and their use in software development.

Module-1	L1,L2,L3	12 Hours

Introduction, Use Cases and Class Models: Introduction to Object Oriented Programming – OOP Principles, Class Fundamentals, Declaring and Assigning Objects, Reference Variables, Introducing Methods, Constructors and Destructors, Introduction to Modelling, Introduction to UML, Use Case Models,

Application: System Modeling

Video Link: https://www.youtube.com/watch?v=RMuMz5hQMf4

Module-2	L1,L2,L3	12 Hours

Class Models and Dynamic Models: Class Modelling, Object Constraint Language, Advanced Class Modeling, Activity Models, Sequence Models, ATM Case Study: Application Class / Interaction Models, State Models, Advanced State Models, Relationship between Class and State Models.

Application: System Modeling

Video Link: https://www.youtube.com/watch?v=Omp4RbHbB0s

Module-3	L1,L2,L3	12 Hours
System and Class Design: System Design, Class Design, Implementation Models, Object Oriented Languages, Database Design. Application: System Design Video Link : https://www.youtube.com/watch?v=IGqAbuxCOXI		
Module-4	L1,L2,L3	12 Hours
Object Oriented Design Principles: GRASP (General Responsibility Assignment Software Patterns) and SOLID (Single Responsibility, Open-Closed, Liskov Substitution, Interface Segregation, Dependency Inversion). Application : System Design Video Link : https://www.youtube.com/watch?v=Uc2qv44cNo0		
Module-5	L1,L2,L3	12 Hours
Design Patterns: What Design Patterns Are, How Design Patterns Solve Problems, How to Select a Design Pattern, How to Implement a Design Pattern, Introduction to Widely Used Design Patterns including Creational, Structural, and Behavioural Patterns. Object Oriented Design Principles Application: System Pattern Video Link: https://www.youtube.com/watch?v=NU_1StN5Tkk		
Practical Experiments:	L3	20 Hours
UML Diagrams for ATM System UML Diagrams for Hospital Management System UML Diagrams for College Management System		

Course outcomes:	
CO1	Use the concepts of classes and objects in Object Oriented Programming. Use UML to model a complex system by defining actors and use cases.

CO2	Construct Class Models and analyze the dynamics of a system using Activity, Sequence, State and Process models.
CO3	Depict the architecture of a software system by using component and deployment models and design a database based on a class model.
CO4	Use GRASP and SOLID principles in the design of software.
CO5	Apply software design patterns in a variety of situations.

Text/Reference Books:	
1.	Object-Oriented Modeling and Design with UML", Michael R Blaha, James R Rumbaugh, 2nd Edition, Pearson.
2	"The Complete Reference Java2", Herbert Schildt, 5th Edition, TATA McGRAW HILL.
3	"Applying UML and Patterns", Craig Larman, 3rd Edition, Pearson.
4	"The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh and Ivar Jacobso, 2nd Edition, Pearson.
5	"Design Patterns Elements of Reusable Object-Oriented Software", Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Pearson.
6	"Core Java", Cay S Horstmann, Tenth Edition, Pearson Education, 2016.
7	"Unified Object Oriented Modeling, Analysis & Design", Dr. Sanchari Saha, Cengage Publisher, 2018

CIE Assessment:
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SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2									2	
CO2			2									
CO3		2										2
CO4				2								
CO5					2							

High-3, Medium-2, Low-1

Course Title	Information Retrieval & Visualization	Semester	VII
Course Code	MVJ20IS742	CIE	50
40 L : T : P :: 3 : 1 : 0	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Learn classical techniques of Information Retrieval and Evaluation

Learn how to query and process

Get an idea about how the different IR algorithms works.

Understand Web Crawler and its functions.

Realize the applications of Information Retrieval

Module-1	L1,L2	8 Hours

Basic Concepts – Retrial Process – Modelling – Classic Retrieval – Set Theoretic, Algebraic and Probabilistic Models.

Retrieval Techniques: Structured Retrieval Models – Retrieval Evaluation – Word Sense Disambiguation.

Application:

Using retrieval Techniques for searching information.

Video Link:

https://www.youtube.com/playlist?list=PLMyP8LIIL3ht_WV4EXjN-uD3EPEK3hIyu

Module-2	L2,L3	12 Hours

Languages – Key Word-based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis.

Document Pre-Processing – Clustering – Text Compression – Indexing and Searching – Inverted Files – Boolean Queries – Sequential Searching – Pattern Matching.

Application:

Analyzing query and document formatting for searching.

Video Link:

https://www.youtube.com/playlist?list=PLMyP8LIIL3ht_WV4EXjN-uD3EPEK3hIyu

Module-3	L2,L3	8 Hours

Overview of Retrieval Models –Boolean Retrieval – The Vector Space Model – Probabilistic Models – Information Retrieval as Classification – BM25 Ranking Algorithm – Complex Queries and Combining Evidence – Web Search – Machine Learning and Information Retrieval.

Application: Select and ranks relevant documents

Video Link: https://www.slideshare.net/mounialalmas/introduction-to-information-retrieval-models

Module-4	L2,L3	8 Hours

Deciding what to search – Crawling the Web – Directory Crawling – Document Feeds – conversion problem – Storing the Documents – Detecting Duplicates – Remove noise.

Application:

Develop application data

Video Link:

https://www.youtube.com/playlist?list=PLMyP8LIIL3ht_WV4EXjN-uD3EPEK3hIyu

Module-5	L2,L3	8 Hours

Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Meta-searchers – Online IR systems – Online Public Access Catalogs.

Digital Libraries: Introduction – Architectural Issues – Document Models – Representations and Access – Prototypes and Standards.

Case Study: Google, Yahoo and Bing Search engines

Application:

Interpret overall working of a search engine. Video Link: https://www.youtube.com/playlist?list=PLMyP8LIIL3ht_WV4EXjN-uD3EPEK3hIyu		
Practical Experiments/ Case Study:	L3	20
Experiments related to Ontology and Semantic Web Experiments related to Semantic Web Services Cast Study: Google Page Ranking Algorithm		

Course outcomes:	
CO1	Rank the document using classical ranking methods
CO2	Querying documents by delivering keywords
CO3	Implement ranking algorithms for rank the documents
CO4	Know how the crawler works
CO5	Know how the web search, online IR systems and search engines works

Text/Reference Books:	
1.	Ricardo Baeza-Yate, Berthieri Ribeiro-Neto, Modern Information Retrieval, Pearson Education Asia, 2012.
2.	W.Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines – Information Retrieval in Practice, Pearson Education, 2015
3.	Grossman, David A. Frieder, Ophir, Information Retrieval Algorithms and Heuristics, 2nd Edition, Springer
4.	G.G. Chowdhury, Introduction to Modern Information Retrieval, Second Edition, Neal-Schuman Publishers, 2010.

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Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3									2		
CO3	3	3								2		
CO4	3	3								2		2
CO5	3	3								2		2

High-3, Medium-2, Low-1

Course Title	Software Testing	Semester	VII
Course Code	MVJ20IS743	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Understand HTML and CSS for designing web pages.

Understand basics of JavaScript as a programming language.

Understand the Document Object Model and enable them to create dynamic web pages that react to user input.

Understand installing and configuring Apache Server and incorporating backend support for their web pages.

Get exposure to the newer features available as part of the HTML standard

Module-1	L1,L2,L3	12 Hours

Syllabus Content: Basics of Software Testing: Basic definitions, Software Quality, Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies, Levels of testing, Testing and Verification, Static Testing. Problem Statements: Generalized pseudocode, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper Application: software systems

Video Link: https://www.youtube.com/watch?v=cv6GvRCIuTs

Module-2	L1,L2,L3	12 Hours

Syllabus Content:

Black Box Testing Types of Black Box Testing Techniques: Boundary Value Testing, Normal Boundary Value Testing Robust Boundary Value Testing, Worst-Case Boundary Value Testing, Special Value Testing, Examples, Random Testing Guidelines for Boundary Value Testing

Equivalence Class Testing Equivalence Classes, Traditional Equivalence Class Testing Improved Equivalence Class Testing, Equivalence Class Test Cases for the Triangle Problem, Equivalence Class Test Cases for the NextDate Function, Equivalence Class Test Cases for the Commission Problem, Edge Testing Decision Table–Based Testing Decision Tables, Decision Table Techniques Test Cases for the Triangle Problem, Test Cases for the Next Date Function, Test Cases for the Commission Problem

Application: Multilanguage support and compatibility Testing

Video Link: https://www.youtube.com/watch?v=2MRU2oRUlDo

Module-3	L1,L2,L3	12 Hours

Syllabus Content:

Evaluating Test Cases Mutation Testing, Fuzzing, Fishing Creel Counts and Fault Insertion Software Technical Reviews Economics of Software Reviews, Roles in a Review Types of Reviews, Contents of an Inspection Packet, An Industrial Strength Inspection Process, Effective Review Culture,Inspection Case Study

Application: Pit mutation testing

Video Link: https://www.youtube.com/watch?v=mZjPzlX9YJY

Module-4	L1,L2,L3	12 Hours

Syllabus Content:

Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution.

Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integration Application: Online delivery system Video Link: https://www.coursera.org/lecture/engineeringandroidapps/integration-testing-FbJOF		
Module-5	L1,L2,L3	12 Hours
Syllabus Content: Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics. Application: TestSigma Video Link: https://www.edureka.co/blog/test-automation-strategy/		
Practical Experiments: 1. Study of any testing tool. 2. Study of any web testing tool 3. Study of any bug tracking tool 4. Study of any test management tool. 5. Case study on Selenium.		

Course outcomes:	
CO1	Apply the concepts of Quality Engineering.
CO2	Design Test cases for various black box testing techniques
CO3	Plan, employ and measure proper Quality approaches applied.
CO4	Apply the appropriate technique for the design of flow graph.
CO5	Create automation test scripts

Text/Reference Books:	
1.	Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 4th Edition, Auerbach Publications, 2013.

2.	Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
3.	Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008
4.	Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007
5.	Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004

CIE Assessment:

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Quizzes/mini tests (4 marks)

Mini Project / Case Studies (8 Marks)

Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				2		2		2				1
CO2		3		2		2		2				2
CO3		3		2		2		2				3
CO4		3		2		2		2				2
CO5		3		2		2		2				3

High-3, Medium-2, Low-1

Course Title	Cyber Security, Law & Ethics	Semester	VII
Course Code	MVJ20IS744	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

Explain the fundamental definitions of different security issues.

Familiarize cybercrimes happening with mobile and wireless devices.

Use cybercrime tools to analyze the security gaps.

Familiarize with different OSI layers and security aspects.

Explain legal aspects and Indian IT Act.

Module-1	L1,L2,L3	12 Hours

Syllabus Content:

Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes, How criminal plan the attacks, Social Eng., Cyber fraud vs. Cybercrime Cyber stalking, Cybercafe and Cybercrimes, Botnets, Attack vector, Cloud computing.

Application:

security services that are invoked at the interface between an application

Video Link:

https://www.youtube.com/watch?v=gfFKuiZ9Y7s

Module-2	L1,L2,L3	12 Hours

Syllabus Content:

Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on

Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Application:

the usage of small wireless mobile devices such as PDAs, Blackberrys and smartphones

Video Link:

https://www.youtube.com/watch?v=frM_7UMD_-A

Module-3	L1,L2,L3	12 Hours

Syllabus Content:

Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft), Case Study.

Application:

Application-level gateway

Video Link:

https://www.youtube.com/watch?v=6MvRi2Gqh_Y

Module-4	L1,L2,L3	12 Hours

Syllabus Content:

Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidance, Forensics Analysis of Email, Digital Forensics Lifecycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting of a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to the Computer Forensics and Social Networking Sites: The Security/Privacy Threats, Forensics Auditing, Anti Forensics.

Application:

Application of Digital Forensics With increasing digital crime in each branch

Video Link: https://www.youtube.com/watch?v=2ESqwX3qb94		
Module-5	L1,L2,L3	12 Hours
Syllabus Content: Cyber law: The Indian Context, The Indian IT Act, Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyber law, Technology and Students: Indian Scenario. Application: Case IV: Ownership of Program Video Link: https://www.youtube.com/watch?v=ZFHCZt5VnMs		
Hands on Experiments: Cyber fraud vs Cybercrime stalking, Cybercafé and Cybercrimes. Mobile Devices: Security Implementation for organizations. Phishing, Password cracking, Dos Attacks. Cyber forensics and digital Evidence.		

Course outcomes:	
CO1	Understand Cybercrime and Cyber offenses
CO2	Explain cybercrime happening with Mobile and Wireless Devices.
CO3	Analyze cybercrimes using different tools and methods.
CO4	Cyber forensics and Digital forensics
CO5	Legal aspects of cybercrimes.

Text/Reference Books:	
1.	"Cyber Security", Nina Godbole, Sunit Belapure, Wiley India, New Delhi, 2011.
2.	"Information Systems Security", Nina Godbole, Wiley India, New Delhi, 2017.
3.	"Cyber Security & Global Information Assurance", Kennetch J. Knapp, Information Science Publishing, 2009.
4.	"Cryptography and Network Security", William Stallings, Pearson Publication, 2005.
5.	"Cyber Security", Avantika Yadav, Narosa Publishing, 2017.

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SEE Assessment:
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CO-PO Mapping												
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1		2										
CO2			2								2	
CO3					2							
CO4			2									2
CO5					2							

High-3, Medium-2, Low-1

Course Title	Cloud Computing	Semester	VII
Course Code	MVJ20IS751	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

understands cloud computing models and infrastructure for larger networks

Identify policies, mechanisms and scheduling for resource management, virtualization, and optimization of networks.

Compare multiple approaches to cloud system design and solve real world problems.

Illustrate storage concept and self-organizing capability for different cloud systems.

Understands cloud security and risk..

Module-1	L1,L2,L3	12 Hours

Defining a Cloud, Cloud Computing Reference Model , Characteristics and Benefits, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing.

Application:

Art Applications

Business Applications

Data Storage and Backup Applications

Video Link:

https://www.youtube.com/watch?v=eaf_l9SBmyQ

Module-2	L1,L2,L3	12 Hours

Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology

Examples, Xen, VMware, Microsoft Hyper-V, Cloud Reference Model and Architecture, Infrastructure as a Service, Platform as a Service, Software as a Service, Types of Clouds, Economics of the Cloud, Open Challenges in Clouds.

Application:

Big data analysis

Storage

Recovery

Backup

Video Link:

https://www.youtube.com/watch?v=_pPlanX5wQY

Module-3	L1,L2,L3	12 Hours

Data-intensive computing Characterizing data-intensive computations, Challenges ahead, Historical perspective, Technologies for data-intensive computing – Storage systems, Programming platforms – Map Reduce. Public Cloud Infrastructures: Amazon Web Services - Compute, Storage, and Communication Services; Google App Engine – Architecture, Application Life-Cycle, Cost Model; and Microsoft Azure.

Application:

Disaster recovery

Online File storage

Photo editing software

Digital video software

Twitter-related applications

Video Link:

https://www.youtube.com/watch?v=9C9VJh19YFs

https://www.youtube.com/watch?v=dB1R9XHAng0

Module-4	L1,L2,L3	12 Hours
ECG Data Analysis on Cloud, Protein Structure Prediction, Satellite Image Processing; Business and Consumer Applications – CRM, Social Networks, Media Applications, and Multiplayer Online Gaming. Advanced Topics in Cloud Computing, Energy efficiency in clouds, Energy-efficient and green cloud computing architecture, Market-based management of clouds, Market-oriented cloud computing, A reference model for MOCC,3 Technologies and initiatives supporting MOCC, Observations Application: Creating image-album Web application for antivirus Word processing application Spreadsheets Presentation software Video Link: https://www.youtube.com/watch?v=s9G2NQhvaKQ		
Module-5	**L1,L2,L3**	**12 Hours**
Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor. Application: Finding a way on the map E-commerce software Miscellaneous applications Video Link: https://www.youtube.com/watch?v=0lw4KU5wHsk		

Practical Experiments/ Case Study:
Creating a Warehouse Application in SalesForce.com. Implementation of SOAP Web services in C#/JAVA Applications. Installation and Configuration of Hadoop. Case Study: Amazon Web Services Case Study: PAAS(Facebook, Google App Engine) Create an application (Ex: Word Count) using Hadoop Map/Reduce

Course outcomes:	
CO1	Explore the basic concepts of cloud computing, cloud infrastructure, cloud models, cloud services, distributed computing, and other related concepts.
CO2	Understand Virtualization, and working of some of industrially popular Virtualization technologies.
CO3	Apply Map Reduce programming model to solve some data-intensive computing applications over public or private cloud platforms.
CO4	Analyzing the security risks in cloud from different perspectives and study some of the available solutions.
CO5	Explain Operating system security, Virtual machine Security and Security of virtualization.

Text/Reference Books:	
1.	Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, 2013, McGraw Hill, New Delhi, India, ISBN-13: 978-1-25-902995-0.
2.	2.Cloud Computing Theory and Practice, Dan C Marinescu, 1st Edition, 2013, Elsevier (MK), ISBN: 9780124046276. (Unit – 5)
3.	3.Distributed Computing and Cloud Computing, from parallel processing to internet of things, Kai Hwang, GeofferyC.Fox, Jack J Dongarra, 1st Edition, 2012, Elsevier(MK), ISBN: 978-0-12-385880-1.
4.	4.Cloud Computing Implementation, Management and Security,John W Rittinghouse, James F Ransome, 1st Edition, 2013, CRC Press, ISBN: 978-1-4398-0680-7.

CIE Assessment:
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CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		2	2							
CO2	2	2		2	2							
CO3	3	3		3	3							
CO4	2	2		2	2							
CO5	2	2		2	2							

High-3, Medium-2, Low-1

Course Title	Mobile Computing	Semester	VII
Course Code	MVJ20IS752	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

To provide an overview of Wireless Communication networks area and its applications in communication engineering

To appreciate the contribution of Wireless Communication networks to overall technological growth.

Define concepts of wireless communication.

Compare and contrast propagation methods, Channel models, capacity calculations multiple

antennas and multiple user techniques used in the mobile communication.

Explain CDMA, GSM. Mobile IP, WImax and Different Mobile OS

Module-1	L1,L2	8 Hours

Cellular Phone Standards, Cellular Evaluation, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANs), Overview of WLAN standards (802.1g/n/ ac/ad) and channel management. Handover in WLAN network.

Application:

Demonstrating applications of wireless network standards

Video Link:

https://nptel.ac.in/courses/106/106/106106147/

Module-2	L2,L3	8 Hours

Syllabus Content: Wifi, Wimax (IEEE 806.16a), IoT Wireless -Topologies, Zigbee Wireless Networks and Transceivers, NFC, 6LoWPAN, Tradeoff between Battery, Bandwidth and

Distance. Wireless Channel Models: Path Loss and Shadowing Models, Millimeter Wave Propagation, Statistical Fading Models, Narrowband Fading, Wideband Fading Models.

Application:

Identifying IoT wireless topologies.

Video Link:

https://nptel.ac.in/courses/106/106/106106147/

Module-3	L2,L3	8 Hours

Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Emerging Technologies: Wireless broadband (WiMAX), Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6. Wireless Networks : Global Systems for Mobile Communication (GSM): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Short Service Messages (SMS): Introduction to SMS, SMS Architecture, SMMT, SMMO, SMS as Information bearer.

Application:

Differentiate various levels of Mobile computing architecture.

Video Link:

https://nptel.ac.in/courses/106/106/106106147/

Module-4	L2,L3	8 Hours

GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS. Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices.

Application:

Making devices mobile using GPRS.

Video Link: https://nptel.ac.in/courses/106/106/106106147/		
Module-5	**L2,L3**	**8 Hours**
Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators Application: Emulating a mobile OS. Video Link: https://nptel.ac.in/courses/106/106/106106147/		
Hands on Experiments:	**L3**	**20**
Program in NS 3 to connect WIFI TO BUS Program in NS 3 to create WIFI SIMPLE INFRASTUCTURE MODE Program in NS 3 to create WIFI SIMPLE ADHOC MODE Program in NS 3 to connect WIFI TO WIRED BRIDGING Program in NS 3 to create WIFI TO LTE(4G) CONNECTION Program in NS3 for CREATING A SIMPLE WIFI ADHOC GRID		

Course outcomes:	
CO1	Understand the cellular system design and technical challenges
CO2	Analyze the Mobile radio propagation, fading, diversity concepts and the channel modeling.

CO3	Explain state of art techniques in wireless communication
CO4	GPRS,CDMA its architecture and application.
CO5	Discover CDMA, GSM. Mobile IP, WImax.

Text/Reference Books:	
1.	"Wireless Communication", Andrea Goldsmith, First Edition, Cambridge University Press.
2.	Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
3.	Fundamentals of Wireless Communication", David Tse, Pramod Viswanath, First Edition, Cambridge University Press.
4.	"Advanced Wireless Communication and Internet: Future Evolving Technologies", Savo G Glisic, Third Edition, Wiley.
5.	Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003
6.	Raj kamal: Mobile Computing, Oxford University Press, 2007

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests Quizzes/mini tests (4 marks) Mini Project / Case Studies (8 Marks) Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	2									
CO2		2	2									
CO3		2	2									
CO4		2	2									
CO5								3				

High-3, Medium-2, Low-1

Course Title	Pattern Recognition	Semester	VII
Course Code	MVJ20IS753	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

The main objective of this course is to introduce the fundamentals of pattern recognition and classification.

Understand Non-parametric Techniques.

Learn Bayesian decision theory, Maximum likelihood estimation, Hidden Markov Models, some of the non-parametric techniques.

Learn linear discriminant functions.

Understand Unsupervised Learning and Clustering

Module-1	L1,L2,L3	12 Hours

Machine perception- example; pattern recognition systems the design cycle - learning and adaptation

Application: Students can learn basics of pattern recognition

Video Link: https://nptel.ac.in/courses/117/105/117105101/

Module-2	L1,L2,L3	12 Hours

Introduction: Bayesian decision theory – continuous features; minimum-error-rate classification - classifiers, discriminant functions, normal density; discriminant functions for the normal density - Bayesian decision theory – discrete features - missing and noisy features - Maximum-likelihood and Bayesian Parameters Estimation - Maximum-likelihood estimation - Bayesian estimation;

Bayesian parameter estimation: Gaussian case and general theory - problems of dimensionality - component analysis and discriminants - Hidden Markov models.

Application: Students can learn various algorithm related to pattern recognition.

Video Link: https://www.youtube.com/watch?v=Lveq5dIaiXY

Module-3	L1,L2,L3	12 Hours
Density estimation - Parzen windows - kn-nearest-neighbour estimation - nearest-neighbor rule - metrics and nearest-neighbour classification - approximation by series expansions. Application: Students can learn how to derive pattern using clustering and classfications. Video Link: https://nptel.ac.in/courses/106/106/106106046		
Module-4	L1,L2,L3	12 Hours
Linear discriminant functions and decision surfaces - generalized linear discriminant functions - two-category linearly separable case - minimizing the perceptron criterion function; relaxation procedures – Non-separable behavior - minimum squared-error procedures - Ho-Kashyap procedures - linear programming algorithms - support vector machines - multicategory generalizations; Application: Students can learn mathematical model for pattern recognition. Video Link: https://www.youtube.com/watch?v=5QWX8vSD9_c		
Module-5		
Mixture densities and identifiability - maximum-likelihood estimates - application to normal mixtures - unsupervised Bayesian learning - data description and clustering - criterion functions for clustering - hierarchical clustering - on-line clustering - component analysis - low-dimensional representation and multidimensional scaling. Application: Students can learn machine learning methods. Video Link: https://www.youtube.com/watch?v=NhimXdFenrg	L1,L2,L3	12 Hours
Practical Experiments/Research paper Study: A Pattern-Recognition-Based Algorithm and Case Study for Clustering and Selecting Business Services Case study in agriculture and aquaculture Case study in Optical Music Recognition Case study in Financial database Case study in fault detection in a gas turbine	20	

Course outcomes:		
CO1	Understand the major concepts and techniques in pattern recognition	
CO2	Acquire abilities to solve problems in specialized application areas such as speech recognition, signal classification	
CO3	Capable of designing pattern recognition systems and QAM	
CO4	Explain Linear Discriminant functions	
CO5	Explore Unsupervised Learning and Clustering:	

Text/Reference Books:	
1.	Pattern Classification, Richard O. Duda, Peter E. Hart and David G. Stork, 2nd Edition, John Wiley, 2001.
2.	Pattern Recognition and Image Analysis, Eart Gose, Richard Johnsonburg and Steve Joust, Prentice-Hall of India, 2003.
3.	Pattern Recognition and Machine Learning, Christopher M. Bishop, 3rd Edition, Springer, 2007.
4.	Statistical Pattern Recognition, Andrew R. Webb, 2nd Edition, John Wiley, 2002.

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SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2									2	
CO2				2								
CO3		2										
CO4				2								2
CO5			2									

High-3, Medium-2, Low-1

Course Title	Ethical Hacking	Semester	VII
Course Code	MVJ20IS754	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: *This course will enable students to*

Understand Cyber Crime and Forensics.

Analyze the nature and effect of cyber-crime in society.

Understand Sarbanes-Oxley Financial and Accounting Disclosure Information

Understand Computer Crime and Criminals.

Understand Liturgical Procedures.

Module-1	L1,L2,L3	12 Hours

Syllabus Content:

Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

Application:

Cybercrime is carried out by individuals or organizations.

Video Link:

https://www.youtube.com/watch?v=ONcQ26UA07M

Module-2	L1,L2,L3	12 Hours

Syllabus Content:

Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, exploitation ,Stalking and Obscenity in Internet, Digital laws

and legislation, Law Enforcement Roles and Responses. Application: IDS makes a better post-mortem forensics tool for the CSIRT to use as part of their security incident investigations Video Link: https://www.youtube.com/watch?v=VPLSIsRegFI		
Module-3	L1,L2,L3	12 Hours
Syllabus Content: Introduction to Cyber Crime Investigation, Investigation Tools, e-Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking. Application: Investigation Tools Video Link: https://www.youtube.com/watch?v=QQ9ZLlj36qs		
Module-4	L1,L2,L3	12 Hours
Syllabus Content: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics. Application: Encrypted Disk Detector. Encrypted Disk Detector can be helpful to check encrypted physical drives Video Link: https://www.youtube.com/watch?v=7eT8KSHMGFw		
Module-5	L1,L2,L3	12 Hours

Syllabus Content:

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

Application:

Digital forensic applications in order to gather evidence information.

Video Link:

https://www.youtube.com/watch?v=rZ63OH2TAOo

Hands on Experiments:

Types of Cyber Crimes: Social Engineering, Categories of Cyber Crime.

Virus Attacks, Software Piracy.

Encryption and Decryption methods.

Analysis using advanced tools.

Course outcomes:

CO1	Describe the importance of Computer Security and the vulnerability issues
CO2	Analyse and explain various types of computer crimes, and the legal aspects of the same along with the Indian IT act
CO3	Identify and Use appropriate tools and techniques to control and prevent the digital criminal activities
CO4	Apply forensic analysis tools to recover important evidence for identifying computer crime.
CO5	Understand laws and ethics.

Text/Reference Books:

1.	Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009, ISBN 13: 9781435498839
2.	Kevin Mandia, Chris Prosise, Matt Pepe, "Incident R esponse and Computer Forensics ",
3.	Tata McGraw -Hill , New Delhi, 2006.
4.	Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005,

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CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	2	2	2						2	2
CO2		2	2	2	2						2	2
CO3		2	2	2	2						2	2
CO4		2	2	2	2						2	2
CO5		2	2	2	2						2	2

High-3, Medium-2, Low-1

Course Title	Machine Learning Laboratory	Semester	VII
Course Code	MVJ20ISL76	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

This course will enable students to

Make use of data sets in implementing the machine learning algorithms

Implementing the machine learning concepts and algorithms in any suitable language of choice.

Sl No	Experiment Name	RBT Level	Hours
1	Implementation of FIND-Algorithm	L3	4
2	Implementation of Candidate-Elimination algorithm	L3	4
3	Implementation of ID3 algorithm	L3	4
4	Implementation of Backpropagation algorithm	L3	4
5	Implementation of naïve Bayesian Classifier	L3	4
6	Implementation of Bayesian network	L3	4
7	Implementation of EM algorithm	L3	4
8	Implementation of *k*-Means algorithm	L3	4
9	Implementation of *k*-Nearest Neighbour algorithm	L3	4
10	Implementation of Locally Weighted Regression algorithm	L3	4

Course outcomes:

CO1	Understand the implementation procedures for the machine learning algorithms.
CO2	Design Java/Python programs for various Learning algorithms
CO3	Apply appropriate data sets to the Machine Learning algorithms
CO4	Identify and apply Machine Learning algorithms to solve real world problems
CO5	Perform statistical analysis of machine learning techniques.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3					3		
CO2	3	3	3	3	3					3		
CO3	3	3	3	3	3					3		
CO4	3	3	3	3	3					3		
CO5	3	3	3	3	3					3		

High-3, Medium-2, Low-1

Course Title	Bigdata and Hadoop Lab	Semester	VII
Course Code	MVJ20ISL77	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 1 : 2)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to:

- Understand Hadoop Distributed File system and examine MapReduce Programming
- Explore Hadoop tools and manage Hadoop with Ambari
- Appraise the role of Business intelligence and its applications across industries
- Assess core data mining techniques for data analytics
- Identify various Text Mining techniques

Sl No	Experiment Name	RBT Level	Hours
1	Implement the following Data structures in Java Linked Lists b) Stacks	L3	4
2	Implement the following Data structures in java a) Queues b) Set c) Map	L3	4
3	Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, Fully distributed	L3	4
4	Use web-based tools to monitor your Hadoop setup.	L3	4
5	Implement the following file management tasks in Hadoop: • Adding files and directories • Retrieving files • Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.	L3	4
6	Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.	L3	4

7	Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.	L3	4
8	Implement Matrix Multiplication with Hadoop Map Reduce	L3	4
9	Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.	L3	4
10	Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes	L3	4

Course outcomes:	
CO1	Master the concepts of HDFS and MapReduce framework
CO2	Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration
CO3	Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making
CO4	Infer the importance of core data mining techniques for data analytics
CO5	Compare and contrast different Text Mining Techniques

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3					3		
CO2	3	3	3	3	3					3		
CO3	3	3	3	3	3					3		
CO4	3	3	3	3	3					3		
CO5	3	3	3	3	3					3		

High-3, Medium-2, Low-1

Course Title	PROJECT PHASE – 1	Semester	VII
Course Code	MVJ20ISP78	CIE	50
Total No. of Contact Hours	-	SEE	-
No. of Contact Hours/week	L : T : P :: 0 : 0 : 4	Total	50
Credits	2	Exam. Duration	-

Course Objective:

- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To expand intellectual capacity, credibility, judgment, intuition.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - I: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course outcomes: At the end of the course the student will be able to:

CO1	Describe the project and be able to defend it.
CO2	Learn to use modern tools and techniques.
CO3	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO4	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO5	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Scheme of Evaluation :

Internal Marks: The Internal marks (50 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	3	2	1	1	2	1	1	2
CO2	2	2	2	3	3	2	1	1	2	1	2	2
CO3	2	2	2	3	3	2	1	1	2	1	2	2
CO4	2	2	2	3	3	2	1	1	2	1	2	2
CO5	2	2	2	3	3	2	1	1	2	1	2	2

High-3, Medium-2, Low-1