Course Title	IoT for Data Science & Analytics	Semester	VII
Course Code	MVJ20CD71	CIE	50
Total No. of Contact Hours	50 L:T:P::4:0:0	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to:

This course viz., aims to prepare the students:

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.

Module-1	L1,L2	10Hrs.
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.		

Module-2	L2,L3	10 Hrs.
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies, IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances.		

Module-3	L3,L4	10Hrs.
Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods, Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security,		

Module-4	L3,L4,L5	10 Hrs.
Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment, IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints		

Module-5	L3,L4,L5	10 Hrs.
RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, 08 Smart City Use-Case Examples.		
Course outcomes:		
CO1	Describe the characteristics and key technologies for IoT system	
CO2	Interfacing Sensor and Actuator with Arduino development board.	
CO3	Implementing IoT device by interfacing communication module and cloud	
CO4	Describe protocols of resource constraint network	
CO5	Elaborate the need for Data Analytics and Security in IoT	

Text Books:	
1.	"IoTFundamentals: Networking Technologies, Protocols, and Use Cases for the Internet ofThings", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743
2.	"Internet of Things",Srinivasa K G,CENGAGE Leaning India,2017

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

course Title	Big Data & Hadoop	Semester	VII
Course Code	MVJ20CD72	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 4: 0: 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

Module-1	L1,L2	10Hours

Introduction to big data and Hadoop Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy,

Module-2	L2,L3	10Hours

Introduction to Infosphere BigInsights and Big Sheets. HDFS(Hadoop Distributed File System)The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives

Module-3	L3,L4	10Hours

Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures
Map Reduce , Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Module-4	L3,L4,L5	10Hours

Hadoop Eco System
Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User DefinedFunctions, Data Processing operators.
Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, QueryingData and User Defined Functions.

Module-5	L3,L4,L5	10Hours

Hbase :HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.Big SQL : Introduction , Data Analytics with RMachine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering.

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

Reference Books:	
1.	Tom White," Hadoop: The Definitive Guide",O'reily Media,Third Edition, 2012
2.	Seema Acharya, SubhasiniChellappan," Big Data Analytics",Wiley,2015

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	3	0	0	0	0	0	0	1	1
CO2	2	3	0	3	0	0	0	0	0	0	1	1
CO3	2	3	0	3	0	0	0	0	0	0	1	1
CO4	3	3	0	3	0	0	0	0	0	0	1	1
CO5	3	3	0	3	0	0	0	0	0	0	1	1

High-3, Medium-2, Low-1

Course Title	Professional Elective-IV Data Analytics	Semester	VII
Course Code	MVJ20CD731	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4(L : T : P :: 3: 0: 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course viz., aims to prepare the students:

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability..

Module-1	L1,L2	8Hrs.

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error.

Module-2	L2,L3	8 Hrs.

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks

Module-3	L3,L4	8Hrs.

Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods. Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window

Module-4	L3,L4,L5	8 Hrs.

Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.. Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream

Module-5	L3,L4,L5	8 Hrs.
Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.		

Course outcomes:	
CO1	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
CO2	Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
CO3	Interpret business models and scientific computing paradigms and apply software tools for big data analytics.
CO4	Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.
CO5	solve complex real-world problems in for decision support.

Text Books:	
1	Michael Berthold, David J. Hand, "Intelligent Data Analysis" Springer,2007
2	Anand Rajaraman and Jeffrey David Ullma, "Mining of Massive Datasets ", Cambridge University Press,2012

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Course Title	Deep Learning	Semester	VII
Course Code	MVJ20CD732	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 2 : 2 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Explain the fundamentals of Deep Learning.
- Familiarize with Tensor Flow, Installation of software module.
- Design and build support vector machine.

Module-1	L1,L2	8Hours

Feedforward Neural networks. Gradient descent and the backpropagation algorithm. Unit saturation, aka the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima. Heuristics for faster training. Nestors accelerated gradient descent. Regularization. Dropout. Convolutional Neural Networks Architectures, convolution / pooling layers

Module-2	L2,L3	8Hours

Recurrent Neural Networks , LSTM, GRU, Encoder Decoder architectures,
Deep Unsupervised Learning , Autoencoders (standard, sparse, denoising, contractive, etc), Variational Autoencoders, Adversarial Generative Networks, Autoencoder and DBM.

Module-3	L3,L4	8Hours

Applications of Deep Learning to Computer Vision , Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models. Attention models for computer vision tasks. Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics.

Module-4	L3,L4,L5	8Hours

Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-ofWords model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning Named Entity Recognition, Opinion Mining using Recurrent Neural Networks , Parsing and Sentiment Analysis using Recursive Neural Networks ,

Module-5	L3,L4,L5	8Hours

Sentence Classification using Convolutional Neural Networks , Dialogue Generation with LSTMs , Applications of Dynamic Memory Networks in NLP , Recent Research in NLP using Deep Learning: Factoid Question Asnwering, similar question detection, Dialogue topic tracking, Neural Summarization, Smart Reply

Course outcomes:	
CO1	Basics of Deep Learning
CO2	Understand TensorFlow and Reinforcement Learning.
CO3	Explain state vector machine
CO4	Explain RNN and Unsupervised Feature Learning
CO5	Explain Architecture of CNNs .

Reference Books:	
1.	Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville,"Deep learning",An MIT Press book in preparation,2015
2.	Bengio, Yoshua," Learning deep architectures for AI " . Foundations and trends in Machine Learning 2.1,2009: 1127

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	3	0	0	0	0	0	0	1	1
CO2	2	3	0	3	0	0	0	0	0	0	1	1
CO3	2	3	0	3	0	0	0	0	0	0	1	1
CO4	3	3	0	3	0	0	0	0	0	0	1	1
CO5	3	3	0	3	0	0	0	0	0	0	1	1

High-3, Medium-2, Low-1

Course Title	Block Chain Technology	Semester	VII
Course Code	MVJ20CD733	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course viz., aims to prepare the students:

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work.
- To securely interact with them.
- Design, build, and deploy smart contracts and distributed applications.

Module-1	L1,L2	8Hrs.
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.		
Module-2	**L2,L3**	**8 Hrs.**
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.		
Module-3	**L3,L4**	**8Hrs.**
Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate., Introducing modeling language for business resources and transactions, Introduction to key concepts related to smart contracts, accounts, transaction events, patterns and examples		
Module-4	**L3,L4,L5**	**8 Hrs.**
History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin		
Module-5	**L3,L4,L5**	**8 Hrs.**
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., Overview of how IoT can benefit from Blockchain implementation		

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 Books:	
1	"Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction,",Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder,Princeton University Press,July 19, 2016
2	"Mastering Bitcoin: Unlocking Digital Cryptocurrencies" ,Antonopoulos

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Course Title	Business Intelligence	Semester	VII
Course Code	MVJ20CD734	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0: 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Explain the complete life cycle of BI/Analytical development
- Explain the various project activities
- Explain the Differences in Database Design Philosophies
- Illustrate technology and processes associated with Business Intelligence framework
- Business View of Information technology Applications

Module -1	L1,L2,L3	8 Hours
Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation.		
Module -2	**L1,L2,L3**	**8 Hours**
Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process.		
Module - 3	**L1,L2,L3**	**8 Hours**
Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery.		
Module-4	**L1,L2,L3**	**8 Hours**
Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard.		
Module-5	**L1,L2,L3**	**8 Hours**

Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics of enterprise reporting, BI road ahead	
Course outcomes:	
CO1	Understand the complete life cycle of BI/Analytical development
CO2	Explain the various project activities
CO3	Illustrate the Differences in Database Design Philosophies
CO4	Illustrate technology and processes associated with Business Intelligence framework
CO5	Understand Business View of Information technology Applications
Text/Reference Books:	
1.	Larissa T Moss and ShakuAtre"Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications" Addison Wesley Information Technology Series 2003.
2.	R N Prasad, SeemaAcharya" Fundamentals of Business Analytics" Wiley India 2011.
3.	David Loshin" Business Intelligence: The Savvy Manager's Guide" Morgan Kaufmann
4.	Brian Larson" Delivering Business Intelligence with Microsoft SQL Server 2005" McGraw Hill 2006
5.	Lynn Langit" Foundations of SQL Server 2008 Business Intelligence" Apress 2011
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												
CO2												
CO3												
CO4												
CO5												

High-3, Medium-2, Low-1

Course Title	Natural Language Processing	Semester	VII
Course Code	MVJ20CD741	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course viz., aims to prepare the students:

- Expose students to the concepts of n-grams and Language Modelling with n-gram
- Expose students to the Natural Language Processing pipeline
- Expose students to the Information Extraction problems and end to end Natural Language Generation problems as applications of Natural Language Processing

Module-1	L1,L2	8Hrs.

Text Normalization, Morphology and Finite State Transducer: Concept/ Types of Ambiguity
in Natural Language Processing, Empirical Laws: Zipf's Law, Heap's Law. Text Normalization: Content and Function Words, Type vs. Token, Unix Tools for Crude Tokenization and Normalization, Word Tokenization and Normalization, Lemmatization and Stemming, Sentence Segmentation. Morphology and Finite State Transducers: Survey of English Morphology, Finite State Morphological Parsing, Combining FST Lexicon and Rules, Lexicon - Free FST - The Porter Stemmer, Human Morphological Parsing

Module-2	L2,L3	8 Hrs.

N-Grams, Edit Distance and Language Modelling: n-grams, Evaluating Language Models - Perplexity, Generalization and Zeros, Smoothing - Kneser-Ney Smoothing, Web and Stupid Back Off, Perplexity's Relation to Entropy. Spelling Correction and Noisy Channel: Noisy Channel Model, Real World Spelling Error, Minimum Edit Distance Algorithm, Improved Edit Models. Word Classes and Part-of-Speech (POS) Tagging: English Word Classes, Penn Tagsets for English, Rule-Based Part-of-Speech Tagging, Transformation-Based Tagging, POS Tagging using Hidden Markov Model, Maximum Entropy Model and Conditional Random Fields, Neural Language Models with Deep Artificial Neural Network

Module-3	L3,L4	8Hrs.

Parsing: Context Free Grammar. Syntactic Parsing: Ambiguity Presented By Parse Trees, CKY Parsing, Chart Parsing and Earley Parser. Partial Parsing: Chunking. Statistical Parsing: Probabilistic Context Free Grammar, Probabilistic CKY Parsing of PCFG, Problems with PCFG, Probabilistic Lexicalized PCFG. Introduction to Dependency Parsing: Dependency Relations, Dependency Formalisms, Dependency Tree Banks, Evaluating Parsers.		
Module-4	**L3,L4,L5**	8 Hrs.
Semantics - Lexical semantics: Word Senses and Relations Between Word Senses, WordNet: A Database of Lexical Relations, Word Sense Disambiguation - Overview, Supervised Word Sense Disambiguation, WSD - Dictionary and Thesaurus Methods, Semi- Supervised WSD, Unsupervised Word Sense Induction. Word Similarity or Semantic Relatedness Based On Thesaurus: Resnik Similarity, Lin Similarity, Jiang-Conrath Distance, Extended Gloss Overlap And Extended Lesk Method. Lexicons For Sentiment and Affect Extraction: Available Sentiment Lexicons, Using Wordnet Synonyms And Antonyms - Sentiwordnet, Supervised Learning of Word Sentiments, Using Lexicon For Sentiment Recognition, Lexicons For Emotions And Other Affective States.		
Module-5	**L3,L4,L5**	8 Hrs.
Information Retrieval, Natural Language Generation and Neural Network Methods for Natural Language Processing - Information retrieval: Information Extraction vs. Retrieval, Information Extraction Sub-Problems, Named Entity Recognition - Practical NER Architectures. Natural Language Generation: An Architecture, Question Answering System - IR Based Factoid Question Answering, Knowledge Based Question Answering, IBM's Watson, Dialogue System And Chatbot - Rule Based And Corpus Based Chatbots.		

Course outcomes:	
CO1	Implement meaningful course or research projects using current Natural Language Processing technology
CO2	Analyze the natural language text.
CO3	Define the importance of natural language.
CO4	Understand the concepts Text mining.
CO5	Illustrate information retrieval techniques

Text Books:	
1	Daniel Jurafsky and James H Martin, "Speech and Natural Language Processing"http://web.stanford. edu/~jurafsky/slp3/,3rd Edition Draft
2	Yoav Goldberg "Neural Network Methods for Natural Language Processing",Morgan and Claypool Publishers

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Course Title	Neural Network	Semester	VII
Course Code	MVJ20CD742	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course viz., aims to prepare the students:

- To provide the student with the basic understanding of neural networks fundamentals
- To demonstrate programs, related algorithms
- To Design the required and related systems.

Module-1	L1,L2	8Hrs.

Neural Network Basics

Classical AI and Neural Networks, characteristics of neural networks, Historical perspective, Thebiological inspiration, models of artificial neuron & activation functions, Artificial Neuron Model andLinear Regression, Nonlinear Activation Units and Training of artificial neural networks.

Module-2	L2,L3	8 Hrs.

Learning Mechanisms: Gradient Descent Algorithm, Learning Mechanisms-Hebbian, Competitive, Boltzmann, Universal function approximation. Single Layer and Multi layerPerceptrons: Representation of perceptron, Linear separability, Perceptron Learning, Single-Layer Perceptions

Module-3	L3,L4	8Hrs.

Unconstrained Optimization: Gauss-Newton's Method, Linear Least Squares Filters, Least Mean Squares Algorithm , Perceptron Convergence Theorem , Back Propagation Algorithm, Practical Consideration inBack Propagation Algorithm Training of single layer and multi-layer, back propagation training algorithm, Applications of back propagation,

Module-4	L3,L4,L5	8 Hrs.

Solution of Non-Linearly Separable Problems Using MLP, Heuristics For Back-Propagation, Multi- Class Classification Using Multi-layered Perceptrons. Associative Memory Networks:- Associative Memory Model, Conditions for perfect Recall in Associative memory, Radial Basis Function Networks: Introduction ,Separability and Interpolation, Learning Mechanisms in RBF, Comparison Between MLP and RBF.

Module-5	L3,L4,L5	8 Hrs.
Introduction to Principal Components and Analysis, Dimensionality reduction Using PCA, Hebbian- Based Principal Component Analysis. Self OrganizingMaps :Introduction to Self Organizing Maps, Cooperative and Adaptive Processes in SOM, Vector-Quantization Using SOM, Competitive learning, Maxican Hat networks.		
Course outcomes:		
CO1	Identify and describe Neural Network techniques in building intelligent machines	
CO2	Apply Neural Network models to handle uncertainty and solve engineering problems.	
CO3	Recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem	
CO4	solve practical problems via implementation of neural network techniques via simulation	
CO5	design single and multi-layer feed-forward neural networks	

Text Books:	
1	"Neural Networks, fuzzy Logic, and Genetic Algorithms" ,Rajasekaran&VijayalakhmiPai ,Pearson,2011
2	"Principles of Soft Computing", Sivanandam, DeepaWiley,2014

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Course Title	Data Visualization	Semester	VII
Course Code	MVJ20CD743	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 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	8 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	8Hours

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**	**8 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**	**8Hours**
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**	**8 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:

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	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	Cyber Security, Law & Ethics	Semester	VII
Course Code	MVJ20CD744	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 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	8Hours

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	8 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	8 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	8 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	8Hours
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.

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		2										
CO2			2								2	
CO3					2							
CO4			2									2
CO5					2							

High-3, Medium-2, Low-1

Course Title	Open Elective II-Principles of OS	Semester	VII
Course Code	MVJ20CD751	CIE	50
Total No. of Contact Hours	40(L : T : P :: 3 : 0 : 0)	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course viz., aims to prepare the students:

- Provide an understanding on the various components of an Operating System.
- The course focuses on fundamental problems and optimal solutions for resource management in operating systems such as process, disk and memory management.
- The course will introduce design principles and trade-offs in the design of Operating Systems.

Module-1	L1,L2	8Hrs.
Overview of Operating Systems: Role, purpose, design issues of modern OSes., Assembly Level Machine Organization : Von Neumann Machine, X86 Assembly Instructions, Heap, Stack, Code Subroutine Calls, I/O and Interrupts Operating System Principles: Processes, Process Control, Threads, Process Control Blocks, Process States, Interrupts, Context-Switching		
Module-2	**L2,L3**	**8 Hrs.**
CPU scheduling, scheduling policies, deadlines, real-timeConcerns Case Study : Windows and Linux Inter-Process Communication; Process Synchronization, Critical Solution Problem and Solutions; Deadlocks Threads, pthreads interface		
Module-3	**L3,L4**	**8Hrs.**
Introduction to Storage Technologies, Memory Hierarchy, Cache Memories Memory Management: Memory Partitioning, Paging, Segmentation, Combined Paging and Segmentation Working Sets and Thrashing; Latencies, Caching, Locality, Cache Consistency Dynamic Memory Management, Garbage Collection		
Module-4	**L3,L4,L5**	**8 Hrs.**
Rationale for protection and predictable performance, levels of indirection Methods for implementing Virtual Memory, Paging and Virtual Memory Virtual Machines: Virtual File Systems, Virtual Devices and I/O Hypervisors, Sandboxes, Emulators.		

Module-5	L3,L4,L5	8 Hrs.
Files : metadata, operations, organization, etc. ; File Access and Security Concerns File Storage Management, Root File system,Disk Allocation Methods; Free Space Management Techniques. File System Partitioning; Virtual Filesystems; Memory Mapped Files, Journaling and Log Structured File Systems.		
Course outcomes:		
CO1	Recognize the important computer system resources and the role of operating system in their management policies and algorithms.	
CO2	Understand various scheduling algorithms.	
CO3	To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.	
CO4	Identify use and valuate the storage management policies with respect to different storage Management technologies	
CO5	Identify various issues of Linux Operating System	

Text Books:	
1	"Operating Systems:Internals and DesignPrinciples",WilliamStallings ,Prentice Hall, 2012,ISBN-13: 978-0-13-230998-1,7th Edition-2012
2	"Computer Systems: A Programmer's Perspective", 2nd Edition, AddisonWesley, ISBN 97801361080473,BryantandO'Hallaron,2010

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Course Title	OPEN ELECTIVE II: Information & Network Security	Semester	VII
Course Code	MVJ20CD752	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3(L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course viz., aims to prepare the students:

- To understand the fundamentals of Cryptography.
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.

Module-1	L1,L2	8Hrs.
Definitions & challenges of security, OSI security architecture, attacks & services. Cryptography & cryptanalysis. Classical encryption techniques, substitution techniques, transposition techniques. Block ciphers, DES, AES structure, multiple encryption-triple DES.		
Module-2	**L2,L3**	**8 Hrs.**
Number theory fundamentals, principles of pubic key crypto systems, RSA algorithm, Strength of RSA, Diffie-Hellman key exchange, Elliptic curve cryptography. Symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 Certificates, PKI.		
Module-3	**L3,L4**	**8Hrs.**
Cryptographic hash functions, applications, security requirements, hash function based on block chaining, SHA-512. MAC, security requirements, HMAC, CMAC, key wrapping, Digital signatures.		
Module-4	**L3,L4,L5**	**8 Hrs.**
Remote user authentication, symmetric and asymmetric encryptions for user authentications, Kerberos, identity management & verification. Web security, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Shell (SSH), HTTPS, E-mail security, PGP, S/MIME		

Module-5	L3,L4,L5	8 Hrs.
IP Security, Policy, encapsulating security payload, combining security association, internet key exchange. Wireless security, Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, and protected data transfer phase		

Course outcomes:	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
CO2	Identify the security issues in the network and resolve it.
CO3	Evaluate security mechanisms using rigorous approaches, including theoretical
CO4	Compare and Contrast different IEEE standards and electronic mail security
CO5	Design security applications in the field of Information technology

Text Books:	
1	"Cryptography & Network Security- Principles and Practices" William Stallings ,Pearson Publishers Sixth Edition,2014
2	"Understanding cryptography" Christof Paar& Jan Pelz,Heidelberg [u.a.] Springer ,2014

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Course Title	Principles of Programming Language	Semester	VII
Course Code	MVJ20CD753	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to:

- Learn constructs in a language.
- Understand data, data types, and basic statements and understand call-return Statements, ways of implementing them.
- Design a new construct/ language.
- Choose appropriate language for real world problem solving, based on the required features.
- Evaluate various language design features considering the programming paradigm.

Module -1	L1,L2,L3	8Hours

Reasons for Studying, Concepts of Programming Languages, Programming Domains, Language Evaluation Criteria, Influences on Language Design, Language Categories, Programming Paradigms – Imperative, Object Oriented, Functional Programming, Logic Programming, Programming Language Implementation – Compilation and Virtual Machines, Programming Environments. Names, Binding, Type Checking and Scopes: Names, Variables, Binding of Attributes to Variables, Type Bindings, Type Inferencing, Type Checking, Strong Typing

Application: Developing application or System Software's.

Video Link:

https://www.freecodecamp.org/news/what-exactly-is-a-programming-paradigm/

https://nptel.ac.in/courses/106/102/106102067/

Module -2	L1,L2,L3	8 Hours

Type Equivalence, Scope, Scope and Lifetime, Referencing Environments. Data types: Introduction, Primitives, Character, User Defined, Array, Associative, Record, Union, Pointer and Reference Types, Design and Implementation Issues Related to These Types, Names, Variable, Concept of Binding, Type Checking, Strong Typing, Type Compatibility,

Named Constants, Variable Initialization. Expressions and Statements: Short Circuit Evaluation, Mixed Mode Assignment, Assignment Statements, Cascading Operators. Application: Developing application or System Software's Video Link: https://www.digimat.in/nptel/courses/video/106102067/L40.html		
Module - 3	**L1,L2,L3**	**8Hours**
Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, Guarded Commands. Subprograms and Blocks: Fundamentals of Subprograms, Scope and Lifetime of Variable, Static and Dynamic Scope, Design Issues of Subprograms and Operations, Local Referencing Environments, Parameter Passing Methods, Overloaded Subprograms, Generic Subprograms, Parameters that are Subprogram Names. Application: Developing application or System Software's Video Link: https://www.digimat.in/nptel/courses/video/106102067/L22.html		
Module-4	**L1,L2,L3**	**8Hours**
Design Issues for Functions, User Defined Overloaded Operators, Co-Routines and Function Closures. Abstract Data types: Abstractions and Encapsulation, Introduction to Data Abstraction, Design Issues, Object Oriented Concepts with Reference to Java and Python. Application: Developing application or System Software's Video Link: https://nptel.ac.in/courses/106/105/106105153/		
Module-5	**L1,L2,L3**	**8Hours**
Exception handling: Exceptions, Specifications, Exception Propagation. Logic Programming Language: Introduction and Overview of Logic Programming, Basic Elements of Prolog, Application of Logic Programming. Functional Programming Languages: Introduction, Fundamentals of FPL, Applications of Functional Programming Languages and Exploration of the Features, Comparison of Functional and Imperative Languages. Application: Developing application or System Software's Video Link: https://nptel.ac.in/courses/106/105/106105191/ https://www.vssut.ac.in/lecture_notes/lecture1424085009.pdf		
Practical Experiments:		

- Programs on Array
- Programs on Function
- Programs on Control Structure
- Programs on overloaded operators
- Programs on Object Oriented Concepts with Reference to Java and Python.

Course outcomes:	
CO1	Choose a particular language for problem solving depending on the application domain.
CO2	Analyze and compare programming language concepts.
CO3	Analyze the implementation issues related to a language design.
CO4	Identify the language design features of any language and evaluate them.
CO5	Identify language features required for supporting various paradigms.

Text/Reference Books:	
1.	Concepts of Programming Languages", Robert W Sebesta, Pearson Education, 10th Edition, 2012
2.	Programming Language Pragmatics", Michael L Scott, Elsevier, 3rd Edition, 2009.
3.	Programming Languages Design and Implementation", Pratt, Zelkowitz, Prentice Hall/ Pearson Education, 4th Edition, 2001.

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	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	Machine Learning	Semester	VII
Course Code	MVJ20CD754	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3: 0: 0)	Total	100
Credits	3	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	8 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	8Hours

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	8Hours
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**	**8Hours**
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**	**8Hours**
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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CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	IoT Lab	Semester	VII
Course Code	MVJ20CDL76	CIE	50
Total No. of Contact Hours	20	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:

- Install IoT applications and handling IoT tools.
- Illustrate the methods of deploying smart objects and connect hem to network
- Compare different application protocols for IoT
- Inter the role of Data Analytics and Security in IoT.
- Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry

Sl No	Experiment Name	RBT Level	Hours
1.	Create a program that blinks the LED on the Arduino development board.	L2	3
2.	Create a program for displaying data from the sensor in regular intervals.	L1	3
3.	Create a program that Arduino can able to communicate with the attached PC.	L3	3
4.	Write a program to interface LDR (Module) Sensor using Arduino Uno	L1	3
5.	Temperature monitoring using LM35 and Arduino.	L1	3
6.	MQ2 sensor data accessing using Arduino.	L2	3
7.	Ultrasonic sensor interfacing with Arduino.	L3	3
8.	Create a program to blink LED in the following manner:- 1010, 1100, 1001,1011	L2	3
9.	Playing Piezo buzzer using Arduino.	L1	3
10.	Display “hello world” message using arduino LCD display.	L3	3

Course outcomes:

CO1	Learn and understand IoT applications and tools
CO2	Interfacing sensor and Actuator with Arduino and Raspberry Pi development modules
CO3	Implementing IoT device by interfacing communication modules
CO4	Developing real time examples using Python
CO5	Elaborate the use of smart objects for designing smart systems

CIE Assessment:
Regular Lab work :20 Record writing :5 Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken) Viva 10 marks
SEE Assessment:
Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be, Write-up : 20 marks Conduction : 40 marks Analysis of results : 20 marks Viva : 20 marks

Course Title	Big Data & Hadoop Lab	Semester	VII
Course Code	MVJ20CDL77	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

Sl No	Experiment Name	RBT Level	Hours
1	Performing Data Operations	L3	3
2	Hadoop MapReduce Program	L3	3
3	Monitoring and Debugging a Hadoop MapReduce Job	L3	3
4	Hadoop Streaming	L3	3
5	Program related to Hbase,	L3	3
6	Program related to Hive	L3	3

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	2	3	0	0	0	0	2	0	0
CO2	3	3	3	2	3	0	0	0	0	2	0	0
CO3	3	3	2	2	3	0	0	0	0	2	0	0
CO4	3	3	2	2	3	0	0	0	0	2	0	0
CO5	3	3	3	2	3	0	0	0	0	2	0	0

High-3, Medium-2, Low-1

Course Title	Project Phase - 1	Semester	VII
Course Code	MVJ20CDP78	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	3Hrs

Course objective :

- To support independent learning and innovative attitude.
- To guide to select and utilize adequate information from varied resources upholding ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- 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 - II: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:

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it

CIE procedure for Mini - Project:

CIE procedure for Project Work Phase - 1:

1. (i)Single discipline:The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
2. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
3. (ii) Interdisciplinary:Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.